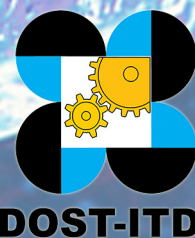


# ANNUAL REPORT 2020





# ABOUT ITDI

The **Industrial Technology Development Institute (ITDI)** laid the groundwork for S&T in the country.

It is one of the DOST's R&D agencies undertaking multidisciplinary industrial R&D, technical services, and knowledge translation or technology transfer/commercialization.

ITDI harnesses know-how in new technology and product innovation. Through the years, it has emerged as a credible and reliable industry and government partner in accelerating growth and development in the country.

## Our Vision

"By 2030, ITDI is the country's leading industry partner in Science, Technology, and Innovation."

## Our Mission

"To contribute to making local industries globally competitive through research and development, transfer and commercialization of innovative and sustainable technologies, and provision of appropriate technical services."

## Our Mandate

- Conduct R&D to generate new knowledge and technologies
- Undertake knowledge translation or technology transfer/commercialization
- Provide technical services, tests, and analyses
- Establish, develop, and maintain national units of measure to provide international traceability

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## MESSAGE

It gives me hope and inspiration that at the Department of Science and Technology (DOST), our agencies, especially the Industrial Technology Development Institute (DOST-ITDI), has remained remarkably productive even on the face of COVID-19 pandemic.

The Institute presented ways to boost the morale of health service frontliners with 3D-printed PPEs and medical devices. It provided such morale boosters particularly during the days with more than 46,000 traffic enforcers and soldiers manning city and provincial highways and streets were provided with its ready-to-eat (RTE) Chicken Arroz Caldo, and other RTE meals and beverages.

For the year 2020, DOST-ITDI formally opened three new service units which have been made available to the public, namely, the MATDEV Laboratory, the Flow Measurement System Facility, and the Ceramic Facility in Sibalom and Tibiao, Antique.

The MATDEV Laboratory provides additive manufacturing resources and technologies aimed to increase industry competitiveness through rapid prototyping and cost-effective use of local resources for the development of 3D printing materials. Meanwhile, the Flow Measurement Facility is a metrological infrastructure for the testing of water meters in the country.

The Ceramic Facility in Antique on the other hand, is an example of a multisectoral collaboration to improve income generation in communities with traditional livelihood enterprises.

The DOST-ITDI's demonstration of passion, resilience, and hard work in helping different sectors with different levels of technology inspires great hope for the people. The road to recovery and growth will surely benefit from DOST-ITDI's continuous search for innovations, for relevant and timely services, and for collaborative partnerships which will show that indeed science is for the people.

MABUHAY!

A handwritten signature in blue ink, appearing to read "F. T. Dela Peña", written in a cursive style.

**PROF. FORTUNATO T. DELA PEÑA**  
Secretary





The year 2020 showed us the unprecedented effects of the COVID-19 pandemic. It has evolved further and left us dealing with a significant global challenge and broader impact on all of our lives and the global economy. We all faced unforeseen and unimaginable challenges that shook and threatened the world's socio-economic and healthcare systems, endangering the lives of humanity.

Nonetheless, this pandemic also allowed us to rise above ourselves and timely respond to the needs of our people and not let this menace cripple us as a nation. It has unleashed the ingenuity in us, ignited our creativity, and through science, developed solutions and produced items, from the most straightforward device to more innovative ones, enabling us to be more resilient and keep moving forward.

Reporting DOST-ITDI's accomplishments for the year has always been a source of pride for me. It is not only an opportunity to share the institute's contributions to nation-building. It also provides a window through which those we serve can see the dedication, expertise, and persistence of ITDI staff to fulfill its commitment to serving the people. I am proud of ITDI for what it did in 2020 to withstand these trying times and its quick response to provide solutions in this national emergency.



Among the notable contributions of DOST-ITDI since the pandemic started in March 2020 were the design and 3D printing of Personal Protective Equipment (PPEs) and medical devices; distribution of ready-to-eat food and drinks; equipment loan; and analytical testing to support quality and safety of materials and products.

The DOST-ITDI, through the Advanced Additive Manufacturing Program under the project, "Multiple Materials Platform for Additive Manufacturing Project (MATDEV)," has designed and 3D printed 2,086 face shields and 900 Ear Relief Bands or Ear Loop for distribution to medical frontliners. Other 3D-printed medical parts are the Multiple Patient Ventilator Splitter and Mechanic Ventilator-Mini War Zone prototypes and N95 masks prototypes using nano-enabled filament material (an anti-viral filter cloth). Another is the 3D-printed filter attachment for commercially available nebulizer masks such as the Modified Oxygen Concentrator Mask. Improvement was made by adding grooves on the mating parts of the filter cartridge to allow easy opening during filter replacement and clip-on caps on the sides of the mask to cover the holes. These were distributed to various hospitals in the country, which were then experiencing supply shortages of medical equipment parts and materials.

Other efforts included distributing Ready-To-Eat (RTE) foods and beverages such as chicken *arroz caldo*, smoked fish rice meal, mungbean-coconut milk beverage, isotonic drink, and ready-to-mix instant calamansi juice powder to frontliners and vulnerable communities around the country.

In addition, responding to the need for increased testing capacities for COVID-19 samples, DOST-ITDI turned over one (1) RT-PCR machine to the Research Institute of Tropical Medicine (RITM). Facilitating the equipment loan arrangement was the Philippine Council for Health Research and Development (PCHRD) between the Department of Health (DOH) and the Department of Science and Technology (DOST).

DOST-ITDI also analyzed and tested the PTRI-developed re-wearable face masks through dermal irritation tests, and the purity and impurities of alcohols that are used as sanitizing agents.



As we continue to battle and find a permanent cure for this virus, we at DOST-ITDI never ceased innovating and developing technologies and processes. Addressing the needs of our local industries is our primary concern. We enable them not only to thrive amidst all the constraints but to emerge, still, as a viable partner for growth and development.

During the pandemic, the institute also adopted a Work From Home arrangement while maintaining a skeleton workforce as a coping mechanism for its employees. With this stringent measure, the institute developed 134 new products and processes from 78 implemented projects, completing around 30 projects.

To name a few in the list are the following: Establishment of a Plastic Waste Pyrolysis System along Esteros for the Rehabilitation of Manila Bay; Intelligent Data Analysis System for Illegal Drug Trafficking Investigation in the Philippines; Strengthening the Municipal Solid Waste Management Program: A Guide on the Preparation of Waste Analysis and Characterization Study (WACS) Plan for the National Capital Region Local Government Units; Effect of Storage Conditions on the Migration Characteristics of Benzophenone in Paper and Paper-Based Food Packaging; I-Salt Project: Design and Prototyping of Salt Processing Equipment; Establishment of Halal Assurance System for Selected Banana Products (Banana Chips, Banana Catsup, and Frozen Banana); Modular Multi-Industry Innovation Center (MMIC); Nanofibrous Scaffolds from Natural Biomaterials for Tissue Engineering; Development of Portable Ultrafiltration/Nanofiltration Membrane Module for Treatment of Potable Water for Remote/Field Application (Mabuhay Straw); and Prototype Development of Natural Fiber-Thermoplastic Composites from Agricultural and Industrial Wastes for Industrial Application.

Equally significant are the interventions and services rendered by the institute in the area of technology promotion and transfer, test and analysis, metrology and calibration, training and support, and administrative matters.

Despite the constraints, the institute continued to provide technical services to its stakeholders through its various testing, calibration, and R&D laboratories rendering a total of 13,248 technical services to 12,388 customers nationwide, generating a total revenue of PhP 30.86M. This revenue is 17.7% lower than last year's revenue of PhP 37.5 M, perhaps due to the pandemic that has limited mobility and face-to-face transactions.

On the other hand, for other specialized technical services, the Technological Services Division reported a total income of PHP 5.49M. Six hundred seventy-nine services were provided to 9,307 clients, increasing up to 192.4% from the previous year.

While going through this crisis, ITDI still managed to continue its knowledge translation initiatives with robust results. We published 129 press releases and had 292 interviews/guestings in TV, radio, radio/TV, and published our 2019 annual report among other publications.

Using the digital platform strengthens our presence in social media. The institute garnered a total of 2,326,020 audience reach, 171,854 engagements, 18,113 likes/followers, and 2,653,594 impressions. Through this medium, DOST-ITDI was able to carry out 33 technical assistance/consultancy, inspection, and assessment. It also carried out 95 training with 9,124 participants through webinars, blended learning, and face-to-face. Negotiations with stakeholders resulted in 18 technology transfer and technical assistance agreements and 15 institutional partners generating a running royalties/technologies of PhP 1,159,446.00.

In 2020, the DOST-ITDI also piloted an off-the-cuff business-type talk show entitled "DOST-ITDI's TekNegoShow" or TNS that was aired via the digital platform in October until the third week of January 2021. This initial season or TNS1 featured technologies and technical services geared towards health and hygiene deemed relevant to the current COVID-19 crisis and be responsive to our various stakeholders. This initiative aimed to widen and heighten the engagement of ITDI's technology generators with the public and, hopefully, increase the likelihood of technology take-up. It also enabled ITDI to maintain its presence online and continue promoting its technologies and services despite the constraints resulting from this pandemic.



Thus, it is evident that the institute never wavered in delivering its mandate no matter how stringent the conditions. We were able to face the challenges head-on and responded the best way we can.

I, therefore, urge our researchers and experts to keep harnessing their gifts and talents, continue being creative and responsive to the needs of the times.

Let science, technology, and innovation or STI be an instrument for our people and country to triumph over this crisis, help rebuild the socio-economic landscape and recoup what was lost, and, hopefully, live better lives in this new normal.

MABUHAY!

A handwritten signature in blue ink, appearing to read 'A. Briones', with a stylized, cursive script.

**DR. ANNABELLE V. BRIONES**  
Director



## HIGHLIGHTS OF ITDI RESPONSE TO THE COVID-19 PANDEMIC

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As the Philippines battles the COVID-19 pandemic, DOST-ITDI redirects its resources to deliver innovative solutions to address problems related to the welfare and safety of frontliners and the general public.



## 3D-printed Medical PPEs and Equipment

Leveraging on 3D printing technology, DOST-ITDI helped increase the production of personal protective equipment (PPEs) and medical devices for frontliners, healthcare workers, and for the urgent needs of the country's health facilities.

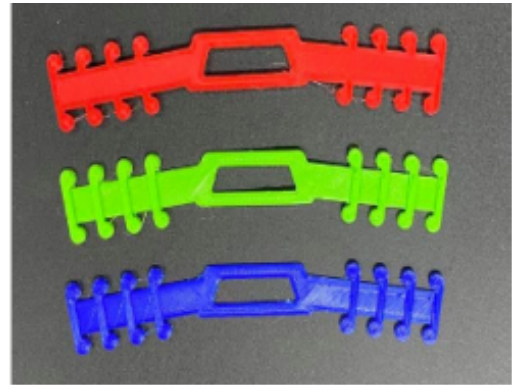
Through its Advanced Additive Manufacturing Program under the project, "Multiple Materials Platform for Additive Manufacturing Project (MATDEV)", the DOST-ITDI designed and 3D printed face shields composed of 3D-printed frames that hold A4 size transparent films. The design allows for the easy slotting of the transparent film to act as the face shield. A total of 2,086 face shields were produced using the Intamsys and Ender Pro FDM 3D printers which were distributed to the different hospitals in Metro Manila and nearby provinces.

A total of 6 rolls (1kg/roll) of filaments for 3D printing along with 150 pieces of plastic sheets were donated to the Philippine Science High School (PSHS) in Quezon City that were used to 3D print more face shield frames for frontline health workers.

In addition, 900 ear relief bands or ear loops were 3D printed and distributed to various hospitals. These are used to prevent injury to the ears and alleviate the pain resulting from wearing face masks for long periods.

Other interventions include the development of medical devices and related parts to address the urgent need for respirators and ventilators in local hospitals. Using the Fused Deposition Modeling and Markforged Mark II 3D printers, prototype valves that connect patients (on intensive care) to breathing machines were produced. Parts of the Multiple Patient Ventilator Splitter and Mechanic Ventilator-Mini War Zone prototypes were 3D printed and distributed to various hospitals. To ensure quality and compliance to international standards, the prototypes produced had passed the physical and mechanical tests (tension, elongation, yield, break strength and modulus of elasticity tests) conducted by the Standards and Testing Division (STD).

As part of its intervention to the University of Santo Tomas Hospital, the institute also conducted sterilization and optical microscopy analysis of filters for their respirators.



**Ear Relief Bands**



**Face Shields**



**Diffuser**

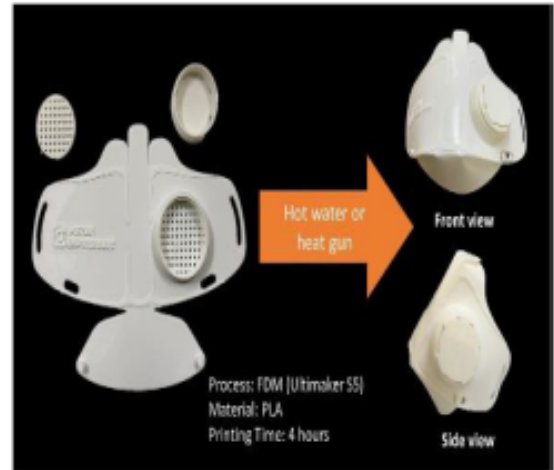


**Venturi Valve**

Likewise, developed prototypes of N95 masks were 3D printed and improved using nano-enabled filament material, an anti-viral filter cloth, and by adding a flexible lining on the edges of the mask.

Also developed through 3D printing technology was a filter attachment for use in commercially available nebulizer masks such as the Modified Oxygen Concentrator Mask. The attachment allows for a more efficient way for patients to intake their medications. This was further improved by adding grooves on the mating parts of the filter cartridge to allow easy opening during filter replacement; and clip-on caps on the sides of the mask to cover the holes.

Various prototypes of door knob handle were also developed using Fused Deposition Modelling (FDM) and printed using Ultimaker S5 and Ender 3D printer.



**3D Printed N95 Mask**



**Multiple Patient Ventilator Splitter**



**Mechanical Ventilator**



**Door Knob Handles**



**Modified Oxygen Concentrator Mask**





**Lung Center of the Philippines**



**Taguig Pateros District Hospital**



**Philippine Children's Medical Center (PCMC)**



**National Children's Hospital (NCH)**

# Distribution of Ready-to-Eat (RTE) Foods and Beverages to Frontliners and Vulnerable Communities

DOST-ITDI distributed ready-to-eat (RTE) foods to various cities and municipalities as the country continued to fight off COVID-19. Through their respective Disaster Risk Reduction and Management Offices, the cities of Taguig, Pasig, Manila, San Juan, and Quezon City augmented their community food supply with 3,000 pouches each of RTE Chicken Arroz Caldo. Davao City received 5,010 pouches of RTE chicken arroz caldo. A total of 3,000 of RTE Smoked Fish Rice Meal was given to Region IV-A and 36,522 pouches of RTE Chicken Arroz Caldo to frontliners in Region II and NCR.

Aside from the COVID-19-affected families, 8,592 pouches of RTE chicken arroz caldo were also distributed to men-in-uniform assigned at various checkpoints in NCR and CALABARZON during the pandemic. Likewise, medical workers at various hospitals in Metro Manila received 5,000 pouches of RTE chicken arroz caldo.

These RTEs are shelf-stable for one year; no drinkables needed, and can be consumed directly from the pouch. For those desiring to eat RTE chicken arroz caldo hot, the package can be directly heated in boiling water. DOST-ITDI technology adopter, Kai Anya Food, produced the RTE arroz caldo, which was distributed to various parts in the country.





RTE smoked fish rice meal and chicken arroz caldo were distributed to frontliners and affected communities



Men in uniform at various checkpoints in Metro Manila



## Mungbean-Coconut Milk Beverage



The Institute also donated 1,008 stand-up pouches of mungbean-coconut milk beverage to the local government units (LGUs) of Pasig and Plaridel, Bulacan through the Ang-Hortaleza Foundation of the Prime Global Corporation.

The mungbean-coconut milk beverage is a nutritious non-dairy drink made from protein-rich green mungbeans and rich creamy coconut milk. It can be enjoyed as an everyday healthy drink, an alternative to dairy milk, and can be used for other food preparations such as coffee, tea, breakfast cereals, shakes and smoothies. The product is a shelf-stable beverage that has undergone thermal processing. Individual serving size is 232 ml (167 kcal) packed in stand-up pouch (SUP).



## Isotonic Beverage and Calamansi Powder Mix

The DOST-ITDI produced, packed, and donated 400 pouches of Isotonic Beverage and 160 flexible pouches of ready-to-mix Instant Calamansi Juice Powder to the City Environment and Natural Resources Office (CENRO) of the City of Parañaque.

The Isotonic Beverage is a coconut-based shelf-stable isotonic drink that helps prevent dehydration while maintaining the body's balance of electrolytes. The beverage packed in 130 mL flexible pouch is naturally prepared with no preservatives/chemicals.

The Ready-to-Mix Calamansi Juice Drink packed in 125-gram flexible pouch is a powder mix using spray-dried calamansi juice and refined sugar, which can be mixed with 1 liter of water, either hot or cold, to instantly produce a refreshing natural calamansi juice drink.



## Equipment Loan

In response to the need for increased testing capacities for COVID-19 samples, DOST-ITDI turned over one (1) RT-PCR machine to the Research Institute of Tropical Medicine (RITM) as part of the equipment loan arrangement between the Department of Health (DOH) and the Department of Science and Technology (DOST).

It was facilitated by the Philippine Council for Health Research and Development (PCHRD). The machine was installed and commissioned at RITM with the assistance of the supplier, ITS Science Philippines.



Turnover of one (1) RT-PCR machine to the Research Institute of Tropical Medicine (RITM), April 16, 2020

## Analytical Testing to Support Quality and Safety of Materials and Products

### ***Purity and Impurities of Alcohols for Sanitation***

Due to the pandemic situation, the demand for alcohol used as agents for hand sanitation increased. However, to ensure the public of quality alcohol products in the market that meet national and international standards, the Chemistry Laboratory of the Standards and Testing Division continued to accommodate test requests for the purity of ethyl and isopropyl alcohol products, presence of methyl alcohol impurities, and physical properties like total suspended and dissolved solids.

### ***Dermal Irritation test of PTRI-developed Re-wearable Face Masks***

Before distribution and usage of DOST-PTRI's (Philippine Textile Research Institute) re-usable, washable, and re-wearable face masks, dermal irritation tests were conducted by the Pharmacology and Toxicology Section, Biological Laboratory of the Standards and Testing Division. This was done to ensure that the materials used on the face masks that are directly in contact with the skin of the human face will not cause any irritation.

## ITDI 6Ps at a glance...

### PRODUCTS & PROCESSES

**134** products & processes  
were produced from **78**  
projects implemented



### PARTNERSHIPS

**62** partnerships were  
forged and maintained



### PAPERS

**50** papers were  
published / presented



### PATENTS & OTHER IPs

**50** IPs were filed / approved



### POLICIES

**101** internal/external policies  
developed



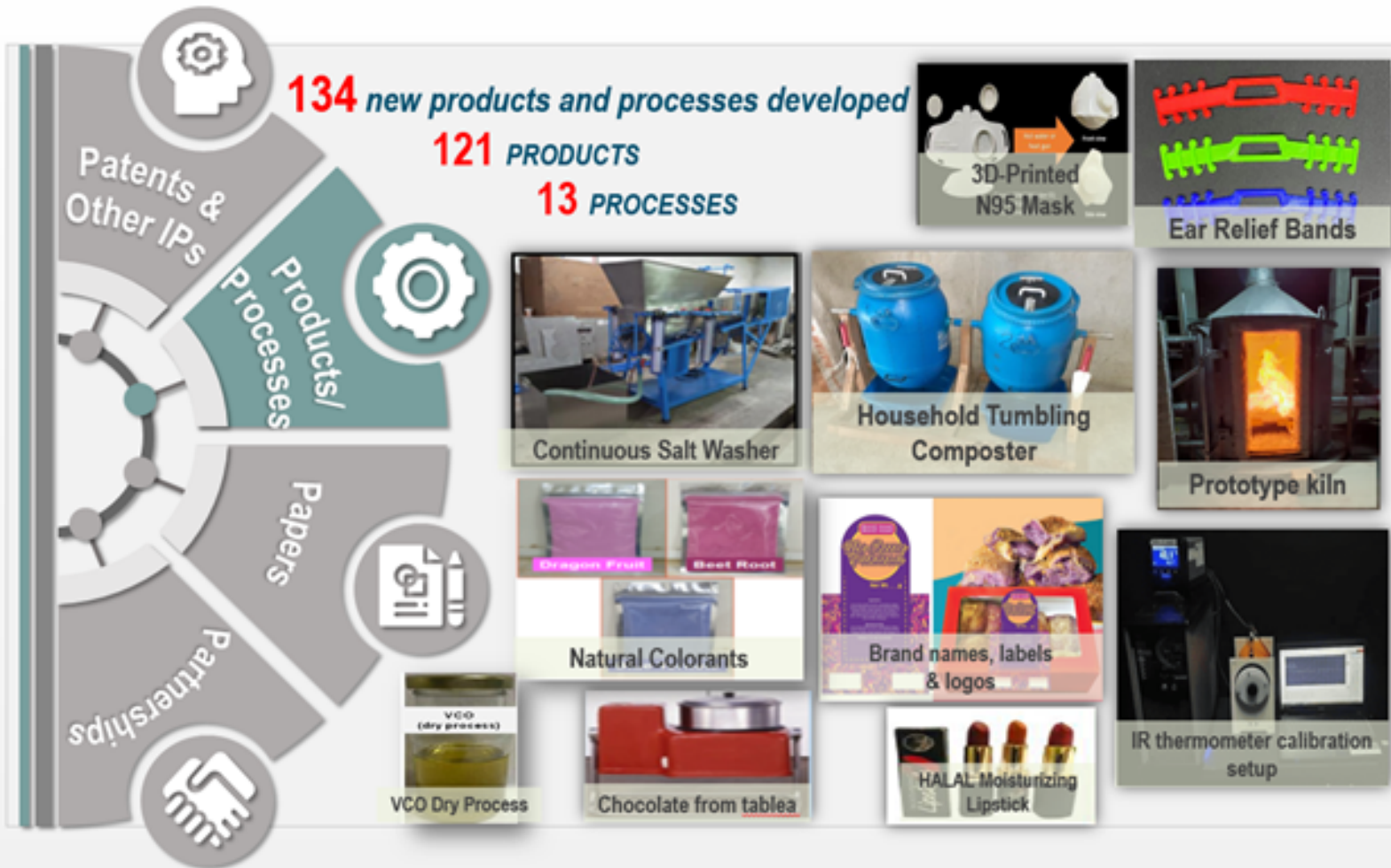
### PEOPLE

**55** staff pursuing  
higher education



## HIGHLIGHTS OF ITDI R&D PROJECTS





## PRODUCTS & PROCESSES DEVELOPED

Despite the challenges posed by the pandemic, ITDI proved resilient and persistently pursued its mission to the Filipino public as it rendered services to make local industries globally competitive. And guided by its vision of being the country's leading industry partner in Science, Technology, and Innovation, ITDI was able to develop 134 new products and processes from a total of 79 implemented projects of which 31 projects were completed, all capitalizing on STI to increase productivity and boost industry competitiveness.

# Establishment of a Plastic Waste Pyrolysis System along Esteros for the Rehabilitation of Manila Bay

Pyrolysis is defined as the thermal decomposition of organic materials in the absence or controlled supply of oxygen which does not lead to combustion. Decomposition depends on the heat, pressure and time the material is withheld within the vessel. Pyrolysis offers better recycling rates to reach higher profitability. The recovered gas and oil can still be used as fuel, while the solid “char” can also be used by some industries as filler material.

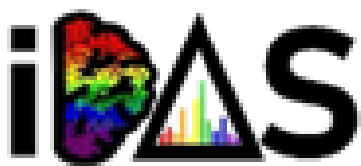
Advantages of the pyrolysis system are as follows:

- Higher recovery of oil
- Cheaper than existing pyrolysis units of similar capacity
- Easy to operate and maintain
- Durable and relatively easy to fabricate

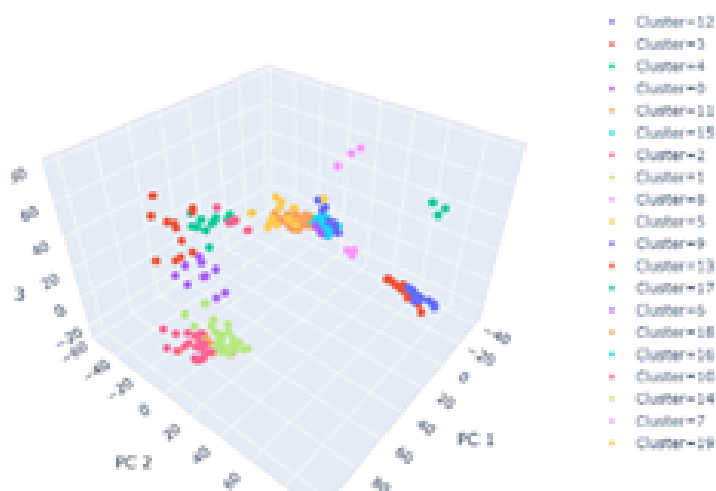
In collaboration with DOST-NCR and LGU-Paranaque City Community Environment and Natural Resources Office (CENRO), the DOST-ITDI developed and deployed a plastic waste pyrolysis system at the city's Material Recovery Facility (MRF). The DOST-ITDI pyrolyzer is a non-burn technology permitted under the Clean Air Act. It can be used as an alternative method for waste management of commercial and industrial plastic wastes such as low density polyethylene (LDPE) and high density polyethylene (HDPE).

The system can also be used for the recovery of pyrolytic, a possible substitute to bunker or industrial fuel oil given that its heating value is approximately 32,170 KJ/kg. A MOA is now being finalized to facilitate the transfer of one unit of pyrolyzer to the Parañaque City MRF.





## Intelligent Data Analysis System: An Intelligent Solution for Industry 4.0



In its fight against illicit drugs, the government implemented a policy, the Philippine Drug War, to help curb the alarming number of Filipinos who are involved in the production, distribution, and use of these illegal drugs. To support this program, DOST-ITDI's ADMATEL in partnership with the Advanced Science and Technology Institute (DOST-ASTI) and the Philippine Drug Enforcement Agency (PDEA) as end user, implemented its pilot R&D through the Intelligent Data Analysis System (IDAS) for Illegal Drug Trafficking Investigation in the Philippines.

IDAS is a 100% DOST-made web-based software that was developed to provide a rapid and innovative profiling technique that reveals the history of materials and substances, processes they possibly underwent, and the probability of causing them their current chemical state or properties. This provides more information on impurities, production methods, and sources of materials, hence interrelations among samples were prominently revealed.

IDAS' enhanced flexibility and robustness was made very useful both for scientific and non-scientific numerical datasets. The IDAS Software V1.0 has already been completed with several functionalities categorized into two modules: (1) PCA and Cluster Analysis Module, and (2) Kinetic Stability Modelling Module. Several performance testing procedures were applied to ensure the validity of results produced by the system.

DOST-funding for IDAS program enabled the establishment of the new ADMATEL Research and Development Laboratory which will offer new advantageous S&T solutions such as Gas Chromatography – Mass Spectrometry (GC-MS), use of equipment for research activities of students or industry partners, and the application of IDAS Technology. ADMATEL will now transcend its customers' experience from testing through R&D.

IDAS Software V1.0 was also made ready to serve industrial needs as its innovative design strengthens failure and defect analyses of materials, as well as advanced characterization and profiling of substances in the perspectives of quality assurance and quality control. With IDAS, possibilities can thus be limitless.





## Data Acquisition of Shock and Vibration Values in the Last Leg Delivery (Motorcycle and Closed Van) of Small Products within Metro Manila

In the last five years, e-commerce has been making exponential growth here in the Philippines. Ranking 3rd in Southeast Asia, the Philippines accounts for 76% of e-commerce transactions in 2017 according to a Google Temasek report. This new purchasing platform changed the current landscape of the traditional *"consumer goes to a retail store to buy goods"* into *"goods delivered directly to a consumer"* scenario. With the rise of e-commerce and just this year, with the impact of COVID-19, the volumes of door-to-door deliveries of goods have also increased. Small and light goods were delivered by motorcycles (2 wheels) while big and heavy items were delivered by vans. The current practice of packaging goods is designed to withstand the traditional distribution system from supplier to retail store or from supplier to distribution center to a retail store. In the e-commerce scenario, on the other hand, this goes on a more complex distribution system with additional distribution channels and handling steps.

The study gathered shock and vibration data of delivery vehicles used in the last-leg delivery of small products purchased thru e-commerce or online shopping within Metro Manila. Field data recorders were mounted to test vehicles to gather shock and

vibration levels during delivery in routes that act as major beltways within Metro Manila.

The study revealed that the positioning of products in the delivery vehicle could affect the level of shock and vibration it absorbs during transportation. Furthermore, on two-wheeled vehicles, the shock and vibration levels were higher in motorcycles equipped with single rear shock absorbers compared to those equipped with dual rear shocks. The recorded shock and vibration levels for four-wheeled vehicles were lower than those of the two-wheeled vehicles. The routes with the highest recorded Grms (G) values were the same for both 2- and 4-wheeled test vehicles.

The vibration data can be used to develop vibration test methods specifically tailored to the Philippines. The test methods can be used to evaluate the performance of designed transport packaging system for e-commerce addressing product damages during distribution. These test methods can be offered to the public by PTD as an additional test service for packaged-product performance evaluation. Online shopping platforms like DOST's E-store will benefit from this study.



## Strengthening the Municipal Solid Waste Management Program: A Guide on Preparation of Waste Analysis and Characterization Study (WACS) Plan for the National Capital Region Local Government Units

Under the Republic Act 9003 or the Ecological Solid Waste Management Act of 2000, Local Government Units are required to prepare a 10-year Solid Waste Management Plan, of which Waste Analysis and Characterization Study is one of its components.

WACS is a process of gathering information on the quantity (tons per day, cubic meters per day, kg per household) and composition (biodegradable, non-biodegradable) of solid wastes generated from various sources. Sources of wastes include households, commercial and industrial establishments, and institutions, among others. This information will help in solid waste projections, selecting appropriate methods or technologies for managing specific waste component, and for estimating the area for Materials Recovery Facility. WACS results will, therefore, serve as basis for accurate solid waste management planning.

Through this project, the DOST-ITDI provided guidance and assistance to LGUs in the metropolis and introduced the simplified method of conducting WACS and preparing the WACS plan.

WACS training-workshops had originally been conducted on-site, but due to the Enhanced Community Quarantine, recent trainings were done virtually. In totality, the project trained 111 participants and 17 LGUs in the National Capital Region (NCR).



# Shelf Life Extension of *Bukayo* (Coconut Candy) and *Budin* (Cassava Cake) through the Application of Improved Packaging Technology

The use of high-barrier and active packaging technology to extend the shelf life of *bukayo* and *budin* was studied. Samples of *bukayo* cubes and *budin* were purchased from processors in Batangas and Tayabas, Quezon, respectively.

Treatments/packaging materials used were Ny/EVOH/LLDPE and Ny/LLDPE. The use of PP as packaging for the product samples served as the control. Packed samples were stored at 20°, 30° and 40°C for *bukayo* and at 5°, 20° and 30°C for *budin*. Product samples were monitored periodically for changes in physico-chemical and sensory attributes.

The results indicated that the use of Ny/EVOH/LLDPE + oxygen absorber gave longer shelf life compared with Ny/LLDPE and PP. At 30°C the shelf life of *bukayo* packed in Ny/EVOH/LLDPE + oxygen absorber was 15.9 months compared to the 10.3 and 6.5 months for *bukayo* packed in Ny/LLDPE + oxygen absorber and PP respectively. For *budin* samples packed in Ny/EVOH/LLDPE + oxygen absorber and stored at 5°C, the shelf life reached 20 days compared to 18 days using Ny/LLDPE + oxygen absorber and only 5 days when packed in PP plastic bag.

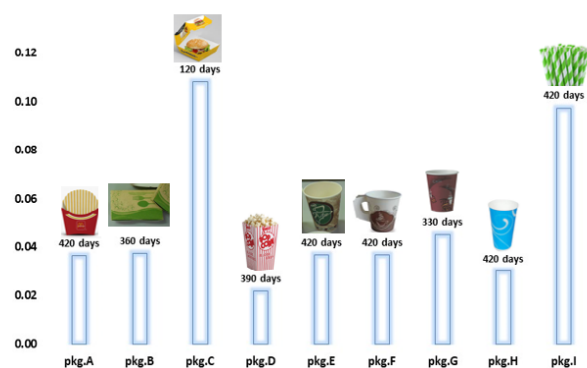


The brand names Coco Bukayo and Quick Munch and package designs were developed for the products. The products in new packaging design and brand name were introduced during the Asia Packaging Network (APN) and International Packaging Symposium and ISTA-APD International Symposium on Distribution Packaging held last October 22-24, 2019 at Dusit Thani Manila.

## Effect of Storage Conditions on the Migration Characteristics of Benzophenone in Paper and Paper-Based Food Packaging

The study has developed migration profiles of benzophenone in different types of paper-based food packaging. Benzophenone is an excellent wetting agent for pigments and acts as a reactive solvent, increasing the flow of inks. The levels of benzophenone were determined at different periods of time and temperature.

The packaging samples were subjected to three (3) different temperatures stored in controlled environment over time after which extraction was performed. These extracts were analyzed with a gas chromatograph-mass spectrometer (GCMS) using the in-house method then modified and adapted from an analytical laboratory of the University of Zaragoza in Spain. All samples analyzed showed concentration of benzophenone that are way below the specific migration limit of 0.6mg/Kg as per European legislation directive 2002/72/EC.



Summary of maximum concentration of benzophenone obtained from the study



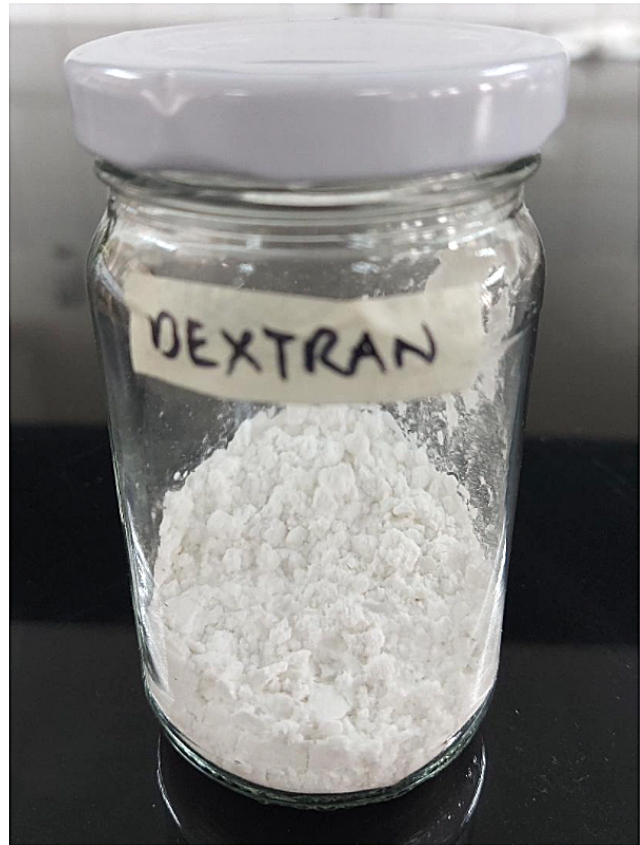
# Pilot Scale Production of Spray-Dried Dextran and High-Fructose Syrup using Whole-Cell (*Leuconostoc mesenteroides* isolate)

## ITDI Fermentation Technology

Dextran is a polysaccharide made of numerous glucose units used in the pharmaceutical (i.e. anticoagulants and volume replacement agents) and food industry (i.e. bread improver product and thickeners for ice creams). In the search for dextran-producing microorganisms, substrates such as coconut water, *buko* flesh, sugarcane, cabbage, carrots, *mustasa* (mustard greens) and *kimchi* were fermented. Dextran producers were isolated using tomato peptone sucrose salts (TPSS) and Mayeux, Sandine & Elliker Agar (MSE) with sodium azide as well as MRS media. The purified colonies were subjected to Gram staining, catalase test, dextran production and 16S rRNA identification. A total of 183 isolates with dextran-producing capability were isolated with 25 undergoing molecular identification.

Results showed that the species identified were *Leuconostoc spp.*, *Weissella spp.*, *Brevibacillus spp.* and *Gluconobacter spp.* High-yielding dextran-producing isolates were also tested for the presence of virulent genes. The absence of virulent genes would imply that the isolates are safe for human applications. During dextran production, high-fructose syrup (HFS) is also produced. The HFS was used as a substitute sweetener for ready-to-drink calamansi juice while the dextran was used in breads and ice cream as a bread improver and thickener, respectively.

Consumer testing (approximately 30 panelists) of the products showed that there is no significant difference in overall consumer acceptability of the three (3) products made in comparison to individual product controls with a range of like slightly (6) to likely very much (8) in a 9-point hedonic scale. A 30% HFS substitution was employed in ready-to-drink calamansi juice drinks while dextran was added to bread and ice cream at 1.0-5.0% and 0.5-1.5%, respectively.



# Natural Food Colors from Local Sources as Food Additive

DOST-ITDI through this project identified geographical sources of five local raw materials; developed processes for extraction of red colorants from four sources; and conducted preliminary batch scale production runs.

Additional studies, however, are needed to address the solvent residues in the final powdered colorant that meets the international requirement of 50 ppm. Initial runs were conducted on ultrasonic-assisted extraction (UAE) of colorants using the probe-type reactor. The UAE shortened the extraction process to 1 hour compared to 16 hours in conventional method at room temperature. The yield of colorant (in terms of total monomeric anthocyanins) was also observed to be higher than using conventional means. A process using the produced natural red color on nata de coco was then developed, and which did not leach out when added to "*sa malamig*".

Yellow colorant from *tiesa* was also extracted with solvent and after concentration was mixed with sunflower for stability. However, the solvent residues measured did not comply with the existing standard and would need further study.



## Phase 1 Product Application



Milk + water +  
sugar + gelatin  
cubes



Red Nata de  
Coco (NDC)



NDC

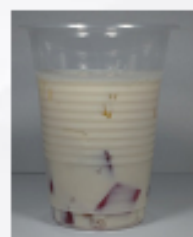
gelatin



Synthetic red



Natural red



30 min. reaction time



Synthetic red Natural red

# Establishment of Halal Assurance System for Selected Banana Products (Banana Chips, Banana Catsup, and Frozen Banana)

This project aims to establish halal assurance systems in the processing of selected banana food products (banana chips, banana catsup, and frozen “*saba*” banana) for the global market. The following outputs were achieved:

- Developed the processes for the production of three banana products that complies with Halal requirements, regulatory and market standards;
- Conducted shelf life study of three banana products based on the quality parameters: aw, moisture, FFA, TSS, pH, TPA, porcine determination for halalness;
- Prepared the Halal Hazard Analysis Critical Control Points (HACCP) for the selected banana products and Business Opportunity Plan (BOP) for each halal product through the assistance of Business Development Section of ITDI-TSD;
- Visited Bangkok, Thailand as part of the benchmarking activity:
  - Supermarkets (Big C Superstore, Chatuchak Market, Siam Plaza and MBK Malls);
  - Food processors (BB&B and I-Bev Thailand Co. Ltd.);
  - The Halal Science Center and the Department of Food Technology in Chulalongkorn University, Thailand Innovation for Scientific and Technological Research (TISTR) and Food Innopolis for project collaboration;
  - Food Innovation Service Plant (FISP) for plant visit;
- Through a signed MOA, assisted five private companies (Mama Rossa Dist. Company now Serilda Food Products, Quezon City; FRUX Food Products, Davao City; Villa Socorro Agri-Eco Village, Inc., Laguna; Global Foods Solution, Inc., Laguna; and See's International Food Marketing Corp., Davao City) on the preparation of HAS Manual and filing of documents for Halal Certification;
- Developed and submitted for copyright (thru ITDI-TSD) the following:
  - The generic Halal Assurance System (HAS) manual and the developed specific HAS Manual for the three (3) products in collaboration with project cooperators;
  - Brochures and monographs with list of permissible and non-permissible raw materials and ingredients including the directory of suppliers for selected Halal banana products;
  - The Halal Hazard Analysis Critical Control Points (HHACCP) of Selected Banana Products;
- Organized with the financial assistance coming from DOST-HRDP the Lead Auditors Halal Training and Certification Program conducted by Dr. Rafek Saleh of MHCT-IIHA of Malaysia. Total of 55 DOST-based/affiliate personnel were trained as Lead Auditors;
- The teams conducted mock audit for halal products (halal banana, bakery, and cosmetics and toiletries products);
- 3 staff were trained on the processing of Muslim delicacies (Shelf stable Chicken Pastil, Beef Pastil and Fish Pastil) packed in retortable pouches that are Halal compliant; and
- Conducted knowledge transfer (Processing of Dried Banana and Banana in Syrup) to See's International Food Marketing Corporation.



# Development of an Effective Distribution System for RTE foods (Chicken Arroz Caldo and Fish Rice Meal) to Mitigate the Magnitude of Distress for Calamity Survivors and Providers of Services

The distribution of relief foods is normally conducted after the natural disaster or calamity has happened. However, in most cases, immediate distribution of relief foods to calamity survivors could not be done due to problems such as continuous heavy rains, flooded areas, and damaged roads.

This project addresses the delay in distributing relief foods to the calamity survivors including DOST-ITDI's developed RTE relief foods (1st and 2nd stage relief foods). In terms of assessing the effectiveness of early distribution, result of a pre-survey questionnaire showed a high percentage (>90%) of positive response, that the RTE relief foods addressed their immediate hunger and also lessened the magnitude of distress or worries.

The DSWD, DILG, and DOST regional offices extended full support and cooperation to PTD in the implementation of the project activities.

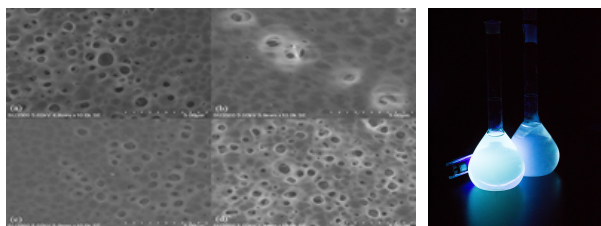


## Biomass-derived Carbon Quantum Dots and CQD / Polymer Composites for Biomedical and Industrial Applications

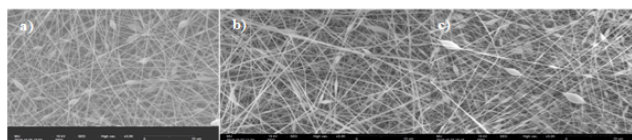
The discovery of photoluminescent carbon quantum dots (C-dots or CQDs) holds great promise for modern nanobiomedicine. CQDs are novel nanomaterials with a wide array of unique physical, chemical and photoluminescence properties and flexibility for surface modifications. Carbon quantum dots have optical properties and biocompatibility, which makes them ideal for biological applications like drug delivery, bio-imaging, biological labelling, and sensing. However, their biological properties should be further studied for them to be applied safely for cellular and in vivo studies, and for clinical use. As a carbon-based material, CQDs are less toxic compared to other semiconductor-based quantum dots. The cytotoxicity

and biocompatibility of CQDs in various in vitro models showed no apparent toxic effects.

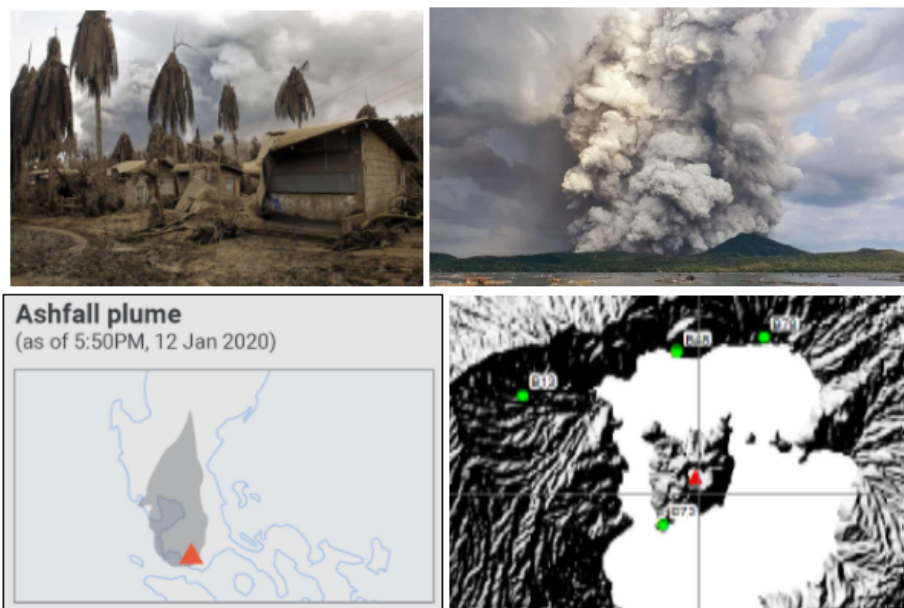
The study's general objective is to synthesize and characterize Biomass-Derived Carbon Quantum Dot (BDCQD) and BDCQD/polymer composites for biomedical & industrial applications. Two types of BDCQD/polymer composites membranes were synthesized. The first membrane was synthesized using BDCQD/PAN and BDCQD/PAN-PCL nanocomposite membranes via electrospinning method. The other was synthesized using BDCQD/PSF nanocomposite membrane via membrane casting method.



SEM micrograph of BCQD/PSF Composite membrane produced via membrane casting method



SEM micrographs of electrospun membranes



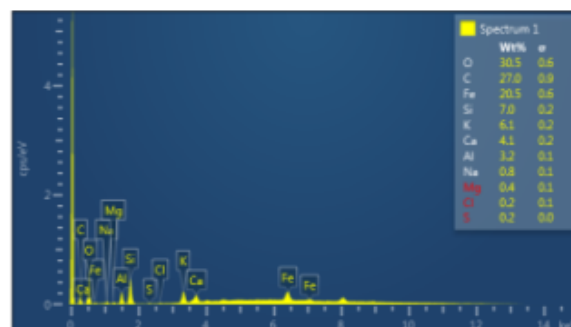
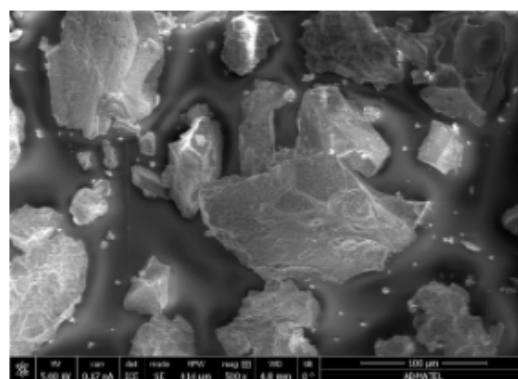
# Preliminary Characterization of Taal Volcanic Ashfall as Potential Raw Material for the Construction Industry

When the Taal Volcano erupted on January 12-13, 2020, it has produced an enormous amount of volcanic ashfall (tephra), which affected Region IV-A and even Metro Manila. The volcanic ashfall emplacement caused widespread damage and disruption to agriculture, infrastructure, health, flora and fauna, lifelines, aviation and the environment. The large ashfall plume dispersed by Taal Volcano, covered many areas in Region IV-A. Therefore, DOST-ITDI took the initiative to check the chemical composition of the volcanic ashfall to check suitability as raw material for the construction industry, e.g. as raw material for cement.

Complete chemical analysis was done to the volcanic ashfall samples taken by experts from the Philippine Institute of Volcanology and Seismology (PHIVOLCS) from four (4) strategic locations at Taal Volcano and its surroundings. Analyses were done for the characterization of the volcanic ashfall samples for silica (SiO<sub>2</sub>), alumina (Al<sub>2</sub>O<sub>3</sub>), titania (TiO<sub>2</sub>), Fe<sub>2</sub>O<sub>3</sub>, MnO<sub>2</sub>, CaO, MgO, NaO, K<sub>2</sub>O, P<sub>2</sub>O<sub>5</sub>, loss on ignition, water and acid soluble sulfate (SO<sub>4</sub><sup>2-</sup>), and water and acid soluble chloride (Cl<sup>-</sup>). Trace metals, arsenic (As), cadmium (Cd), total mercury (Hg), and lead (Pb) were also analyzed.

The results obtained can be used by local industries in Region IV-A to utilize the collected volcanic ashfall in formulating cement mixtures for the local construction industry.

The characterization of the volcanic ash samples using Scanning Electron Microscope - Energy Dispersive using X-Ray (SEM-EDX) analysis by the Advanced Device and Materials Testing Laboratory (ADMATEL) have shown the microscopic nature of the volcanic ashfall samples, as well as the elemental compositions, which have helped the PHIVOLCS in understanding the nature of the January 2020 eruption.





## Modular Multi-Industry Innovation Center (MMIC)

The Modular Multi-Industry Innovation Center (MMIC) is an industrial processing facility with multifunctional / multi-application modular operation equipment units that can be retrofitted to a number of different manufacturing lines.

The MMIC is created to address the concerns of different industrial sectors such as absence or lack of equipment units for R & D, economic restraints, and lack of efficient manufacturing facilities. The industries, academe, and other stakeholders may use the Center for research and development of new products, product equivalent, product variances and product reintroduction. The Center's researches focus mainly on raw materials that are by-products or wastes of commercial operations which could generate new innovative products on food ingredients, beauty nutritional supplements, as well as on the development of improved and efficient processes.

The three main processing lines of the MMIC are nut/seed oils, mix powder blends, and liquids/emulsions. To date, the MMIC has identified a total of 39 product prototypes.

There are four modes of engagement from which industries or clientele can avail the use of MMIC's facilities:

- Use of facility/equipment units – technical assistance on the use of equipment units will be provided (subject to fees & charges).
- Technical Service – use of facility plus DOST-ITDI experts (subject to fees & charges)
- Technology Transfer – use of the facility with the assistance of DOST-ITDI experts adopting DOST-ITDI developed technology (subject to a Technology Licensing Agreement with technology fee)
- Contract Research – use of the facility with the assistance of DOST-ITDI expert working on client's concept or idea (subject to a Memorandum of Agreement or Research Agreement with fees & charges).

Mapagmahal Foods, Hi Las Marketing, Leslie's Pili, and Northern Foods Corporation provided the by-product materials used in the processing of product prototypes.





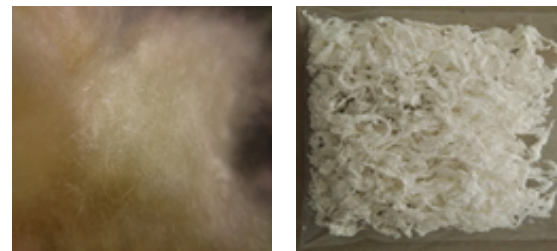
# Nanofibrous Scaffolds from Natural Biomaterials for Tissue Engineering

The utilization of natural biopolymers has shown potential in generating innovations for tissue engineering applications. In this study, nanofibrous composites as scaffolds for tissue engineering were developed and fabricated. The developed nanofibrous scaffolds consist of (1) cellulose acetate derived from *kapok*, abaca, or pineapple fibers and (2) calcium phosphates from locally sourced nanoprecipitated calcium carbonate (NPCC).

Cellulose was first extracted from *kapok*, abaca, and pineapple fiber, followed by acetylation of the extracted cellulose. After that, both the extracted celluloses and synthesized cellulose acetates were characterized using Attenuated Total Reflectance – Fourier Transform Infrared (ATR-FTIR) spectrometer, X-ray diffractometer (XRD), and Differential Scanning Calorimeter (DSC). FTIR analysis has shown the extracted celluloses and synthesized cellulose acetate from *kapok*, abaca, and pineapple. XRD analysis also confirmed the presence of cellulose acetate from *kapok* (KCA), abaca (ACA), and pineapple (PCA).

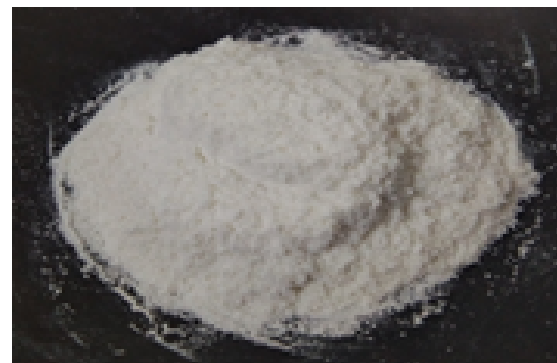
On the other hand, calcium phosphates were synthesized by mixed oxide method utilizing locally sourced nanoprecipitate calcium carbonate (NPCC) and calcium hydrogen phosphate dihydrate ( $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$ ). Three (3) types of calcium phosphate were synthesized, namely: tricalcium phosphate (TCP), hydroxyapatite (HAP) and biphasic calcium phosphate (BCP).

Two kinds of scaffolds were fabricated: (1) cellulose acetate-based and (2) modified cellulose acetate to produce a nanocomposite fibrous scaffold. Furthermore, the fabrication of these nanofibrous scaffolds used the non-solvent induced phase separation (NIPS) method to produce 2D scaffold in the form of flat membrane and 3D scaffolds using a 3D-printed mold.



(a)

(b)

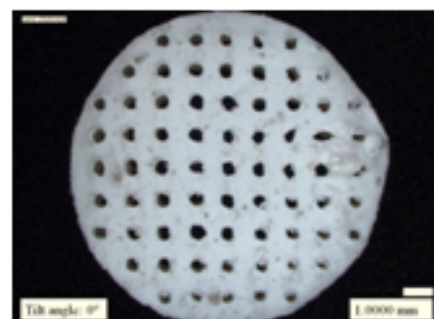


(c)

Synthesis of cellulose acetate from natural fibers: (a) local *kapok* fiber (b) extracted cellulose from local *kapok* and (c) cellulose acetate from extracted cellulose



(a)



(b)

Fabricated nanofibrous scaffolds: (a) 2D and (b) 3D

# Development of Portable Ultrafiltration / Nanofiltration Membrane Module for Treatment of Potable Water for Remote / Field Application (Mabuhay Straw)



The portable membrane filter is a hand-operated filtration module for drinking water application. The manual operation facilitates the flow of water and at the same time prevents contamination relative to suction-by-mouth type membrane filtration. The mechanism of the module enables backflow for cleaning of the filter after use. The membrane module is replaceable and the hand pump is reusable.

The membrane filter consists of a hollow fiber membrane to enable compact operation with high treatment efficacy. Pore size is in the ultrafiltration range, allowing filtration of bacteria, parasites, other microorganisms, particulate, and colloidal matter.

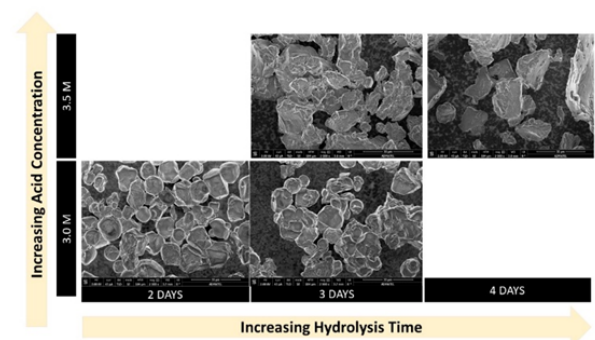
Through 3D printing, the membrane module was customized with provisions to refill standard bottles used as water containers. This configuration enables storage of treated water for use at any time. In addition, further customization can be performed to fit other types of storage media.

## Synthesis, Characterization, and Production of Starch Nanocrystals

Starch nanocrystals are one of the novel nanomaterials that gain growing interest among various sectors due to the availability, biodegradability, and biocompatibility of the raw materials. Since nanocrystals can be formed from different sources of starch, these nanomaterials can be produced from local starch sources, which will also lower the cost of the starting material.

Starch nanocrystals (SNC) are crystalline platelets obtained by the acid hydrolysis of amorphous parts of starch. In this study, various processing conditions were investigated to determine their effects on the properties of the synthesized starch nanocrystal from raw corn starch via acid hydrolysis using sulfuric acid ( $\text{H}_2\text{SO}_4$ ).

The starch nanocrystals can be used as reinforcing nanomaterials for different applications such as natural rubber, bio-sourced and biodegradable polymers, drug-release systems, and emulsion particle stabilizers. Starch nanocrystals can also be utilized for environmental applications as it can be used as adsorbents for the removal of pollutants.



SEM images of some representative SNCs showing the effects of hydrolysis time and acid concentration

# Prototype Development of Natural Fiber-Thermoplastic Composites from Agricultural and Industrial Wastes for Industrial Application

Natural fibers were found to have properties such as low density, low energy consumption, and lower potential health risks. Natural fibers have already been used in construction, automotive, electrical and electronics goods and other industrial applications.

The core technology of this project is creating a prototype product involving melt compounding of recycled plastics and agricultural waste fibers, and wood wastes for construction, home furniture, 3D filaments and other industrial purposes. The agricultural waste fibers used in the processing of natural fiber-reinforced thermoplastic composites are coir dust, bagasse, different species of tobacco stalks including the wood wastes of derived from Falcata, Mahogany and Mancono. The thermoplastic matrices used in mixing with fibers are commingled waste plastics of High-Density Polyethylene (HDPE) and Polypropylene (PP), recycled HDPE, and other materials.

The produced materials are lightweight, environment-friendly, have good dimensional stability, good thermal expansion, improved strength, stiffness and rigidity, low shrinkage, low water absorption and are highly resistant to termites and decay fungi, which make them very good building materials for various application.



**Building materials**



**Injection-molded tray**



**Electronic**



**3D filaments**



# i-SALT Project: Design and Prototyping of Salt Processing Equipment

The salt-making industry was once a vibrant industry in the Philippines. However, it has since been crippled by the country's vulnerability to climate change and lack of technology that will boost the productivity and improve the quality of locally produced salt. To address the problem, DOST-ITDI is offering improved salt production process using the following equipment that will allow processors to produce salt even during rainy seasons and will help them comply with the standards mandated in the Republic Act No. 8172 also known as An Act for Salt Iodization Nationwide (ASIN) Law.

DOST-ITDI improved evaporating pan with furnace will allow cooked salt processors to produce refined salt with higher purity and less solid fuel consumption. The evaporating pan has a filling capacity of 300L/batch and the furnace is covered with bricks resulting to lower heat losses and, thus, shorter cooking time.



**Evaporating Pan with Furnace**



**Salt washer**

The spin dryer is designed to decrease the moisture content of refined salt as required by ASIN Law. Drying is by centrifugation, which can process up to 75 kg of salt per batch. Contrary to traditional dripping and sun drying, this equipment allows processors to produce salt even in humid and rainy conditions.



**Spin dryer**



**Salt iodizer**

The DOST-ITDI-modified salt iodizer is designed to allow processors to consistently and uniformly infuse salt with iodine using atomized spray in the range of 30 to 70 ppm as required by Food and Drug Administration (FDA Circular No. 2013-007). It is a portable screw-type machine which can be operated continuously with maximum capacity of 750 kg/hr.

# Pilot-Scale Biogas Production of Biodegradable Solid Waste for Muntinlupa

To help the LGU of Muntinlupa City comply with RA 9003 (Ecological Solid Waste Management Act of 2000), DOST-ITDI, in close coordination with LGU officials, proposed to put up their City Materials Recovery Facility (MRF) with recycling and composting as major components. The LGU also has to double its efforts in collecting and processing of its wastes due to the establishment of an animal pound, backyard, and livestock farming in the city.

This project involves the fabrication, installation, and operation of the 1,000 liters portable biogas digester system at the Materials Recovery Facility of Pacwood Compound in Tunasan, Muntinlupa City. The portable biogas digester system comprises of an IBC tank as the digester, and two 200 liters drums as gasholders. The fabricated portable biogas digester was transferred to the MRF of Muntinlupa City on February 27, 2020.

The substrates used for the digester were piggery manure and market waste, including vegetable and fish wastes. The digester is loaded daily with about 10 kg of hog manure and 10 liters of water, with weekly loading of 10 kg fish waste and 10 kg pre-treated vegetable waste with 10 liters of water. Pre-treatment involves shredding and mixing with a fungi degrader, *Trichoderma harzianum*.

The biogas produced was about 400-500 liters per day and was used for boiling water and cooking of the food of the operators of the MRF. In addition, wastewater that was discharged from the portable biogas digester, about 20 liters per day, was transferred to a 160 liters covered blue drum and used as nitrogen source for the bioreactor operation at the MRF.

Beneficiaries of the project were municipal animal pounds, backyard piggeries, canteens, and other livestock industries.



Loading to digester



Pre-treated vegetable waste



Fish waste



Manure

# Establishment of a Halal-Compliant Assurance System and Standardized Process for Cosmetics and Toiletries

The value of Halal transcends cultural and religious boundaries in light of ensuring health, cleanliness and safety that comes with great moral and social responsibility. Currently, the cosmetic and toiletry sector as one of the key players in the Halal market experiences a substantial growth and is consistently driven, especially by the Muslim and Non-Muslim younger generation being the more conscious consumers.

This project under the DOST Halal S&T Program led by DOST-ITDI greatly emphasizes the use of halal-compliant ingredients, hygienic manufacturing and processing facilities. Therefore, it mainly implies incorporating strict halal compliance in developing products, namely: moisturizing lipstick, moisturizing lip balm, herbal whitening toothpaste, moisturizing and whitening bath soap, and shampoo with hair-growth promoting properties in 4 various forms (liquid clear, liquid pearlized, clay, and bar). Furthermore, this project generally sets up a Halal assurance management system with specific hazard analysis and critical control point (HACCP) and traceability framework, all embodied with guidelines only permissible to Shariah principles.



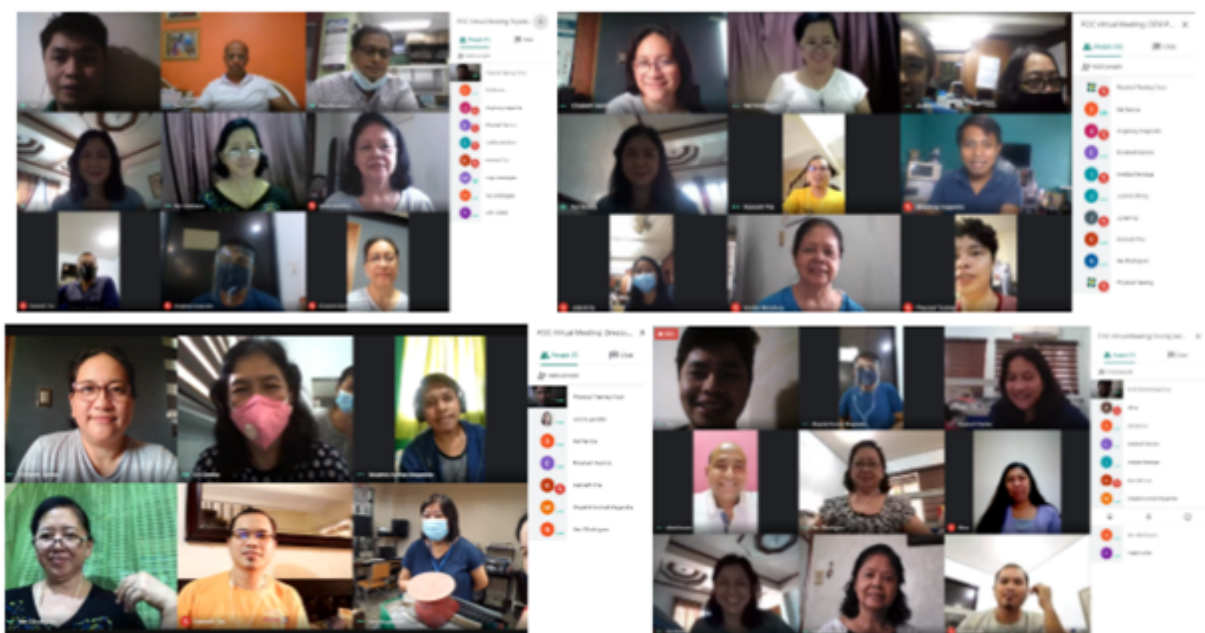
## Development of Natural Colorants for Cosmetics

Color is an important property that significantly influences the appearance, processing, and acceptance of a product. Consequently, there has been a growing interest in the development of natural colorants to replace synthetic colorants, due to the latter's association with health and ecological concerns.

However, factors such as temperature, pH, water activity, and light greatly affect the stability of the natural pigments, leading to a loss in color and functional properties. In this study, natural colorants from plant sources such as *Beta vulgaris* (red beetroot), *Clitoria ternatea L* (blue ternate), *Hylocereus polyrhizus* (red dragonfruit), and *Garcinia mangostana* (mangosteen) were obtained through aqueous and solvent extraction methods. These extracts were subjected to microencapsulation through the spray-drying process to protect the sensitive components from the external environment. The developed natural colorants were used to formulate cosmetic products such as lipstick, blush-on, and eyeshadow, achieving higher value, sustainability, safety, and potential health benefits.







## Conduct of Virtual Assessment of the Formula of Conversion (FOC) Services

The Physical and Performance Testing Laboratory (PPTL) of the Standards and Testing Division issues Formula of Conversion (FOC) certificates for tax and duty drawbacks of imported raw materials used in the manufacture or processing of products for export. This is a regular service offered by the Standards and Testing Division to various companies nationwide. The PPTL staff conducts visits and inspections of facilities and evaluations of manufacturing processes of imported raw materials into export product for the issuance of the FOC certificate. But because of the pandemic, actual plant visits were not possible.

This restriction, however, did not stop the ITDI-STD in continuing its service to the general public for the needed FOC certificates. Online teleconferencing software, i.e. Google Meet and Zoom, were utilized for the virtual visit and assessment of the manufacturing process of various companies.

The virtual FOC assessment has resulted in 47 companies accommodated and issued FOC certificates to export their products to other countries as of December 18, 2020. Thus, the FOC services have helped the Philippine exporters to still pursue with their businesses despite the challenges brought about by the pandemic.



## PLACES REACHED & ESTABLISHED

A total of 25 places were reached in 2020 - 20 in Luzon, 1 in the Visayas, and 4 Overseas (1 in South Korea, 1 in Singapore, and 2 in Thailand) to provide technical assistance to the locals in their technology needs or to gain additional knowledge through hands-on training and workshops. DOST-ITDI also continues to establish state-of-the-art facilities aligned with international standards and guidelines in support of its vision to be a leading industry partner in Science, Technology, and Innovation.

## Facilities Established

Various facilities were also established in 2020 by DOST-ITDI. These include: Flow Measurement System Facility and MatDev Laboratory in DOST-ITDI Bicutan, Taguig City; Muscovado Processing Plant in Santiago, Isabela; and Ceramic Facility in Sibalom, Antique.

### Flow measurement system facility

Inaugurated last November 23, 2020, this P18-Million facility was acquired through the implementation of Project 4: Strengthening the Physical Metrology Capabilities of the NML. This Automatic Flowmeter Calibration System is designed to calibrate flowmeters with sizes ranging from DN 25 to DN 100. It has two test lines that can accommodate at most, two units under test depending on the size and type of flowmeter.

Its operation will open opportunities for NML to realize one of its commitments in Legal Metrology which is to establish a metrological infrastructure for the testing of water meters in the country. This facility will also encourage concessionaires of water utilities and water metering regulatory agencies of government to harmonize their verification test procedures with the international standards.



**Flow Measurement System Facility, ITDI, Bicutan,  
Taguig City**



## Establishment of a common service facility (CSF) for muscovado processing in Santiago City, Isabela



**Muscovado Processing Plant, Santiago, Isabela**

This project aims to help the sugarcane farmers/processors have a continuous source of income by motivating and encouraging them to go into the business. Market potential of the product is promising in both local and international markets. With the trend towards organic and healthier food sources and the increasing health consciousness of consumers by reducing chemical intake, demand for muscovado has been increasing at a fast pace.

DOST Regional Office II, together with LGU-Santiago has collaborated with DOST-ITDI and to implement the project titled: "Establishment of a Common Service Facility" (CSF) for Muscovado Processing in Santiago City". The ITDI muscovado processing technology integrates modifications and re-engineering of the traditional equipment and the development of a standard production process. The main objective is to improve the traditional technology and be able to produce a globally competitive product, thereby, helping the sugarcane farmers/processors augment their income.

During the project implementation, the DOST-ITDI has provided the following: assistance in the preparation of the proposed plant layout, recommendation on the set-up of equipment, supervision on the construction, installation, testing, and firing of the newly constructed muscovado furnace. The institute also supervised the fabrication of muscovado equipment units (i.e. evaporating pan, pasteurizer, drying table, and settling tank), conducted oversight renovation of the plant, and functional testing of equipment.

The common service facility for muscovado processing was virtually launched on October 26, 2020. DOST-ITDI will continuously give support and technical assistance to the project.

## MATDEV Laboratory

The Materials Development (MATDEV) Laboratory Facility is located at the Pilot Plant building of the Materials Science Division, Industrial Technology Development Institute, DOST Compound, Bicutan, Taguig. The building that houses the MATDEV facility meets the safety standards that are applicable to the equipment associated with the various materials development and characterization.

The MATDEV facility houses state-of-the-art small-scale 3D printers for ceramics, polymers and multiple materials. This facility also includes a laboratory for research, characterization, standardization and performance testing of developed 3D printing materials from local and indigenous sources. The facility was inaugurated in December 2020.



**MatDev Laboratory, ITDI, Bicutan, Taguig City**



**Ceramic Facility, Sibalom, Antique**

## **Ceramics facility in Sibalom, Antique**

The project was implemented through collaboration amongst DOST-ITDI, DOST-VI, the University of Antique, Asosasyon ng Maninohon sa Barangay Bandoja (AMABBA) at Tibiao, and Manugkoron Cooperative at Sibalom. It is an initiative of Congresswoman and Deputy House Speaker Loren Regina B. Legarda for the Province of Antique. The project intends to provide technical assistance for the upgrading of community-based terra cotta production in Tibiao and Sibalom, Antique through skills and facility upgrading; introduction of new techniques, equipment, and establishment of a production facility.

Skills trainings were provided to the potters and staff of the University of Antique like training on pottery production, kiln operation, and firing techniques. Study visits and benchmarking were also conducted by the potters of Antique wherein they witnessed the current practices and products made by the potters at Lezo, Aklan.

Samples of clay and sand were also analyzed and characterized to determine their physical properties and compressive strength. Results have shown that the clay of Antique is a potential material for the production of ceramic water filters aside from the usual bricks and pots. However, further confirmatory studies and trials still need to be conducted.

Kiln and plant designs were provided by DOST-ITDI to supplement the needs and requirements of the beneficiaries. A bottle-type kiln prototype was fabricated and installed at the University of Antique as a temporary site for the Manugkoron potters. Although there were delays caused by the pandemic and typhoons, the construction of 2 cu. m. shuttle-type kiln and repair of facilities at Brgy. Bandoja, Tibiao are almost completed. Other sets of auxiliary equipment were also given such as gas kiln, roll kneader, jiggering machine, brick molding machine, diesel generator, banding wheels, and electric potter's wheel.

## Other Places Reached

### CED

- Edge Electronics – NCR
- Mondelez Phils. – NCR

### EBD

- Quezon City Hall – NCR
- Anda and Mabini – Region I
- Lancaster New City – Region IV-A
- Robinsons General Trias – Region IV-A
- Manila Zoo – NCR
- Sanchez Mira, Cagayan – Region II
- Mariano Marcos State University – Region I
- Technological Institute of the Philippines - NCR
- Fish2Go Dasmariñas – Region IV-A (& FPD)
- CocoPlus Aquarian Development Corporation – Region IV-A
- Eco-Waste Management System – Region IV-A
- Eneco Holdings Inc. – Region IV-A

### STD

- Advanced Research Lab – Thailand

### FPD

- Chulalongkorn University, Thailand/Halal Science Center; Food Technology – Thailand
- Thailand Innovation for Scientific and Technological Research (TISTR), Food Innovation Service Plant (FISP); and Food Innopolis/Thailand
- Caryana Lay Monastic Community, Pampanga – Region III

### PTD

- Laguna State Polytechnic University-Siniloan Campus – Region IV-A
- Amanda's Food Products – Region III

### NMD

- Korea Research Institute of Standards and Science – South Korea
- ICP-MS (Inductively Coupled Plasma Mass Spectrometry) Training in Singapore – Singapore

## List of 2020 Completed Projects

A total of 31 projects were completed for this year. Of these projects, 12 are regular or GAA-funded, and 19 are GIA or externally-funded, focusing on ITDI R&D areas such as food, packaging, environment, energy, material science, and chemical synthesis.

**Table 1. GAA funded projects**

| PROJECT TITLE   | LEAD                          |
|---|-------------------------------|
| 1. Utilization of Chicken Eggshell Wastes as Biomaterial for Hydroxyapatite Synthesis   | E. Panerio                    |
| 2. Development of Shelf-Stable Food Products as Ready Food Reserve (GAD)  | M.D. Villaseñor               |
| 3. Characterization of Philippine Banana Cultivars for Food Processing Application  | M.E. Falco                    |
| 4. Nanozeolite Monoliths for Gas Adsorption Application   | J. Celorico                   |
| 5. Synthesis, Characterization, and Production of Starch Nanocrystals   | C. Emolaga /<br>M. Paglicawan |
| 6. Biomass-derived Carbon Quantum Dots and CQD/Polymer Composites for Biomedical & Industrial Applications  | P.A. de Yro                   |
| 7. Superparamagnetic Iron Oxide Nanoparticles (SPIONs) from Natural Mineral Deposits – Phase 1  | B. Basilia                    |
| 8. Development of Portable Ultrafiltration/Nanofiltration Membrane Module for Treatment of Potable Water for Remote/Field Application (Mabuhay Straw) | M. Margarito                  |
| 9. Effect of Storage Conditions on Migration Characteristics of Benzophenone in Paper and Paper-based Food Packaging (Phase 2)                        | J. Diaz                       |
| 10. Data Acquisition of Shock and Vibration Values in the Delivery (Motorcycle and Closed Van) of E-commerce Products within Metro Manila             | E. Nolasco                    |
| 11. Shelf-Life Extension of <i>Bukayo</i> and <i>Budin</i> through the Application of Improved Packaging Technology                                   | F. Loberiano                  |
| 12. Exploratory Study on Chocolate Confectionery  | M.D. Villaseñor               |



**Table 2. GIA / externally funded projects**

| PROJECT TITLE   | LEAD                        |
|---|-----------------------------|
| 1. I-SALT: Improving Productivity and Efficiency of Local Salt Producers Towards a Self-Reliant Philippines in 2020 Project 1: Design, Prototyping of Salt Processing Equipment (Washer, Dryer, Iodizer, Crystallizing Pan, Furnace, Concentrator (ion-exchange membrane) | O. Evangelista              |
| 2. Modular Innovation Center for Oils, Blends and Sauces (Y3)   | M. Carandang                |
| 3. Establishment of Plastic Waste Pyrolysis System along Esteros for the Rehabilitation of Manila Bay   | A.V. Bawagan                |
| 4. Post-treatment of Food Processing Wastewater Effluent for Nutrient Removal   | R. Esguerra                 |
| 5. Strengthening the Municipal Solid Waste Management Program: A Guide on Preparation of Waste Analysis and Characterization Study (WACS) Plan for the National Capital Region Local Government Units   | M. Tansengco                |
| 6. Pilot-scale Production of Spray-Dried Dextran and High-Fructose Syrup using Whole Cell ( <i>Leuconostoc mesenteroids</i> isolates) ITDI Fermentation Technology  | U. Bigol                    |
| 7. Pilot-Scale Biogas Production of Biodegradable Solid Waste for Muntinlupa City   | D. Herrera                  |
| 8. Development of Powdered Salted Egg Using Appropriate Processing Technologies   | M. Macaraeg                 |
| 9. Natural Food Colors from Local Sources as Food Additive (Project 4: Natural Dyes and Colorants R&D Program)  | M.D. Villaseñor             |
| 10. Establishment of Spray Drying Technology and Equipment for the Regional Food Innovation Centers – Batch 2   | N. Ambagan                  |
| 11. Establishment of Halal Assurance System for Processing Selected Banana Products (Banana Chips, Banana Catsup, and Frozen Banana)  | M.E. Falco                  |
| 12. Prototype Development of Natural Fiber-Thermoplastic Composites From Agricultural and Industrial Wastes for Industrial Applications   | M. Paglicawan               |
| 13. Intelligent Data Analysis System (IDAS) for Drug Trafficking Investigation in the Philippines Project 1: Application of Multivariate Analysis on Methamphetamine HCl Chemical Fingerprints and Kinetic Stability Modelling  | A. Monsada                  |
| 14. ADMATEL Expansion and Business Continuity   | A. Monsada                  |
| 15. Nanofibrous Scaffolds from Natural Biomaterials for Tissue Engineering  | J. Celorico                 |
| 16. Development of an Effective Distribution System for RTE Foods (chicken arroz caldo and fish rice meal) to Mitigate the Magnitude of Distress for Calamity Survivors and Providers of Services   | D. Tañafranca               |
| 17. Asia Packaging Network (APN) and International Packaging Symposium and ISTA-APD International Symposium on Distribution Packaging   | D. Tañafranca               |
| 18. Preliminary Characterization of Taal Volcanic Ash for Risk Assessment and Potential Raw Material for Construction Industry (Phase 1)  | A.R. Dablio                 |
| 19. Enhancing OneLab for Global Competitiveness   | A. Briones /<br>A.R. Dablio |

# Commercialized Technologies

**Table 3. Commercialized ITDI technologies**

| TECHNOLOGY TRANSFERRED / COMMERCIALIZED                            | NAME OF BENEFICIARY                     | LOCATION OF BENEFICIARY                        |
|--|---|--|
| 1. Dietary Fiber using Calamansi Waste with Essential Oil training | Zambo Tropical Foods                    | Zamboanga De Sur {Region IX}                   |
| 2. Dual-Drum Composter   | BBM Machine Shop<br>LAMACO              | Pampanga {Region III}<br>Cavite {Region IV-A}  |
| 3. Portable Biogas Digester  | BBM Machine Shop<br>LAMACO              | Pampanga {Region III}<br>Cavite {Region IV-A}  |
| 4. Household Tumbling Composter                                    | BBM Machine Shop<br>LAMACO              | Pampanga {Region III}<br>Cavite {Region IV-A}  |
| 5. Setting-up of Salt Equipment Line                               | Mary Clauderine Jarmilla,<br>Edna Yadao | Ilocos Sur (Region I)<br>Ilocos Sur (Region I) |
| 6. OL Trap   | Heritage Veterinary Corporation         | Bulacan (Region III)                           |
| 7. MOSYMU  | Geriatrica International, Inc.          | Pasig City (NCR)                               |
| 8. Analgesic Balm  | Jose Leo Viñas                          | Pasay City (NCR)                               |
| 9. RTE Chicken Arroz Caldo   | Prime Global Corporation                | Pasig City (NCR)                               |



**Dietary fiber using calamansi waste**



**Salt equipment line**



**Household tumbling composter**



**Dual-drum composter**



**Portable biogas digester**



**OL trap**



**MOSYMU**



**Analgesic balm**



**RTE chicken arroz caldo**

# Technology Transfer and Accomplishments

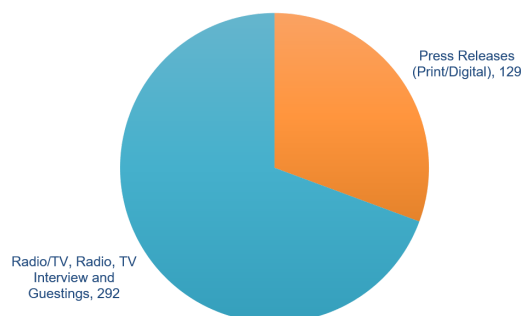
The onset of the pandemic did not deter the institute in pursuing its technology transfer program. While proving to be doubly challenging considering the constraints in doing business with limited mobility and face-to-face transactions, the institute still managed to conduct its programs and deliver its commitments to its stakeholders. This was achieved by leveraging on the use of the digital platform or online medium which emerged as the most practicable and efficient channel of delivery since the COVID-19 crisis.

## Quad media promotion of technologies and services

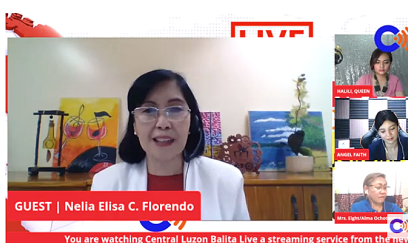
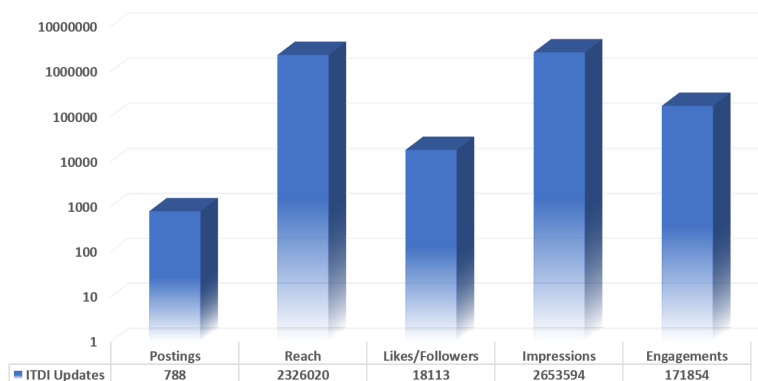
While going through this crisis, ITDI persevered to continue with its knowledge translation initiatives with robust results. Despite the Work from Home arrangement of staff, promotion activities still went full swing on the home front, while simultaneously contributing significantly to DOST COVID-19 communication initiatives.

The institute had a good standing in quad media in 2020 with 129 press releases published both in print and online and a total of 292 interviews/guestings in TV, radio, radio/TV. Its social media presence was further strengthened during the year garnering a total of 2,326,020 audience reach, 171,854 engagements, 18,113 likes/followers, 2,653,594 impressions; from its 788 postings.

2020 QUAD-MEDIA METRICS



DOST ITDI UPDATES FACEBOOK METRICS





As an intervention to displaced OFWs and other workers, the institute re-launched its livelihood technology videos online via YouTube and Facebook and print, dubbed *TekPinoybiz*, to serve as sources of ideas for income-generating ventures even at home-based level. As well, 77 technology posters some in 'how-to' format were posted on ITDI's Facebook page.

Its regular publications were also continued and published, namely: 2019 Annual Report, 10 issues of MiscellaNews (internal), 1 issue of Techno Bulletin (official newsletter), and 7 issues of NewsFlash.

**ITDI S&T MEDIA SERVICE R&D MAKING CHANGE HAPPEN**

**COVID-19 Update at DOST-ITDI**

**DOST-ITDI helps fight COVID-19 with 3D printed face shields**

As the number of COVID-19 cases continued to rise, Filipino health workers fighting the pandemic are finding themselves in a short supply of personal protective equipment. Among these is the medical face shield used by doctors and nurses when attending to patients with infectious diseases.

In response to this national emergency, the DOST-ITDI Director Dr. Annabelle V. Briones, through MATDEV Team Leader and Chief of the Materials Science Division (MSD-ITDI) Dr. Bessie A. Bastia, produced 3D printed face shield holders based on Fused Deposition Modeling (FDM) Technology. This technique enables the fabrication of optimized face shield digital design using thermoplastic filaments.

The MATDEV or the Development of Multiple Materials Platform for Additive Manufacturing Project Team undertakes research and development of materials for use in additive manufacturing. They aim to reduce the cost of filaments and other materials for 3D printing by utilizing our local resources.



Our Business is Industry  
Department of Science and Technology INDUSTRIAL TECHNOLOGY DEVELOPMENT INSTITUTE  
DOST Compound, General Santos Avenue, Bicutan, Taguig City Tel.: (02) 8837-0271 local 2184 / 2269

**ITDI S&T MEDIA SERVICE R&D MAKING CHANGE HAPPEN**

**COVID-19 Update at DOST-ITDI**  
*DOST-ITDI joins frontliners, brings RTE foods to 6 Metro Manila, Davao cities*

Corona virus disease or COVID-19, now pandemic in magnitude is an infectious disease caused by a newly discovered coronavirus, as of March 20, 2020, 4:00 PM PST, the Philippines has 1,418 confirmed cases, 71 deaths, and 42 recoveries.

At a time when most of us are staying at home for safety due to COVID-19, a team from DOST-ITDI's (Industrial Technology Development Institute) Packaging Technology Division (PTD) lowered the streets and their safety last March 20, 2020 and delivered relief foods we call "Pack of Hope" which means that in every pack is a hope to address hunger.



The DOST-ITDI team of modern day heroes include Carmina Salicrán, Joan Parier, Roger Takamor, Rolly Baaco and Larry Andarico, and their counterparts, Harold Amario, Mary Joy Pisco, Marile Basilio and 5 ITDI juniors.

Some 20,010 pouches of ready-to-eat (RTE) foods were distributed by DOST-ITDI to cities in Manila and Davao on March 20, 2020 as the country continued to fight COVID-19.

Five Disaster Risk Reduction and Management Offices in Taguig, Pasig, Manila, San Juan, and Quezon City augmented their community food supply with 3,000 pouches each of RTE Chicken Arroz Calido while Davao City received 5,010 pouches (RTE chicken arroz calido and smoked fish rice meal).

DOST-ITDI technology adapter, Kai Anya produced the RTE arroz calido. Tuck enough, through RSD (research and development), we can serve our people, save lives, and make a difference.

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**ITDI S&T MEDIA SERVICE R&D MAKING CHANGE HAPPEN**

**TekPinoy.biz #47: Pili Food Products.**


*Misato at Kumisita  
Cook your way to wealth*

Have you ever wondered how you can reach financial freedom in spite of the COVID-19 pandemic?

If you are out of a job or desiring to leave one and feeling cooped up at home, there is a favorable, easy way out.

\*Kiting-Kita sa TekPinoy.biz Series of ITDI\* is the turn of the year learning tool for you. Let the Industrial Technology Development Institute (DOST-ITDI) teach you 55 simple and cheap ways to prepare meat, fish, fruits, and vegetables. For the many type - muscle up with 14 machine-based technologies.

Below is TekPinoy.biz #47: Pili Food Products.



**Pili and Pili**

The Philippines prides itself on its lush ecology, including in its many indigenous species of plants and trees.

Of great economic interest, however, is the extraordinary nut-bearing, the pili.

The pili's kernel is its most important product that can be eaten raw or roasted. When roasted, its mild, nutty taste and tender-crispy texture pop out, making it taste even better than other kinds of nuts.

Further, the pili kernel is used as additional flavoring to chocolate, ice cream, and baked goods.

To make the most out of this valuable nut, ITDI has prepared four recipes using pili kernels.

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**ITDI S&T MEDIA SERVICE R&D MAKING CHANGE HAPPEN**

**GROUND-BREAKING CEREMONY**  
15 March 2019



**DOST-ITDI ANNUAL REPORT 2019**

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**ITDI S&T MEDIA SERVICE R&D MAKING CHANGE HAPPEN**

**ITDI Techno Bulletin**  
ISSN: 1555-9614 VOL. 40 NO. 1 JAN - JUN 2020

The official newsletter of the Industrial Technology Development Institute published semi-annually

**PRRD appoints Ignacio as DOST assistant secretary, first woman top appointee from ITDI**

President Rodrigo Duterte appointed Dr. Clara L. Ignacio, Deputy Director for Administrative and Technical Services (DATS) of DOST-ITDI, as DOST's new Assistant Secretary on January 9, 2020 at the Presidential Palace in Manila.

Sworn to duty by the President together with hundreds of other government officials, Dr. Ignacio is the fifth officer and first woman appointee from ITDI to take one of the top posts in the Science Department in executive branch.

In 1978-1988, DOST, then known as the National Science and Technology Authority, appointed ITDI's then Director Dr. Clara L. Ignacio as Deputy Director General of DOST. Dr. Clara L. Ignacio, a former Director General of DOST, Dr. Flaminio A. Ulat and Dr. Rufino C. Ling, both former directors, followed as the 11th Science Secretary and Undersecretary for R&D, respectively, from 1991 to 2001. Dr. Ruggela A. Panagasi followed as Undersecretary for R&D from 2001 to 2015.

Dr. Ignacio was sworn to office as assistant secretary by DOST Secretary Francisco T. Sison-Pardo on January 15, 2020, two years after serving as Deputy Director for DATS of DOST-ITDI from January 23, 2018 to January 15, 2020.

**CED winds up energy project**

The energy audit team of the Department of Science and Technology (DOST) and the Department of Energy (DOE) completed the Energy Efficiency and Conservation (EECC) project for State Universities and Colleges (SUCs) in six regions on December 11, 2019 at the Cebu Hotel in Muntinlupa City. CED-CEC, Engr. Raul Victor C. Sison, together with Engr. Patrick E. Morales of DOST-POED, led the closing and awarding ceremony for the schools.

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Dr. Ignacio was sworn to office as assistant secretary by DOST Secretary Francisco T. Sison-Pardo on January 15, 2020, two years after serving as Deputy Director for DATS of DOST-ITDI from January 23, 2018 to January 15, 2020.

**Engineers Sison and Morales presented four awards**

At the closing ceremony, Regional Center leaders in Engr. Sison's, Sacer of DOST-CEC, The National Planning

**ENTREPINOS! CHECK THIS OUT!**

**UBE PROCESSING**  
KITANG-KITA NA SA TEKPINOY.BIZ SERIES #5

Learn how to make:

- Ube powder
- Ube jam
- Ube pastillas

**ACCESS IT HERE:**  
<http://itdi.gov.ph/index.php/division/technological-services/services>

**DOST-ITDI**

**ENTREPINOS! CHECK THIS OUT!**

**JACKFRUIT PROCESSING**  
KITANG-KITA NA SA TEKPINOY.BIZ SERIES #6

Learn how to make:

- Dried Jackfruit
- Jackfruit Flakes
- Jackfruit Pastillas

**ACCESS IT HERE:**  
<http://bit.ly/ITDIvLivelihoodSeries>


**DOST-ITDI**

**TekPinoy.biz**  
OUR BUSINESS IS INDUSTRY

**ENTREPINOS! CHECK THIS OUT!**

**BOTTLED DRIED FISH IN OIL**  
Kitang-kita na sa TekPinoy.biz Series #42

**ACCESS IT HERE:**  
<http://bit.ly/ITDIvLivelihoodSeries>



**DOST-ITDI**

**TekPinoy.biz**  
OUR BUSINESS IS INDUSTRY

**ENTREPINOS! CHECK THIS OUT!**

**SOY SAUCE MANUFACTURE**  
Kitang-kita na sa TekPinoy.biz Series #30

**ACCESS IT HERE:**  
<http://bit.ly/ITDIvLivelihoodSeries>



**DOST-ITDI**

In 2020, the institute started implementing its project, "DOST-ITDI Strategic Communication Portfolio for Enhanced Technology Promotion and Transfer" funded by DOST-GIA and monitored by PCIEERD. Through this project, the DOST-ITDI piloted an off-the-cuff business-type talk show entitled "*DOST-ITDI'S TekNegoShow*" or TNS, a first within the DOST system. It was aired via the digital platform in October until the third week of January 2021. This initial season or TNS1 comprised of 13 episodes and featured technologies and technical services geared towards health and hygiene deemed relevant to the current Covid-19 crisis and be responsive to our various stakeholders.

This initiative aimed to widen and heighten engagement of ITDI and its technology generators with the public and, hopefully, increase the likelihood of technology take up. Likewise, it is being undertaken to support the DOST campaign "Communicating Science for the People (SFTP)" and pave the way for the transfer of STI (science, technology and innovation) to the production sector and help effect the desired change as echoed in DOST's Science for Change or S4C project. It also enabled ITDI to maintain its presence online and continue promoting its technologies and services despite the constraints resulting from this pandemic.

A novel feature of TekNegoShow was its *TekTok Challenge*, a first-ever attempt to capitalize on the current online craze "TikTok" to make science more 'masa' and funny, and hopefully, elicit more active engagement with the netizens or viewers.



The project also provided for the conduct of Design Thinking and Social Media Marketing Workshop for the institute's social media managers. The training-workshop focused on the practical application of design thinking in crafting marketing campaigns and aimed to effectively use the digital platform for communication campaigns, build up the Institute's online presence, and increase its social media engagement especially for TekNegoShow.



## Visits and exhibits

In 2020, despite the constraints, TSD facilitated study tours or client visits to the various ITDI divisions for the following eight parties:

1. Mapua University
2. WIPO delegates' visit of ADMATEL
3. Benchmarking of lab tours for DOST-CAR
4. Ocampo National High School
5. Our Lady of Fatima University-Antipolo
6. Universal Robina Corporation
7. UNILAB/Synnovate Pharma
8. Sec. Mama-o and party

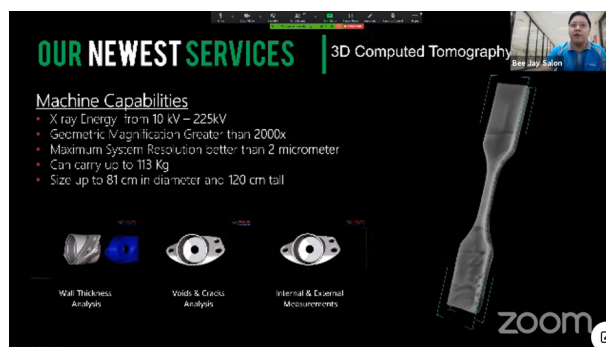


Due to the restrictions brought by the COVID-19 pandemic, the Institute started to conduct virtual tours of its facilities in lieu of physical tours.

Such were the virtual tours of the National Metrology Division, which was among the technical service facilities featured at DOST-TAPI's SPICES to DOST LabS (Strategic Promotion through Integrating Collaboration and Engagement of SMEs to Support the Technology Transfer and Commercialization of DOST-Developed Technologies including Testing Laboratories and Services),

Likewise, the Advanced Device and Materials Testing Laboratory (ADMATEL) as well as DOST's newest facilities, the Modular Multi-Industry Innovation Center (MMIC), also known as *Innohub sa Pinas*, each had a virtual tour of technical service facilities. These were shown via Facebook Live and YouTube.

Due to the pandemic, physical exhibits were no longer allowed, thus the annual celebration of the National Science and Technology Week (NSTW) was held virtually for the first time on November 23-29, 2020. Featured ITDI technologies and services included mungbean-coconut milk drink, isotonic drink, Pack of Hope RTE foods, and the Advanced Manufacturing Center (AMCen). Aside from the virtual exhibits, webinars were also held via Zoom and Facebook Live, featuring ITDI technical services for industries (ADMATEL services, Metrology in Chemistry, Metrology in Biology, and STD's chemical lab services). Along with DOST-MIRDC, a webinar on AMCen was also held.





Likewise, the National Biotechnology Week (NBW) was held simultaneously with the NSTW from November 23-28, 2020. Featured ITDI technologies included the portable biogas digester, household tumbling composter, and compact wastewater treatment system. Aside from the exhibit, a webinar was held via Zoom, focusing on managing organic wastes with ITDI composting and biogas technologies, namely the household tumbling composter, dual-drum composter, bioreactor, and the portable biogas digester.



In coordination with the Technology Application and Promotion Institute (TAPI), ITDI also took part in Handa Pilipinas, which featured the various DOST agencies' responses to disaster risk reduction and management. With its physical exhibit in March postponed due to the COVID-19 pandemic, the posters were instead shown virtually via TAPI's Facebook page.

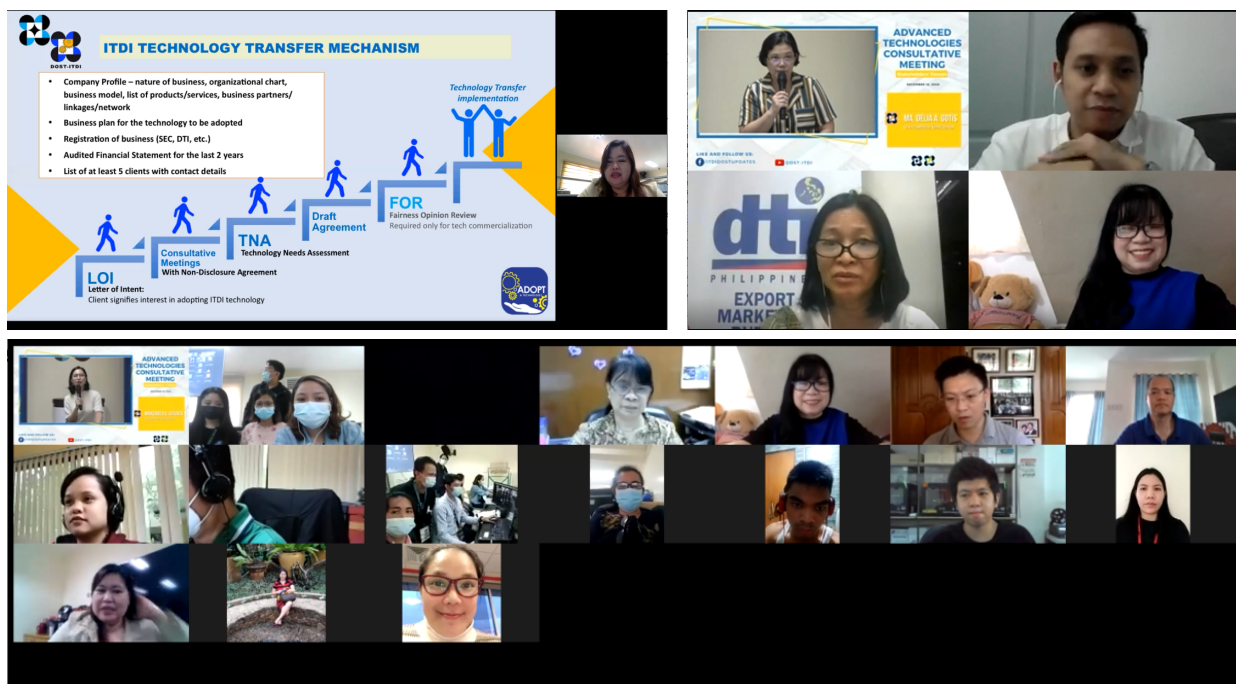
## Forums and technology offerings

These quad media outings, visits, and study tours were further complimented with the conduct of 20 technology forums and consultations, and offerings which were all conducted virtually. There were 16 technology pitches on various technologies conducted with regional offices and other government agencies and individuals.

A technology offering with virtual presser in December focused on salt iodization machine and gourmet salts, cacao machines and tablea, coconut mungbean and isotonic beverages, and RTE potato/fish. These improved products and processes were presented in a bid to drive forward food industry thrusts and increase awareness of locally developed food products with improved functionalities that can be positioned as sports nutrition, functional beverages, and dietary supplement.

This was followed with another stakeholders' forum on natural fiber thermoplastic composite and nanoclay production where new products and studies were presented followed with an exchange of ideas and experiences between the technology generators and industry stakeholders that can possibly address concerns in the field.





## Technology transfer / technical assistance agreements

During the year, negotiations with stakeholders resulted to 18 technology transfer and technical assistance agreements and 15 institutional partners. In terms of income, a total of Php 1,159,446.00 was generated in running royalties/technology fees.

**Table 4. 2020 DOST-ITDI MOA with partners**

| TECHNOLOGY   | COMPANY   | CLIENT ADDRESS                                      | TYPE OF AGREEMENT |
|--|---|---|-------------------|
| • ITDI Plastic Densifier   | Engr. Mauricio Mariñas<br><i>Mariñas Technologies Inc.</i>        | 260 J.P. Rizal St., Brgy. Bulilan Sur, Pila, Laguna | MOA               |
|  | Leonilo Angeles<br><i>L. Angeles Machineries Corporation</i>      | 86 Laurel St., Anibal I, City of Bacoar, Cavite     | MOA               |
| • OL Trap  | Mr. Leopoldo M. Mendoza<br><i>Heritage Veterinary Corporation</i> | By-Pass Road, Brgy. Guyong, Santa Maria, Bulacan    | MOA               |
| • ITDI Bioreactor  | Engr. Mauricio Mariñas<br><i>Mariñas Technologies Inc.</i>        | 260 J.P. Rizal St., Brgy. Bulilan Sur, Pila, Laguna | MOA               |
| • Vacuum Fried Products  | Mr. Paris Uy<br><i>LiveGreen International Inc.</i>               | 139 Sct Limbaga, Brgy. Sacred Heart, Quezon City    | MOA               |
| • ITDI Dual-Drum Composter, Portable Biogas Digester and Household Tumbler | Engr. Harvie R. Mañago<br><i>BBM Machine Shop</i>                 | Brgy. Sta. Teresita, San Fernando City, Pampanga    | MOA               |

| TECHNOLOGY   | COMPANY  | CLIENT ADDRESS   | TYPE OF AGREEMENT                 |
|--|--|--|-----------------------------------|
| • ITDI Household Tumbler and Portable Biogas Digester      | Loida P. Angeles<br><i>L. Angeles Machineries Corporation</i>                            | 86 Laurel St., Anibal I, City of Bacoor, Cavite  | MOA                               |
| • ITDI Dietary Fiber using Calamansi Waste & Essential Oil | Ms. Fe Hau<br><i>Zambo Tropical Foods</i>  | J. Ruste Drive, Sta. Maria, Zamboanga City   | MOA                               |
| • ITDI MOSYMU supplement                                   | Mr. Juan S. Cruz, Jr<br><i>Geriatric International Inc.</i>                              | 19 Danny Floro St., Brgy. Oranbo, Pasig City   | MOA                               |
| • ITDI Analgesic Balm                                      | Mr. Jose Leo Viñas   | 270a! S. Raymundo St. Brgy. 87 Libertad, Pasay City                                      | MOA                               |
| • VF banana chips and Halal banana chips                   | Jason Cajustan and Patricia Ramos<br><i>Quick-stop Convenience Store, Inc.</i>           | Unit 301 Goldhill Tower Condominium, 5 Annapolis St., Greenhills, San Juan City          | MOA                               |
| • RTE Chicken Arroz Caldo                                  | Mr. Vincent Ace Villa-Real<br><i>Prime Global Corporation</i>                            | 8F The Currency Tower, F. Ortigas Jr. cor. J Vargas Avenue, Ortigas Center, Pasig City   | MOA                               |
| • Household Tumbling Composter                             | Ms. Minda Sepacio<br><i>KEBA Engineering</i>   | Lot 93 Electronic Road, FTI Complex, Western Bicutan, Taguig City                        | TLA                               |
| • Isotonic Drink   | Mr. Henry Gomes<br><i>Banawe Soybean Curd Food Products Corp.</i>                        | #64 Linclon St., Brgy. San Antonio, Quezon City  | MOA                               |
| • Setting Up of Biogas Digester                            | Ms. Avella Lipata<br><i>GreenPhil, Inc.</i>  | Barangay Anahaw 1, Silang, Cavite  |                                   |
|  | Mr. Manuel C. Alvarez<br><i>Waste and Resoures Management, Incorporated (WARM, Inc.)</i> | Pineapple St., Sitio Pag-asa, Brgy. Aguado, Trece Martirez, Cavite                       | MOA                               |
| • Setting up of Salt Production Facility                   | Ms. Mary Clauderine B. Jaramillo   | Brgy. Calay-ab, Sto. Domingo, Ilocos Sur   | MOA                               |
| • Laboratory tests   | Ms. Ellen Mendoza<br><i>Specifique Marketing Corp.</i>                                   | 1910 19/F, Marco Polo Ortigas Manila, Sapphire Road Barangay San Antonio, Ortigas Center | MOA for Specialized Tech Services |

Also this year, the *Guidelines in Identifying and Managing ITDI Research Outputs for Public Good*, the first of its kind within the DOST system has been approved and signed. This was meticulously reviewed by ITDI management and DOST Central Office prior to official endorsement and implementation. And in the pipeline is the drafting of a set of guidelines on the provision of technical assistance/services to foreign clients.



## Training and technical assistance

While 2020 proved to be very challenging due to the pandemic, DOST-ITDI did not cease delivering its services to its stakeholders and continued providing technology-based training and technical assistance to improve products and processes towards improved productivity.

A total of 95 trainings were facilitated/implemented in 2020 focusing on Calibration, Energy Audit, Waste Analysis and Characterization Study (WACS), and livelihood courses (food and non-food processing). There were a total of 9, 124 participants coming from MSMEs, LGUs, cooperatives, associations, academe, government offices, and private individuals from different regions of the country. Trainings for the year generated an income of Php 495,459.45.

These trainings were classified into regular training (RT), customized training (CT), and regional training (RGT) delivered through various modes such as webinars, online, blended learning, and face-to-face.

The webinars were streamed via Youtube under the DOST-ITDI Webinar Series for Livelihood Courses and offered free to the general public which they can use as source/s of livelihood during the pandemic. Among these webinar-trainings were on: Calamansi, Taho Processing and jam making; Hand Sanitizer Production, Liquid Handwash, and Soapmaking; and Chemical Safety and Hazardous Waste Management.

Likewise, the Institute offered free webinar series for the Senate on Packaging Technology and Additive Manufacturing, and other trainings in collaboration with DOST-NCR.

Despite the constraints, the institute was still able to render technical assistance to various clients through the online platform. In 2020, a total of 33 technical assistance/consultancy, inspection, and assessment were carried out from around the country. Some of these involved assessment of facilities and equipment, and processes; processing/product development of different food products; salt production; and facility set up with GMP compliance.

Post training monitoring that aim to determine the usefulness of the ITDI training program was continued. Survey questionnaire in google form for metrology and livelihood trainings were sent to training participants from 2017-2019, and gave 39.52% response rate.

For livelihood trainings, almost 100% of the respondents agreed that the courses' learning objectives and purpose were effectively achieved. Seventy per cent of the respondents also used or adopted the acquired knowledge and skills.

Meanwhile, for metrology trainings, respondents also gave positive marks in terms of usefulness and relevance to their jobs, among others.

In addition, DOST-ITDI in partnership with the Technical Education and Skills Development Authority (TESDA) pursued its review of training regulations and has accomplished the following during the year:

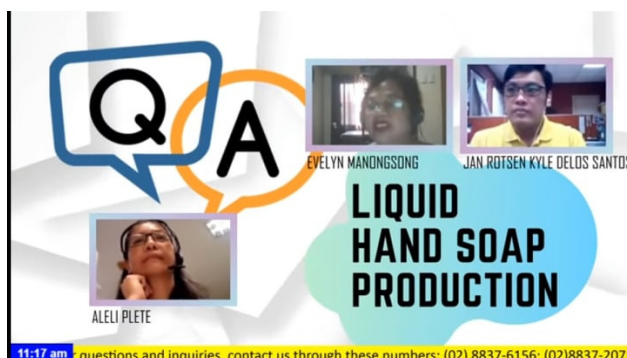
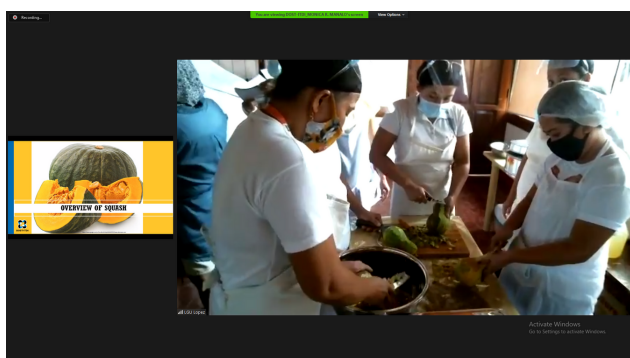
### 1. Validation Workshop on the Review of Training Regulations (TRs):

- Food Processing NC III - Food Preparation Equipment Operation
- Food Processing NC III - Thermal Equipment Operation
- Food processing NC III - Cooking and Drying Equipment Operation

### 2. TR Finalization for Food Processing NC III - Food Preparation Equipment Operation

### 3. Orientation on Competency Assessment Tools (CATs) Development





## Establishment of the Ceramic Facility in Sibalom, Antique

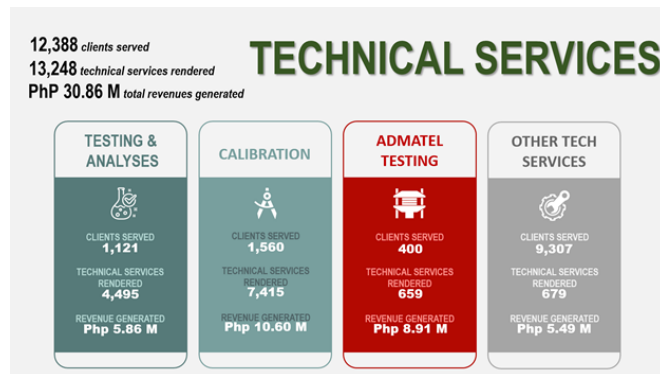
The institute, through TSD, in the latter part of the year, spearheaded the establishment of the ceramic facility in Sibalom, Antique. This was achieved in collaboration with DOST-VI, the University of Antique, and the Asosasyon ng Maninohon sa Barangay Bandoja (AMABBA) in Tibiao, and Manugkoron Cooperative at Sibalom.

The project is an initiative of Congresswoman and Deputy House Speaker Loren Regina B. Legarda for the Province of Antique. The project intends to provide technical assistance for the upgrading of community-based terra cotta production in Tibiao and Sibalom, Antique through skills and facility upgrading; introduction of new techniques, equipment, and a production facility.

With the cooperation of all stakeholders, the ceramic facility was launched in December 2020 with Sen. Legarda as special guest.



## Technical Services



This year, DOST-ITDI continued to provide technical services through its various testing, calibration and R&D laboratories rendering a total of 13,248 technical services to 12,388 customers nationwide generating total revenue of PhP 30.86M. This revenue marked 17.7% reduction this year in comparison to last year's revenue of PhP 37.5M.

The Standards and Testing Division (STD) obtained PHP 5.86M from conducting services to various industries, government agencies, and the academe. The services rendered totaled to 4,495 and 1,121 served customers. The services availed by customers include regular testing, contracted testing and Formula of Conversion (FOC).

There were a total of 7,415 services offered and 1,560 attended clients for this year, amounting to a total income of PhP 10.6M from the calibration services of the National Metrology Laboratory (NML). This exhibits 37.6% reduction in comparison to the

preceding year's revenue due to lockdown. Though there is a significant reduction in the income, NML were still able to generate a huge amount of income with the help of the remote calibration process offered by the laboratory.

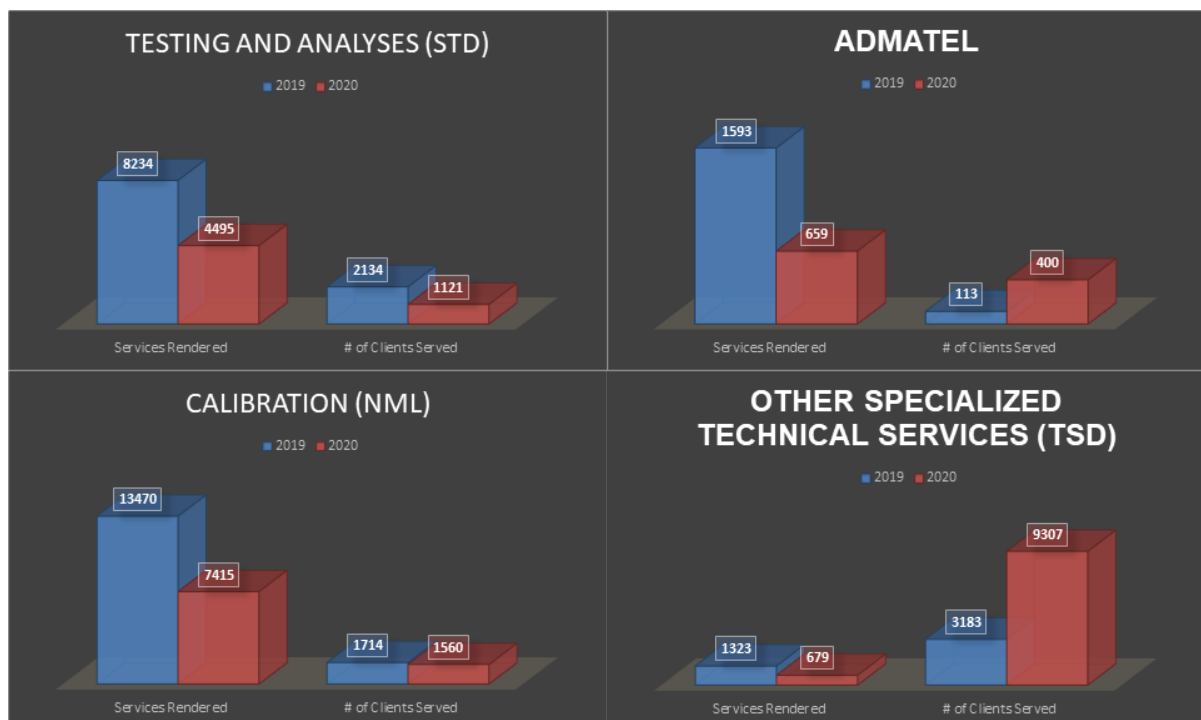
Additional services made available for this year are enumerated as follows:

- Torque Wrenches and Calibrators
- Hardness Testing Machines and Reference Blocks

Below is the new service rendered for 2020:

- 2D X-Ray

For other specialized technical services, the Technological Services Division (TSD) reported to have a total income of PhP 5.49M. There were 679 services given and served 9307 clients; an increase of up to 192.4% from the previous year, from the academic institutions, government agencies and private companies.



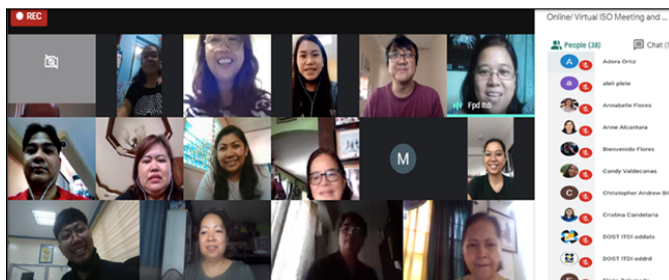


# Governance

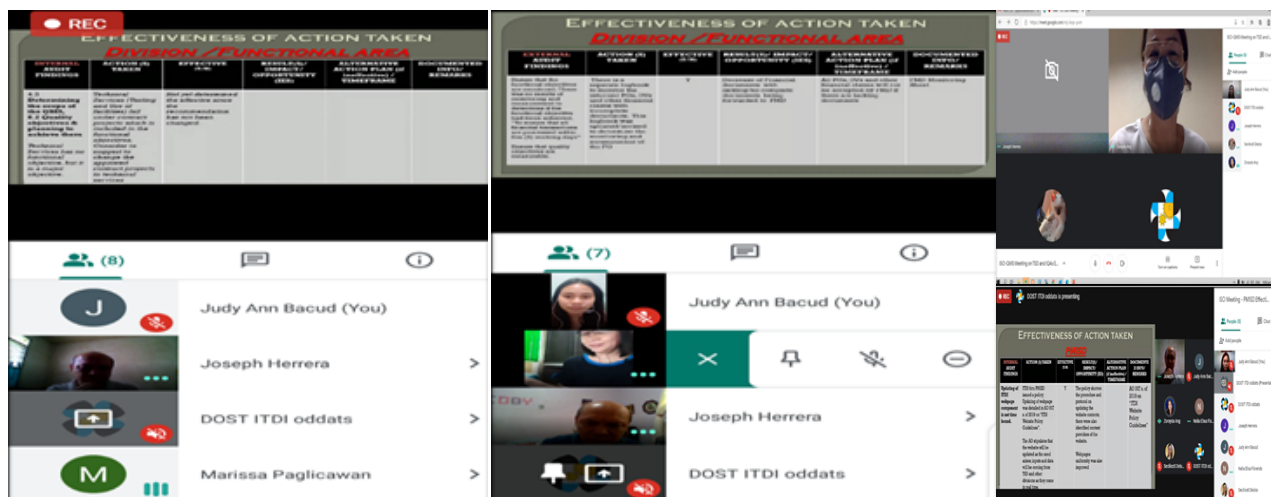
## Commitment to management

Amidst the pandemic, DOST-ITDI ISO 9001:2015-related committees had been continually active in strengthening their commitment in sustaining the institute's Quality Management System. Several initiatives were implemented through the collaborative efforts of the lead committee, ISO Technical Committee supported by the Internal Quality Audit (IQA) Group, Risk Review Committee (RRC), Document Custodians (DC), and Risk Management Group (RMG).

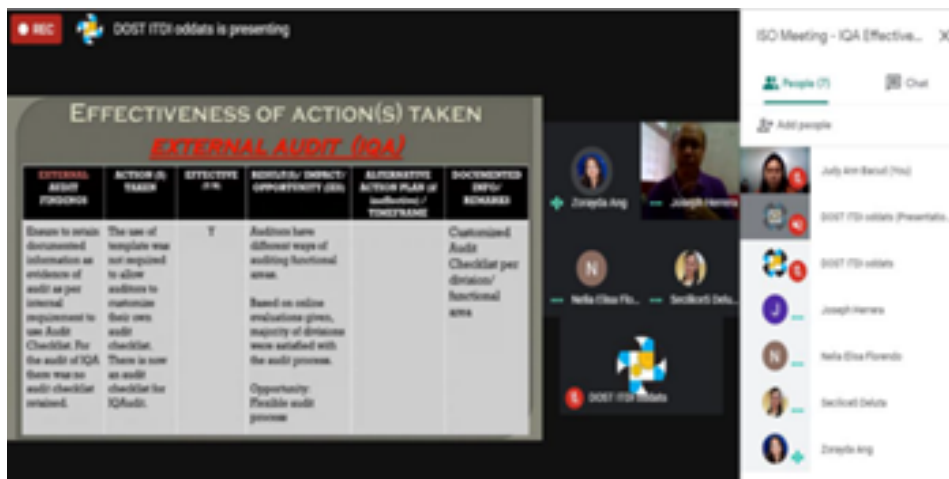
As part of the new normal, numerous virtual meetings though Google Meet or Zoom were conducted with the participation of the ISO-related committees and process owners from different divisions of DOST-ITDI. Meetings were done to review the effectiveness of actions taken from previous year's external and internal audit findings in preparation for ISO recertification.



1st ITDI Virtual ISO Meeting, July 3, 2020, Google Meet



Virtual ISO Meeting- Review of Effectiveness of Actions from Audit Findings of TSD – July 17, MSD – July 24, FMD – July 28 and PMISD – August 7



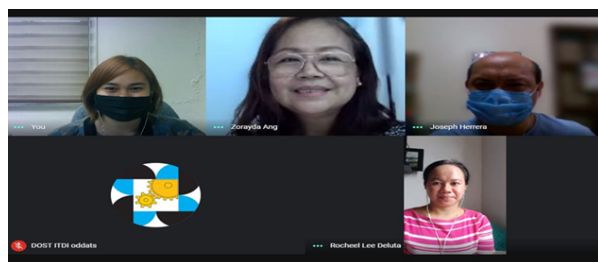
Virtual ISO Meeting- Review of Effectiveness of Actions from Audit Findings of IQA, August 4, 2020, Google Meet

For this year, DOST-ITDI has been recertified by the International Organization for Standardization (ISO) 9001:2015 up to October 28, 2023 upon meeting the criteria and standard for Quality Management System. The External Audit Team from TÜV-Rheinland conducted the Stage II Certification Audit last August 19, 2020 which was headed by Mr. Lionell Aala, TÜV Audit Leader.

DOST-ITDI was recertified with 8 Positive Findings, 28 Opportunities for Improvement (OFIs) and 1 Minor Non-Conformity. The institute's QMS-related committees assisted in the preparations of the divisions and functional areas for the external audit, including the compliance of documented information.



For continual improvement, review of OFIs from the August 19 external audit has been consistently done to efficiently implement action plans.



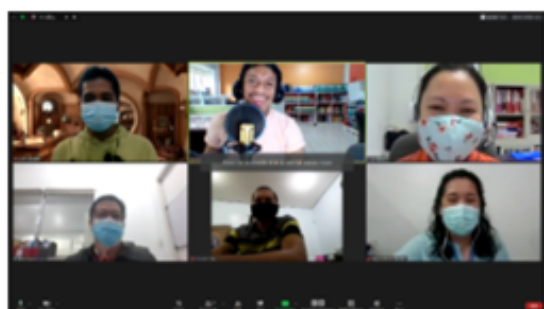
**Virtual ISO Meeting - Review of Opportunities for Improvements (OFIs) from External Audit Findings of Procurement and Property, Document Control and Risk Management, October 20, 2020, Google Meet**



**Virtual ISO Meeting- Review of Opportunities for Improvements (OFIs) from External Audit Findings of IQA, CED and PTD, October 21, 2020, Google Meet**



**Virtual ISO Meeting- Review of Opportunities for Improvements (OFIs) from External Audit Findings of MSD and HR, November 24, 2020, Zoom**




The National Metrology Division received in February this year, from DAKS Assessor, the reaccreditation of their existing scope and for extension of scope of temperature measurement. The virtual assessment of other metrology services in existing scopes in mass, pressure, volume, and quality system were carried out in August of same year. The NMD has also obtained from the TCM Chair the approval to include their Calibration and Measurement Capabilities (CMC) in the Key Comparison Database (KCDB) 2.0 for pressure measurement.

Meanwhile, the Standards and Testing Division has four (4) testing laboratories accredited under the Philippine Accreditation Bureau (PAB) of the Department of Trade and Industry (DTI), for the international standard on the competence of testing laboratories, PNS ISO/IEC 17025. All accredited laboratories had already completely transitioned to the 2017 version of the international standard and applications for renewal of accreditation were all received by PAB-DTI. The Microbiology Section, Biological Laboratory is already in its fourth cycle of accreditation since 2005, while the three laboratories are on for renewal, third cycle for the Physical and Performance Testing Laboratory and the Organic Chemistry Section, Chemistry Laboratory; and second cycle for the Inorganic Chemistry Section, Chemistry Laboratory.

As part of the continual improvement of the DOST-ITDI PNS ISO/IEC 17025 accredited laboratories, the STD Inorganic Chemistry Section-Chemistry Laboratory has already implemented the declaration of expanded measurement uncertainty and metrological traceability of test measurements done in its Test Reports. These have helped customers in decision making relevant to the test results obtained for their various purposes of availing analytical testing. STD has also implemented the automatic sample tagging module of the Unified Laboratory Quality Management System (ULIMS) which contributed to streamlining of the sample receiving/validation process and upgraded the quality of sample tags for proper sample identification.



| Sample Code<br>Sample<br>Sample Description &<br>Identification   | Test Parameter, Unit            | Result           | Method Used                      | Analysts<br>Name and Signature  |
|---|---------------------------------|------------------|----------------------------------|---|
| <b>Water</b><br>Clear liquid in plastic<br>bottle; date & time<br>collected: 06/17/20 @<br>8:00 am, approx. 4L  | Residual Chlorine<br>(Cl), mg/L | Not<br>Detected* | SMEWW**<br>4500-Cl B             |  |
|   | pH @ 25°C                       | 5.64 ± 0.07      | SMEWW**<br>4500-H <sup>+</sup> B |   |
|   | Conductivity @ 25°C,<br>µS/cm   | 1.62 ± 0.11      | SMEWW**<br>2510 B                |   |
| <b>Method Detection Limit:</b> Residual Chlorine = 1.0 mg/L.  |                                 |                  |                                  |   |
| <b>Metrological Traceability:</b> pH test method traceable to SI through US EPA WaR™ Supply pH CRM S247-779; Conductivity test method traceable to SI through US EPA WaR™ Pollution Minerals CRM B270-506; and Residual Chlorine test method traceable to SI through US EPA WaR™ Supply Residual Chlorine CRM S238-696.   |                                 |                  |                                  |   |
| <b>Uncertainty of Measurement:</b><br>The uncertainty stated is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor $k = 2$ . It has been determined in accordance with ISO/IEC Guide 98-3:2008 Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement. The value of the measurand lies within the assigned range of values with a probability of 95%. |                                 |                  |                                  |   |
| <b>Reference:</b> **Daird, R.B., et al. Standard Methods for the Examination of Water and Wastewater, 23 <sup>rd</sup> Ed. American Public Health Association; American Water Works Association; Water Environment Federation: Washington, DC 20001-3710, USA, 2017 (Print).  |                                 |                  |                                  |   |



ADMATEL is the country's first testing laboratory for material characterization and failure analysis and has maintained its international standards making it at par with those of other countries. Thereby, it ensures the integrity and quality of test results and has been actively supporting the local industries and research community amidst the challenges of the ongoing COVID-19 pandemic.

This unprecedented situation motivated ADMATEL to upgrade its operation to include the delivery of tests results and consultations online. ADMATEL's recent successful transition from PNS ISO/IEC 17025 since 2015 to the new ISO/IEC 17025: 2017 version equipped it better in the scope of testing, calibration, and sampling.

ADMATEL houses three sub-laboratories, namely; the Surface Analysis Laboratory, the Thermal Analysis Laboratory, and the Chemical and Metallurgical Laboratory. All these laboratories follow the industry standard requirements for clean room temperature, humidity, and ESD safety compliance. ADMATEL operates a total of eight accredited, state-of-the-art equipment capable of providing 30 accredited services in the areas of research such as:

- Miscellaneous Materials and Products/ Chemical Testing,
- Metals and Alloys/ Chemical Testing
- Non-destructive Test by Surface Technique/ Mechanical Testing,
- Non-destructive Test by Visual Inspection/ Mechanical Testing



**The Advanced Device and Materials Testing Laboratory (ADMATEL) has been certified compliant to ISO/IEC 17025: 2017 version last March 2, 2020**

Under the new ISO/IEC 17025: 2017 version, ADMATEL was able to acquire two new additional scopes: Materials and Chemical Analysis using TOFSIMS/ Chemical Testing, and Non-destructive Test by Radiography/ Mechanical Testing.

ADMATEL was also recently awarded a Certificate of Excellence for achieving 100% acceptable laboratory results in the nanomaterial size measurement local interlaboratory comparison which was participated by various testing laboratories in the Philippines. This achievement shows the superior quality of ADMATEL's nanomaterial dimensional analysis.

It has also been involved in standards and policy formulation such as: Philippine Standards (BPS TC 83, Cleanroom and controlled environments), BPS TC85 (Nanosafety) ; BPS TC88 (Additive Manufacturing), and STMA (strategic trade management Act RA10967 –NSC-SCTR (ITDI-ADMATEL).

## ITDI Technical Services Information Systems Track



## Implementation of ITDI Technical Services Information System



## Development of IT systems towards operational efficiency and customer-centric service

Most government agencies are working towards improving online transaction capabilities in support to the country's initiatives to counter the economic impact brought by the COVID-19 pandemic, as well as compliance with the Philippine Digital Transformation. The DOST-ITDI provides diverse professional and laboratory technical services to various industries nationwide and the electronic processing of these technical services requests, payments, and releasing of reports is imperative as the risk of transmission of the disease remains high.

To address this need, the institute through its Planning and Management Information Systems Division developed and deployed various IT systems. For the processing of requests and releasing of reports, the DOST-ITDI Technical Services Information System was implemented. Another example is the ITDI-devised Online Transaction Framework that enables customers to do transactions even when not physically present at the office or the establishment.

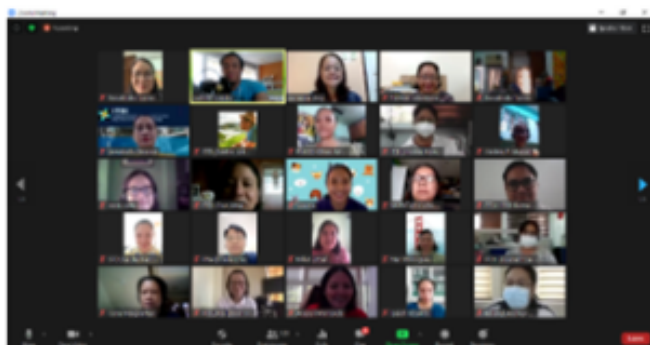
The DOST-ITDI Online Customer Portal ([www.itdi.com.ph](http://www.itdi.com.ph)) offers convenience and ease of access to clients who wish to avail of the Institute's technical services, webinars, trainings, and seminars.

With the launching also of the DOST-ITDI ePayment System in September 2020, customers now have an option to pay online using different digital bank and prepaid accounts. The system does not require a third-party payment portal. It is directly connected to the Land Bank of the Philippines' link, Biz portal, enabling daily real-time processing of remittances to the Bureau of the Treasury. With this, transactions and processing fees are cheaper and require no payment retention period.

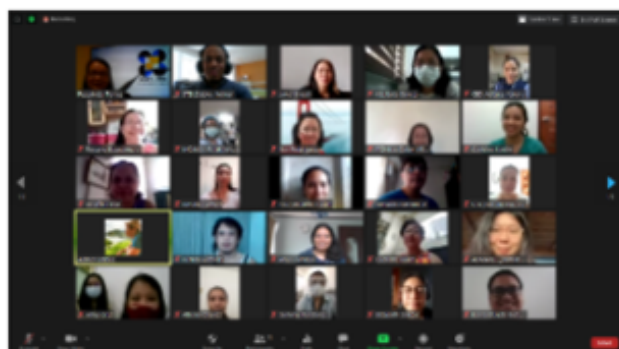
The Accounting and Cashier modules attached to the ePayment system are able to generate segregated reports for General and Trust Fund account remittances. Overall, the framework helps improve efficiency of internal operations, data integrity and data consistency. The DOST-ITDI Online Transaction Framework, being modular, can be easily implemented by other government agencies. Adoption by other DOST agencies is under way since November 2020.

## Gender and development (GAD) activities

The DOST-ITDI Gender and Development (GAD) Focal Point System (GFPS) through its Technical Working Group conducted two GAD webinars namely “*Familiarizing Harmonized Gender and Development Guidelines (HGDG) and Gender Mainstreaming Framework (GMEF)*” and “*Gender Analysis and Data Disaggregation*”. The first webinar was conducted last September 25, 2020 and participated by around 133 DOST-ITDI employees while the second one was conducted on September 28, 2020 and 71 DOST-ITDI employees participated.



**Webinar on Familiarizing Harmonized Gender and Development Guidelines (HGDG) and Gender Mainstreaming Evaluation Framework (GMEF) on 25 Sept 2020**



**GAD Gender Analysis and Data Disaggregation on 28 Sept 2020**

Likewise, DOST-ITDI participated in the celebration of the 18-Day Campaign to Violence Against Women (VAW). The VAW-designed face masks were procured and distributed to all ITDI employees including some COA employees and guards. The VAW Streamer was posted at the NML and Executive Offices Building and at the STD Building. GAD also distributed 70% Ethyl Alcohol, Body Temperature Thermometers and alcohol-based Hand Sanitizers to each ITDI Division as part of preventive measures against the spread of the COVID-19 infection, and assisted in the disinfection of all the buildings.

Moreover, to boost the immune system of all staff and to enable them to be more productive and healthy particularly the women, sodium ascorbate with zinc capsules were distributed and pneumonia and flu vaccines were given. The TWG further initiated issuance of some policies namely memoranda on the 18-Day Campaign to End Violence Against Women, Webinar on HGDG & GMEF and the creation of a GAD Section in the ITDI Website. The ITDI GMEF Assessment 2017-2019, GAD Accomplishment Report for 2019, GAD Plan and Budget for 2021 and GAD Focal Point System (GFPS) Profile Form were prepared and submitted to DOST GAD Focal Point and PCW.





VAW Streamer posted at the NML and Executive Offices Building and at the Poster Area of the STD Building Main Entrance; VAW-designed Face Masks distributed to both regular and contract of service ITDI staff



VAW Poster posted at the STD Facebook Page



Constant showing of Women Empowerment Video at the STD lobby TV

## Policies developed

This year, the Institute developed policies that involve health protocols in the workplace and the technical support to the public sector in developing standards, methodologies and guidelines for government agencies and industries focusing on the areas of environment, energy, nanotechnology, packaging; and product standards and testing.

### 17 Internal Policies on Alternative Work Arrangement, IT Security and Online Access to Files, and Business Transactions during ECQ

- Revised Interim Guidelines for Alternative Work Arrangements and Support Mechanism for Workers in ITDI during the Period of State of National Emergency Due to COVID-19 Pandemic
- Guidelines on the Organizational Roles, Responsibilities, and Authorities in the R&D Project Management
- Guidelines on the Use of Derwent Innovation: Patent Research and Analytics Tool
- Implementation of Network Attached Storage (NAS)
- Policy Guidelines on Information Technology Security of the Industrial Technology Development Institute for the Alternative Work Arrangements during the Period of State of National Emergency Due to COVID-19 Pandemic
- Prescribing the FMD Guidelines on the Issuance of Statement of Accounts (SOA) and/or Demand Letters (DL) for Uncollected Fees/Income
- Guidelines for Public Health and Social Measures Conduct of Face-to-Face Training in the Context of the COVID-19 New Normal
- Use of ITDI Online File Serve and Accessing ITDI File Server Instruction Manual
- Interim Guidelines in Receiving Delivery of Goods Under the New Normal
- Interim Guidelines in Transacting Business with the Cashier Section of ITDI during the Period of General Community Quarantine (GCQ)
- Guidelines in Identifying and Managing ITDI Research Outputs for Public Good
- Reiterating the Institute's Advisory on Preventive Measures for Protection against COVID-19
- Advisory on Preventive Measures for Protection against COVID-19 Management
- Suspension of Delivery of Non-Essential Goods/Services and Lifting of Liquidated Damages during COVID-19 Situation
- Guidelines on Work Arrangement under Work Suspension Pursuant to DOST AO 004 s.2020 with Additional Guidelines
- Advisory to All Suppliers, Contractors and Service Providers of ITDI Relative to the Extension of ECQ
- Incorporation of Gender and Development (GAD) Section at the ITDI Website

### 84 External Policies on DOST Fees and Charges, Environment, Energy, Nanotechnology, Packaging, Product Standards and Testing, and Laboratory Accreditation

#### ***DOST System Fees and Charges***

- Updated Guidelines on the Computation of Fees and Charges for DOST Testing, Calibration and Other Technical Services

#### ***Environment***

- Proper Disposal of Used Gloves and Face Masks
- Proper Disinfection of Facilities
- Reusing Surgical Face Masks
- Disinfection of Building

#### ***Energy***

BPS-DTI TC 87 Coconut Shell Products

- BPS TC 87/ SC 1 Coconut Shell Products — WDPNS on Coconut Shell Charcoal Briquettes – Grading and Classification (*under circulation*)

#### ***Nanotechnology***

BPS-DTI TC 85 Nanotechnologies

- ISO/TS 16195: 2018 — Nanotechnologies - Specification for Developing Representative Test Materials Consisting of Nano-Objects in Dry Powder Form
- ISO/TR 10929: 2010 — Nanotechnologies - Characterization of Multi-Wall Carbon Nanotube (MWCNT) Samples
- ISO/TS 11888: 2017 — Nanotechnologies - Characterization of Multi-Wall Carbon Nanotubes - Mesoscopic Shape Factors
- ISO/TR 11811: 2012 — Nanotechnologies - Guidance on Methods for Nano and Microtribology Measurements
- ISO/TR 18196: 2016 — Nanotechnologies - Health and Safety Practices in Occupational Settings
- ISO/TR 19716: 2016 — Nanotechnologies - Occupational Risk Management Applied to Engineered Nanomaterials - Part 1: Principles and Approaches

- ISO/TR 12885: 2018 — Nanotechnologies - Health and Safety Practices in Occupational Settings
- ISO/TS 12901-1: 2012 — Nanotechnologies - Occupational Risk Management Applied to Engineered Nanomaterials - Part 1: Principles and Approaches
- ISO/TS 12901-2: 2014 — Nanotechnologies - Occupational Risk Management Applied to Engineered Nanomaterials - Part 2: Principles and Approaches
- ISO/TR 13014: 2012 ASO/TR 13014: 2012/Cor 1: 2012 — Nanotechnologies - Guidance on Physico-Chemical Characterization of Engineered Nanoscale Materials
- ISO/TR 13121: 2011 — Nanotechnologies - Nanomaterial Risk Evaluation
- ISO/TR 13329: 2012 — Nanotechnologies - Preparation of Material Safety Data Sheet (MSDS)
- ISO/TR 16196: 2016 — Nanotechnologies - Compilation and Description of Sample Preparation and Dosing Methods for Engineered and Manufactured Nanomaterials
- ISO/TR 16197: 2014 — Nanotechnologies - Compilation and Description of Toxicological Screening Methods for Manufactured Nanomaterials
- ISO/TR 18637: 2016 — Nanotechnologies - Overview of Available Frameworks for the Development of Occupational Exposure Limits and Bands for Nano-Objects and their Aggregates and Agglomerates (NOAAs)
- ISO/TS 19807-1: 2019 — Nanotechnologies - Magnetic Nanomaterials - Part 1: Specification of Characteristics and Measurements for Magnetic Nanosuspensions
- ISO/TS 20660: 2019 — Nanotechnologies — Antibacterial Silver Nanoparticles - Specification of Characteristics and Measurement Methods
- IEC PAS 62565-2-1: 2011 — Nanomanufacturing - Material Specifications - Part 2-1: Single Wall Carbon Nanotubes - Blank Details Specification
- IEC TS 62565-4-2: 2018 — Nanomanufacturing - Material Specifications - Part 4-2: Luminiscent Nanomaterials - Detail Specification for General Lighting and Display Specifications
- IEC 62607-3-1: 2014 — Nanomanufacturing - Key Control Characteristics - Part 3-1: Luminiscent Nanoparticles - Quantum Efficiency
- ISO TS 21236-1:2019 — Nanotechnologies - Clay Nanomaterials - Part 1: Specification of Characteristics and Measurement Methods for Layered Clay Nanomaterials
- PNS ATSM C403/C403: 2020 — Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance

- PNS ASTM C1436: 2020 — Standard Specification for Materials for Shotcrete
- DPNS ASTM C270-19e1 — Standard Specification for Mortar for Unit Masonry (under circulation)
- DPNS ASTM C476-20 — Standard Specification for Grout for Masonry (under circulation)

#### BPS-DTI TC 6 Gas Cylinders

- PNS ISO 22991: 2004 Gas cylinders — Transportable Refillable Welded Steel Cylinders for Liquefied Petroleum Gas (LPG) - Design and Construction

#### BPS-DTI TC 16 Rubber and Rubber Products

- PNS ISO 1382: 2020 — Rubber - Vocabulary
- PNS ISO 1307: 2006 — Rubber and Plastic Hoses - Hose Sizes, Minimum and Maximum Inside Diameters, and Tolerances on Cut-to-length Hoses
- PNS ISO 8030: 2014 — Rubber and Plastic Hoses - Method of Test for Flammability
- PNS ISO 8308: 2015 — Rubber and Plastic Hoses and Tubing - Determination of Transmission of Liquids through Hose and Tubing Walls
- ISO 19003: 2006 — Rubber and Rubber Products - Guidance on the Application of Statistics to Physical Testing
- ISO 18899: 2013 — Rubber - Guide to the Calibration of Test Equipment
- ISO 1408: 1995 — Rubber - Determination of Carbon Black Content - Pyrolytic and Chemical Degradation Methods
- ISO 248-1: 2011 — Rubber, Raw - Determination of Volatile-Matter Content - Part 1: Hot-Mill Method and Oven Method

#### BPS-DTI TC 37 School and Office Supplies

- PNS 1162: 2020 — Staple Wires - Specification
- PNS 1561: 2020 — Stapler - Specification
- DPNS ISO 9177-1: 2020 — Mechanical Pencils for Technical Drawings - Part 1: Classifications, Dimensions, Performance Requirements and Testing (*under circulation*)
- DPNS ISO 9177-2: 2020 — Mechanical Pencils - Part 2: Black Leads Classification and Dimensions (*under circulation*)
- DPNS ISO 9177-3: 2020 — Mechanical Pencils - Part 3: Black Leads Bending Strengths of HB Leads (*under circulation*)
- DPNS ISO 20318-1: 2020 — Mechanical Pencils and Leads for General Use Classification, Dimensions, Quality and Test Methods - Part 1: Mechanical Pencils (*under circulation*)
- DPNS ISO 20318-2: 2020 — Mechanical Pencils and Leads for General Use Classification, Dimensions, Quality and Test Methods - Part 2: Black Leads (*under circulation*)



#### BPS-DTI TC 50 Fireworks

- PNS 1220-1: 2019 — Fireworks - Categories 1, 2 and 3 -- Part 1: Classification
- PNS 1220-2: 2019 — Fireworks - Categories 1, 2 and 3 -- Part 2: Specification
- PNS 1220-3: 2019 — Fireworks - Categories 1, 2 and 3 -- Part 3: Test Methods

#### BPS-DTI TC 51 Adhesives and Allied Products

- PNS ASTM D7888: 2020 — Standard Practice for Evaluating Adhesive and the Effects of Plasticizer Found Within Polyvinyl Chloride-Backed Floor Coverings
- PNS ASTM D7998: 2020 — Standard Test Method for Measuring the Effect of Temperature on the Cohesive Strength Development of Adhesives using Lap Shear Bonds under Tensile Loading
- PNS ASTM D8089: 2020 — Standard Practice for Accelerated Heat Aging for Floor Covering Adhesives
- PNS ISO 21194: 2020 — Elastic Adhesives - Testing of Adhesive-Bonded Joints - Bead Peel Test
- PNS ISO 22631: 2020 — Adhesives - Test Methods for Adhesives for Floor and Wall Coverings - Peel Test
- PNS ISO 22632: 2020 — Adhesives - Test Methods for Adhesives for Floor and Wall Coverings - Shear Test
- PNS ISO 22633: 2020 — Adhesives - Test Methods for Adhesives for Floor and Wall Coverings - Determination of the Dimensional Changes of a Linoleum Floor Covering in Contact with an Adhesive
- PNS ISO 22635: 2020 — Adhesives - Test Methods for Adhesives for Floor and Wall Coverings - Determination of Dimensional Changes after Accelerated Ageing
- PNS ISO 22637: 2020 — Adhesives - Test of Adhesive for Floor Covering - Determination of the Electrical Resistance of Adhesive Films and Composites
- PNS ISO 10354: 2020 — Adhesives - Characterization of Durability of Structural-Adhesive-Bonded Assemblies - Wedge Rupture Test
- PNS ISO 11343: 2020 — Adhesives - Determination of Dynamic Resistance to Cleavage of High-Strength Adhesive Bonds under Impact Conditions - Wedge Impact Method
- PNS ISO 13445: 2020 — Adhesives - Determination of Shear Strength of Adhesive Bonds between Rigid Substrates by the Block-Shear Method
- PNS ISO 14676: 2020 — Adhesives - Evaluation of the Effectiveness of Surface Treatment Techniques for Aluminum - Wet-Peel Test by Floating-Roller Method

#### BPS-DTI TC 54 Jewelry

- PNS ISO 11210: 2020 — Jewelry - Determination of Platinum in Platinum Jewelry Alloys – Gravimetric Method After Precipitation of diammonium hexachloroplatinate
- PNS ISO 11426: 2020 — Jewelry - Determination of Gold Jewelry Alloys – Cupellation Method (Fire Assay)
- PNS ISO 11427: 2020 — Jewelry – Determination of Silver in Silver Jewelry Alloys – Volumetric (Potentiometric) Method using Potassium Bromide
- PNS ISO 18323: 2020 — Jewelry – Consumer Confidence in the Diamond Industry
- DPNS 2109 — Gemstones – Terminologies and Classification (*under circulation*)
- DPNS ISO 9202 — Jewelry and Precious Metals – Fineness of Precious Metal Alloys (*under circulation*)
- DPNS ISO 10713 — Jewelry – Gold Alloys Coatings (*under circulation*)

#### DOE TC on Petroleum Products and Additives

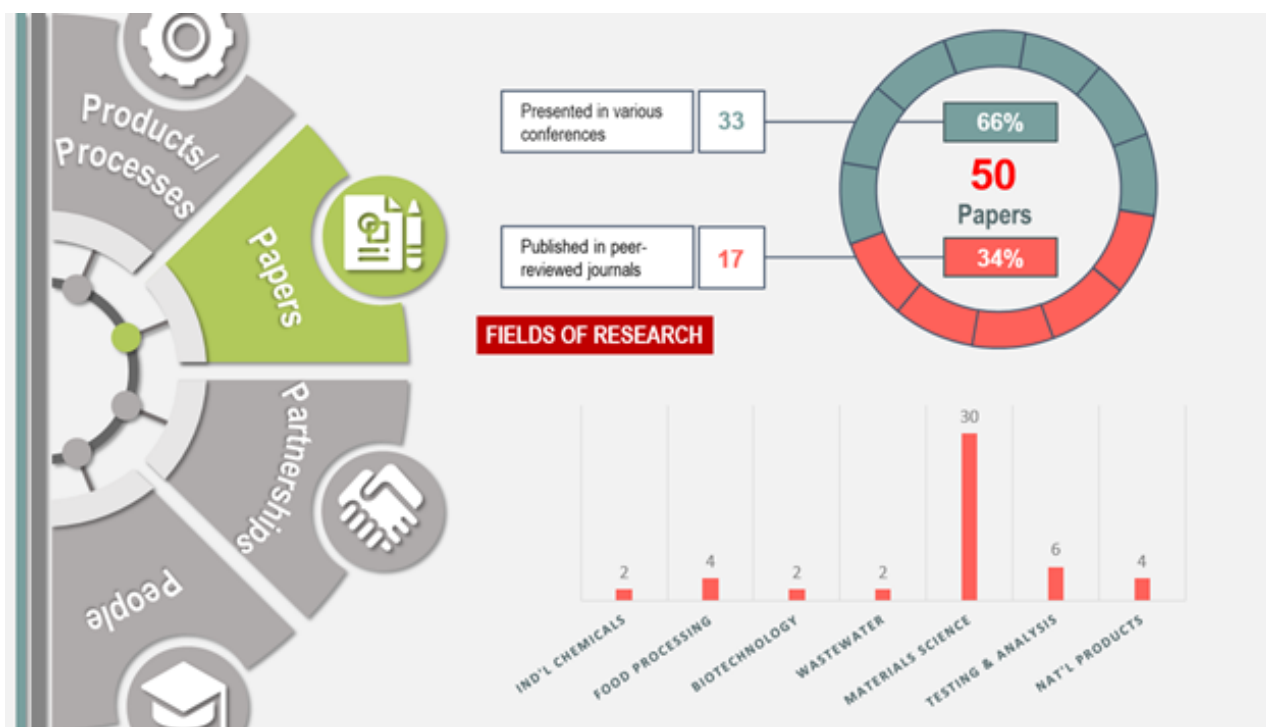
- PNS/DOE QS 009: 2019 — Petroleum Products – Kerosene – Specification

#### FDA-DOH TC 45 Medical Gloves

- PNS ISO 11193-1: 2020 — Single-Use Medical Examination Gloves – Part 1: Specification for Gloves Made from Rubber Latex or Rubber Solution

#### PAB-DTI Laboratory Accreditation Technical Committee (LATC)

- LA/SR01 — Supplementary Requirements for Proficiency Testing (*issued April 2020*)
- LA/SR02 — Supplementary Requirements for Metrological Traceability (*issued April 2020*)
- LA/SR03 — Supplementary Requirements for the Use of PAB Symbol (*issued April 2020*)
- LA/SR04 — Supplementary Requirements for Accreditation of Microbiological Testing Laboratories (*issued September 2020*)
- LA/GD01 — Guidance Document on Accreditation Process (*issued July 2020*)
- LA/GD09 — Guidance Document on Remote Assessments (*issued July 2020*)
- LA/GD11 — Guidance Document for Accreditation of Chemical Testing Laboratories (*issued September 2020*)



## PAPERS PUBLISHED AND PRESENTED

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For this year, DOST-ITDI published a total of 17 publications in peer-reviewed journals and presented 33 R&D papers in various conferences. There were also 27 papers drafted for publication and 1 paper submitted for oral presentation.

## Effect of a direct sulfonation reaction on the functional properties of thermally-crosslinked electrospun polybenzoxazine (PBz) nanofibers

*R.P. Parreño Jr, Y. Liu, A.B. Beltran, and M.B. Carandang*

DOI: 10.1039/D0RA01285H (Paper) RSC Adv., 2020, 10, 14198-14207

### ABSTRACT

Electrospun nanofibers of polybenzoxazines (PBzs) were fabricated using an electrospinning process and crosslinked by a sequential thermal treatment. Functionalization by the direct sulfonation process followed after the post-electrospinning modification treatment. The first stage of experiment determined the effects of varying the concentration of sulfuric acid as the sulfonating agent in the sulfonation reaction under ordinary conditions. The second stage examined the mechanism and kinetics of the sulfonation reaction using only concentrated H<sub>2</sub>SO<sub>4</sub> at different reaction time periods of 3 h, 6 h, and 24 h.

The mechanism of the sulfonation reaction with PBz nanofibers was proposed with only one sulfonic acid (–SO<sub>3</sub>H) group attached to each of the repeating units since only first type substitution in the aromatic structure occurs under this condition. The kinetics of the reaction exhibited a logarithmic correlation where the rate of change in the ion exchange capacity (IEC) with the reaction time increased rapidly and then reached a plateau at the reaction time between 18 h and 24 h. Effective sulfonation was confirmed by electron

spectroscopy with a characteristic peak associated with the C–S bond owing to the sulfonate group introduced onto the surface of the nanofibers. ATR-FTIR spectroscopy also confirmed these results for varying reaction times. The SEM images showed that sulfonation has no drastic effects on the morphology and microstructure of the nanofibers but a rougher surface was evident due to the wetted fibers with sulfonate groups attached to the surface. EDX spectra exhibited sulfur peaks where the concentration of sulfonate groups present in the nanofibers is directly proportional to the reaction time.

From surface wettability studies, it was found that the nanofibers retained the hydrophobicity after sulfonation but the inherent surface property of PBz nanofibers was observed by changing the pH level of water to basic, which switches its surface properties to hydrophilic. The thermal stability of the sulfonated nanofibers showed almost the same behavior compared to non-sulfonated nanofibers except for the 24 h sulfonation case, which has slightly lower onset temperature of degradation.

## Sulfur copolymers (SDIB) from inverse vulcanization of elemental sulfur (S8) for polymer blend

*R.P Parreño Jr., Y. Liu, A.B. Beltran*

DOI: 10.1088/1757-899X/778/1/012023

### ABSTRACT

Elemental sulfur (S<sub>8</sub>) is a largely available resource as by-product from petroleum refining process which is causing ‘excess sulfur problem’ due to its limited usage. The utilization of sulfur as valuable material will not only address environmental concerns but provide cost-effective ways of consuming this huge amount of waste to develop new high-value, high-volume products. One facile synthetic method of utilizing sulfur directly as feedstock to produce polymeric material is inverse vulcanization.

In this study, sulfur copolymers (SDIB) was synthesized via inverse vulcanization from S<sub>8</sub> and processed into polymer blend with component polymers, polybenzoxazine (PBz) and poly(methyl methacrylate) (PMMA) to show its potential processability into polymer blend. Initially, synthesis of SDIB with varying feed ratios of sulfur to comonomer 1,3-diisopropenylbenzene (DIB) was evaluated for its resulting properties. Spectroscopy showed copolymerization reactions occurred based on the change in characteristic absorption peaks (C=C–H, C=C, C–H) present in the spectra. Thermogravimetric analysis (TGA) indicated that SDIB is more

thermally stable with the increase in onset temperature of degradation. Differential scanning calorimetry (DSC) profile exhibited new single glass transition temperature (T<sub>g</sub>) that slightly increased with higher DIB ratio indicating evolution of microstructures of copolymers produced.

The processability of SDIB into polymer blend was investigated by using SDIB (50 wt% S) with PBz and PMMA. Blending process using simple mixing technique with solvents was carried out for SDIB/PBz (10/10 wt%) and SDIB/PMMA (7.65/7.65 wt%) blend compositions. The results of this study demonstrated that polymer copolymers interactions influenced the phase structure and behaviour with polymer blend of SDIB/PBz showing higher degree of miscibility with more homogeneous and transparent blend as compared to SDIB/PMMA blend. The suitability of polymer blend in electrospinning of nanofibers could provide variety of new applications for SDIB.



## Biodecolorization of textile dye and wastewaters by crude laccase from *Pleurotus florida* ITDI 6003 cultivated in wheat grains

E.N. Montague, J.D. Guzman, N.M. Unciano, E.G. Panerio, U.G. Bigol, I.J.L. Castro, J.P. Jose, S.D. Mantaring

DOI: 10.5943/cream/10/1/17

### ABSTRACT

The continuous growth of the textile industry in the Philippines resulted in an increase in the discharge of textile wastewater which includes environmental contaminants such as dyes. The current most common decolorization treatment of textile wastewater is through the use of chemicals, which in turn, also adds to environmental contamination. Thus, this study aims to employ biological treatment through the use of enzyme, particularly of crude laccase, extracted from *Pleurotus florida* ITDI 6003 grown on wheat grains. The crude laccase from *P. florida* ITDI 6003 yielded an enzyme activity of 5.36 U/mL based on the oxidation of 2, 2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) diammonium salt (ABTS). Furthermore, the crude

laccase was able to significantly decolorize the textile dye Remazol Blue RGB, and four textile wastewaters originally collected from the dyeing facility of the Philippine Textile Research Institute (DOST-PTRI). UV-Vis spectrophotometric analyses of the laccase-treated textile dye and wastewater samples also showed decrease in absorbances at their respective specific  $\lambda_{max}$ . Full wavescan analyses indicated hypsochromic shifts in the  $\lambda_{max}$  as also observed on the changes in color on the visual analyses of the treatment setups. The results show the potential of using crude laccase from *P. florida* ITDI 6003 in the decolorization of textile dye and wastewaters discharged from the textile industry.

## Isolation, screening, and characterization of biosurfactant-producing *Bacillus* spp. from soil and their potential biofilm inhibitory activities against *Pseudomonas aeruginosa*

J.P.M. Guzman, J.M. Alba and M.L. Torres

### ABSTRACT

Biosurfactants are surface-active compounds usually produced by microbial cells, thus, their biodegradable nature and low toxicity. The capability to lessen surface and interfacial tensions characteristic of these compounds paved the way for their potential to inhibit biofilm formation. Biofilms are complex matrices of microbial cells formed on surfaces which provide microorganisms protection against substances found in the environment, including antimicrobials.

In this study, *Bacillus* spp. isolated from soil samples were screened for their production of biosurfactants through Oil Drop Collapse and Parafilm M assays. Out of 12 isolates, four, GAT-01, GAT-04, GAT-05, and GAT-07, tested positive, and

were identified based on their phenotypic and genotypic characteristics as *B. pseudomycoloides*, *B. cereus*, *B. pseudomycoloides*, and *B. mycoloides*, respectively. GAT-01 was able to yield the highest biofilm inhibition activity against *Pseudomonas aeruginosa* ATCC 27853 with 43.12%, GAT-04 with 32.42%, GAT-05 with 35.78%, while GAT-07 showed the lowest activity with 26.91%. No antibacterial activities against *P. aeruginosa* ATCC 27853 were observed. Quorum sensing inhibition assay using *Chromobacterium violaceum* ATCC 12472 also showed negative results for all the biosurfactants. These present the potential of biosurfactants from *Bacillus* spp. as bioactive substances against biofilm formation through physical interactions.

## Influence of antemortem and slaughtering practices on the pH of pork and chicken meats

M.R. Manalo and A.A. Gabriel

### ABSTRACT

This study aimed to document and determine the effects of antemortem and slaughtering practices on the post-mortem pH of pork and chicken meats. Selected hog slaughterhouses (SHs) and poultry dressing plants (PDPs) located in Valenzuela City, Philippines were assessed to gather basic information regarding the practices of each plant. The post-mortem pH at 45 min and 24 h for pork ( $n = 39$ ) and post-mortem pH at 20 min and 24 h for chicken ( $n = 24$ ) meats produced in the visited plants were determined. Measured pH values were used as the basis for classifying meat quality as pale, soft, and exudative (PSE); dark, firm, and dry (DFD); and acceptable meat. Early post-mortem temperature was also determined in both types of meat. Ocular plant inspection revealed that the average age of pigs and chickens slaughtered were 4 mo and 40–45 d old, respectively. Animals were transported from farm to slaughterhouse in a forward open cab vehicle with a

partition at a distance that ranged from 45–60 km for pigs and 65–172 km for chicken with a travel time of 1–3 h. The resting period of pigs prior to slaughter was 1.5–8 h and 2–4 h for chicken.

Generally, a higher percentage of suspected DFD (38.46% vs. 30.30%) and PSE (17.95% vs. 6.06%) in pork meat was observed at early post-mortem pH in comparison to ultimate pH. The majority of the PSE-like meat came from pigs slaughtered using electric stunner while DFD incidence occurred from pigs with a short resting period prior to slaughter (1.5–2 h). For chicken meat, 29% of the samples were suspected PSE based on ultimate pH while the remaining 71% were meat with suspicious quality. PSE-like meat was recorded from chicken transported from farm to abattoir with a longer travel period (3 h).

## **Structural, textural, and thermal properties of freeze-thawed quick-frozen cooked rice PSB Rc 18 (*Oryza sativa* L.)**

*U.G.M. Dollete and M.P.V. Azanza*

### **ABSTRACT**

The study characterized the quality properties of freeze-thawed, quick-frozen intermediate amylose cooked rice PSB Rc 18 (*Oryza sativa* L.). Scanning electron microscopy (SEM), texture profile analysis (TPA), and differential scanning calorimetry (DSC) were employed to monitor structural, textural, and thermal properties including retrogradation in quick-frozen rice as subjected to 1, 3, and 5 freeze-thaw cycles (FTCs) (-18 °C for 16 h; 10 °C for 8 h). Data from SEM, TPA, and DSC explained progressive deteriorative quality

changes with increasing FTC. The SEM micrographs revealed the formation of honeycomb structures. The TPA results showed significant ( $p < 0.05$ ) increase in hardness, cohesiveness, chewiness, springiness; as well as a decrease in adhesiveness. The DSC analysis demonstrated the decreasing trend of thermal transition temperatures. Based on the obtained results, it is recommended that quick-frozen cooked rice should not be exposed to more than 3 FTCs.

## **Changes in the physicochemical and microbiological properties of pork and chicken meats at ambient storage condition**

*M.R. Manalo and A.A. Gabriel*

DOI: 10.18485/meattech.2020.61.1.3

### **ABSTRACT**

Pork and chicken meat samples were collected from pre-selected slaughterhouses to characterize the pH, titratable acidity (%TA), and aerobic plate count (APC) from slaughter until end of shelf-life at ambient temperature (30±2°C). Results showed that the population of microorganisms on meat samples increased over the storage time. On the other hand, pH and % TA were variable, showing no statistically significant changes throughout the storage period. Based on microbiological analysis, the shelf life of pork and chicken meats ranged from 8 to 12 h and 3 to 6 h, respectively. Pearson correlation revealed there was no significant

relationship between APC and pH of pork ( $r=-0.10$ ,  $n=278$ ,  $p>0.05$ ) or between APC and %TA of pork ( $r=0.053$ ,  $n=278$ ,  $p>0.05$ ). However, there was a weak negative relationship between APC and pH in chicken ( $r=-0.165$ ,  $n=267$ ,  $p<0.005$ ) and a positive relationship between APC and %TA ( $r=0.401$ ,  $n=266$ ,  $p<0.005$ ). This showed that pH cannot be used as a good indicator of meat spoilage. Furthermore, the differences between fresh and obviously spoiled meat samples, for both pH and %TA, were not great enough for practical use.

## **Assessing the performance of thin-film nanofiltration membranes with embedded montmorillonites**

*M.B.M.Y. Ang, A.B.G. Deang, R.R. Aquino, B.A. Basilia, S. Huang, K. Lee and J. Lai*

### **ABSTRACT**

In this study, the basal spacing of montmorillonite (MMT) was modified through ion exchange. Two kinds of MMT were used: sodium-modified MMT (Na-MMT) and organo-modified MMT (O-MMT). These two particles were incorporated separately into the thin-film nanocomposite polyamide membrane through the interfacial polymerization of piperazine and trimesoyl chloride in n-hexane. The membrane with O-MMT (TFNO-MMT) has a more hydrophilic surface compared to that of membrane with Na-MMT (TFNNa-MMT). When various types of MMT were dispersed in the n-hexane solution with trimesoyl chloride (TMC), O-MMT was well-dispersed than Na-MMT. The poor dispersion of Na-

MMT in n-hexane led to the aggregation of Na-MMT on the surface of TFNNa-MMT. TFNO-MMT displayed a uniform distribution of O-MMT on the surface, because O-MMT was well-dispersed in n-hexane. In comparison with the pristine and TFNNa-MMT membranes, TFNO-MMT delivered the highest pure water flux of  $53.15 \pm 3.30$  L·m<sup>-2</sup>·h<sup>-1</sup> at 6 bars, while its salt rejection for divalent ions remained at 95%–99%. Furthermore, it had stable performance in wide operating condition, and it exhibited a magnificent antifouling property. Therefore, a suitable type of MMT could lead to high separation efficiency.

## **Fabrication of polythiourea-copper complex composite membrane and its anti-fouling property**

*M.T. Margarito, A.B. Beltran, M.A. Promentilla, A. Orbecido, B. Basilia, R. Damalerio, and U. Bigol*

### **ABSTRACT**

A composite flat sheet membrane containing polythiourea-copper (PTU-Cu) complex was fabricated through a two-step phase separation involving complexation and/or crosslinking of the polymer by copper ions ( $\text{Cu}^{2+}$ ) on the first step and non-solvent induced phase separation on the second step. The surface topography of the membrane was analyzed using Atomic Force Microscope (AFM) in non-contact mode. The incorporation of copper at the surface was confirmed through Scanning Electron Microscope-Energy Dispersive X-ray (SEM-EDX) mapping wherein other elements such as Sulfur (S), Carbon (C) and Oxygen (O) of the polymer were

conducted. The fabricated membrane was rigid as shown by high value (about 2.15 GigaPascal) of measured Young's modulus using the Pinpoint Nanomechanical Analysis Mode of AFM. In addition, the surface charge and hydrophobicity were measured using the Electrostatic Force Microscope (EFM) and water contact angle respectively. The antifouling characteristic of the membrane was evaluated through antimicrobial membrane surface contact test wherein *E. coli* was used as test microorganism. Other membrane properties such as pore size distribution and pure water flux were measured using a porometer and a filtration apparatus.

## **Thermomechanical properties of woven abaca fiber-reinforced nanocomposites**

*M.A. Paglicawan, M.P. Rodriguez, J.R. Celorico*

### **ABSTRACT**

In this study, natural fiber-reinforced polymer nanocomposites were prepared from high-density polyethylene (HDPE), abaca fiber, and nanoprecipitated calcium carbonate (NPCC) using the hot press technique. The study investigated the influence of untreated and alkali-treated woven abaca fabric and NPCC hybrid reinforcement on the thermomechanical behavior of the natural fiber composites. The HDPE with different amounts of NPCC was melt-blended in a twin-screw extruder followed by hot press to produce sheets. A lamination of composites containing alternating layers of HDPE sheets with different amounts of NPCC and layers of untreated and alkali-treated woven abaca fabric was produced using a hot press machine. The resulting

material was composed of 20% weight ratio of woven abaca fibers. The tensile strength showed that the nanocomposite exhibited a high tensile value of 60.1 MPa with alkali-treated abaca and 1% NPCC. However, a further increase in the NPCC concentration beyond 1% reduced the mechanical strength of the nanocomposite. The thermal stability of the abaca fiber-reinforced nanocomposite improved with addition of NPCC. Scanning electron microscopic analysis demonstrated that alkali-treated abaca and 1% NPCC improved the adhesion and compatibility between the fiber and polymer matrix. The potential applications of this natural fiber-reinforced composite are for automotive and construction materials.

## **Physicochemical properties and stability of microencapsulated betacyanin pigments from red dragon fruit peels and flesh**

*R.C. Torres, C.K.F. Jose, D.C.P. Canillo, R.M.G. Yumang*

*DOI: 10.36811/ojpsr.2020.110008*

### **ABSTRACT**

Dragon fruit (*Hylocereus polyrhizus*) is known for its purple-colored peels and pulp, which can be attributed to the presence of betalains. In this study, the potential of red dragon fruit as a source of natural colorant was investigated. Betacyanins were extracted from red dragon fruit peels and flesh in 1:3 ratio with water. Microencapsulation by spray drying was done by adding 5% and 10% (w/v) maltodextrin (DE 11.8) to peels and flesh extracts, respectively. The spray-

dried colorant powders all obtained <10% moisture content, 5.261-6.409 g/100g hygroscopic moisture content, and 5.317-7.349 (mg/100L) betacyanin content. Morphological characterization revealed spherical, agglomerated particles with visible cracks on the surface. The stability study conducted showed that pigment retention was lowest at 70°C and highest at 4°C.



## Physicochemical properties and stability of microencapsulated blue colorant from *Clitoria ternatea* L.

R.C. Torres, C.K.F. Jose, R.Z.M.L. Walde, R.M.G. Yumang and D.C.P. Canillo

DOI: <http://dx.doi.org/10.24327/ijar.2020.22374.4409>

### ABSTRACT

Anthocyanins are water-soluble vacuolar pigments that provide wide range of colors depending upon the existing pH. Generally known for their free radical scavenging activity and numerous health-promoting benefits, these natural pigments appeared promising making them suitable to replace existing harmful synthetic ones. However, prolonged exposure to certain environmental conditions makes them susceptible to degradation. The purpose of this study is to microencapsulate anthocyanin pigments extracted from *Clitoria ternatea* L. at pH 5 and 7 through spray drying

technique by using 5% Maltodextrin DE 11.8 as the carrier agent. The resulting physicochemical properties, particle size distribution and surface morphology are intended for its future functional applications. Stability studies in relation to color characteristics, moisture and total monomeric anthocyanin content were also evaluated to monitor its quality throughout storage. No signs of inter-particle liquid bridges among powders and a minimal noticeable color difference ( $\Delta E < 4$ ) were detected for each colorant after 12 weeks.

## Synthesis and characterization of polycaprolactone (PCL) organo-montmorillonite (O-MMT) blend via solvent casting

R.M.A. Ramos, R.R. Aquino, M.S. Tolentino, E.G. Eleazar, B.A. Basilia

DOI: <https://doi.org/10.4028/www.scientific.net/MSF.998.255> (2020) *Materials Science Forum*,

ISSN: 1662-9752, Vol. 998, pp 255-260

### ABSTRACT

Polycaprolactone (PCL) is a hydrophobic, semi-crystalline polymer that has been broadly applied in long term implants, drug release applications, and in the tissue engineering field owing to its availability, it is cheaper, and can be modified. Organo-montmorillonite (O-MMT) clay has been extensively used for various polymer-nanocomposite studies and widely used as adsorbent due to its high specific surface area. Most polymer clay nanocomposites are used in biomedical applications such as in drug delivery systems and wound healing. In this study, O-MMT was incorporated to PCL via solvent casting, which resulted into film membranes that were characterized for their surface morphology, chemical structure, wettability, mechanical property, pore size, and

antibacterial properties at varying concentrations. The SEM and FTIR results indicated the presence of both PCL and O-MMT within the membrane. The mechanical properties of the film membranes showed an improvement upon reaching an optimal point. An increase in pore size was determined relative to its hydrophilicity. The film membrane showed an antibacterial activity only at higher concentrations of the O-MMT using the *S. aureus* strain. As such, the results showed an improvement in the mechanical, wettability, water absorption and antibacterial properties of the PCL with the incorporation of the O-MMT, making it a potential dressing material for wound healing.

## Effect of polysulfone/organomontmorillonite blends on nanocomposite membrane properties

R.R. Aquino, M.S. Tolentino, M.L. Esmalde, D.V.B. Condol, B.A. Basilia

DOI: <https://doi.org/10.4028/www.scientific.net/KEM.801.331> *Key Engineering Materials Vol 801*, pp 331-36

### ABSTRACT

In this study, an organically modified montmorillonite (OMMT) hydrophilic clay was incorporated in PSf through non-solvent induced phase separation fabrication process to improve its properties. Afterwards, hand casting was done and the PSf/OMMT membranes produced were characterized to determine the effect of OMMT addition to its structural, mechanical and thermal properties, and hydrophilicity. Scanning electron microscope (SEM) images of the surfaces showed a denser surface as the OMMT content increases but the pores on the images were not pronounced unlike the SEM images of the cross-section which depicted spherical macrovoids for 1.0% while wider macrovoids were observed for 3.0% and 5.0% OMMT. The mechanical properties of the

nanocomposite with clay content up to 3.0% were improved. The glass transition temperatures of the PSf/OMMT nanocomposites were lower than the pure PSf while no significant difference was observed for the melting point. By statistical analysis, the addition and variation of the clay concentrations showed no significant effect to the thermal properties. The hydrophilicity of the membranes improved with the increasing OMMT concentration, but was found to be insignificant. The overall data gathered showed that the clay addition had improved characteristics compared to the pure PSf membrane, which implies that PSf/OMMT nanocomposite could be likely used in filtration applications.

## **Development and physico-chemical characterization of polyvinylidene flouride (PVDF) flat sheet membranes with antibacterial properties against *E. coli* and *S. aureus***

*J.G. Escorial, S.P. Lanzas, K.J. Berjamine, M.H. Caliolio, E. Dimaunahan, V. Lagura, L. Milo and B.A. Basilia*  
DOI: 10.1088/1742-6596/1593/1/012042 (2020) *Journal of Physics: Conference Series* 1593 012042

### **ABSTRACT**

The use of silver-modified montmorillonite (Ag-MMT) nanoclay from local montmorillonite ore as an additive for the development of PVDF flat sheet membranes with antibacterial properties for use in water disinfection was the focus of this study. It covers the development of PVDF flat sheet membranes with Ag-MMT nanoclay. The physico-chemical characterization was done through XRD, AFM, contact angle measurement, and FE-SEM while the antibacterial properties against gram-positive *S. aureus* and gram-negative *E. coli* were through inhibition zone and contact inhibition assessment. XRD results showed exfoliation of the Ag-MMT nanoclay in the PVDF flat sheet membrane, with minimal intercalations and similar functional group interactions. AFM results showed an

increased surface roughness for every increase in Ag-MMT nanoclay which correlates to the contact angle measurement of membranes, demonstrating high contact angle measurement and high hydrophobicity for rougher surfaces, showing high hydrophilicity for the 0.250% Ag-MMT nanoclay membrane with a contact angle of 79.5 degrees. FE-SEM results reveal the morphology of the membrane. All experimental membranes are negative in contact inhibition against *E. coli* and *S. aureus*. However, the Ag-MMT nanoclay has been found to have antibacterial properties with the formation of inhibition zones, showing a higher sensitivity against *E. coli*.

## **Effect of fiber loading on the chemical, structural, and mechanical properties of 3D-printed polylactic acid/abaca microcrystalline cellulose composites**

*C.L. Custodio, J.M. Cabañero, M.A. Paglicawan and B.A. Basilia*

### **ABSTRACT**

In an attempt to improve the physical properties of 3D printed polylactic acid (PLA), this study aims to develop a microcrystalline cellulose fiber and observe the effects of fiber loading on the PLA/cellulose composites to the composition, crystallinity, morphology, and tensile properties of the resulting 3D printed material. Microcrystalline cellulose (MCC) have been extracted from indigenous raw abaca fibers and used as the fiber reinforcement for the PLA matrix. Composites of 1 and 3 wt% MCC fibers with PLA were processed using the twin-screw extruder to produce

filaments. The resulting composite filaments were 3D printed utilizing the fused deposition modeling technology. FTIR, XRD, digital microscopy, and mechanical testing were used in characterizing the various 3D printed PLA/MCC composite. With the incorporation of cellulose, the PLA/MCC had up to 32% increase in tensile strength and 43% increase in modulus at just 3 wt% fiber loading due to the inherent high modulus of abaca cellulose. The MCC significantly influences the chemical, structural and mechanical properties of the 3D printed PLA/MCC composites.

## **Development of nanocomposite polysulfone-nanoclay membrane with enhanced hydrophilicity**

*B.A. Basilia, S. Cayabyab, E. Casa, A.K. Collera, P.A. de Yro, M. Margarito, L. Milo, M.C. Que, V. Lagura, B. Visaya*  
*Journal of Environmental Science and Management SI-1: 29-36 (2020) ISSN 0119-1144*

### **ABSTRACT**

This research involves the development of membranes with local raw materials to suit water and wastewater treatment applications. Indigenous montmorillonite clay was surface-modified with dialkyldimethyl ammonium chloride to be used as functional additive in polymeric membranes. Polysulfone pellets were dissolved in N-methyl-pyrrolidone (NMP) and organomodified-montmorillonite (OMMT) or nanoclay was incorporated at varying concentrations up to 1.00%. Casting solutions were vacuum-mixed and degassed using a planetary mixer then casted using MEMCASTTM to produce flat sheet membranes. Characterizations include X-Ray Diffractometry, Atomic Force Microscopy, Scanning Electron Microscopy, and contact angle measurement. The exfoliation of OMMT platelet structures within the PSf matrix at 1.00% loading showed improved surface roughness and more porous morphology.

Improved surface roughness was observed with an increase in magnitude as a function of increased OMMT concentration. Meanwhile, the morphology of the nanocomposite membranes showed three distinct layers: dense skin layer, porous finger-like layer, and sponge-like structured layer. Moreover, the contact angle of the membranes decreased by 13.7% with 1.00% addition. This enhancement in hydrophilicity could affect properties like permeate flux and membrane fouling which could play an important role in the functional performance of synthesized membranes with nanoclay additives. One-way ANOVA reveals that the change in OMMT concentration has shown significant effects on the surface roughness and contact angles of the membranes at 95% confidence level.

# Paper and Poster Presentations

**Table 5. Papers presented at convention/conferences**

| TITLE OF PAPER PRESENTED  | CONFERENCE/EVENT  | DATE                 |
|---|---|----------------------|
| <ul style="list-style-type: none"> <li>Design and prototyping of continuous screw type iodizing machine</li> </ul>  | 81st PICHE Convention   | February 19-22, 2020 |
|   | NICE  | March 4-6, 2020      |
| <ul style="list-style-type: none"> <li>Development of compact wastewater treatment system for restaurants in Boracay</li> </ul>   | 81st PICHE Convention   | February 19-22, 2020 |
| <ul style="list-style-type: none"> <li>Integration of PNS ISO/IEC 17025 verified rubber and rubber-based products test methods to meet the needs of Philippine rubber industry</li> </ul>   | 81st PICHE Convention   | February 19-22, 2020 |
| <ul style="list-style-type: none"> <li>Physicochemical properties and stability of microencapsulated blue colorant from <i>Clitoria ternatea</i> L.</li> </ul>  | 87th NRCP General Membership Assembly and Scientific Poster Contest   | April 27, 2020       |
| <ul style="list-style-type: none"> <li>Phosphate reduction in an aerated activated sludge wastewater treatment system</li> </ul>  | 87th NRCP Membership Conference   | June 30, 2020        |
| <ul style="list-style-type: none"> <li>Effect of density of sawdust in the mechanical properties of thermoplastic composite</li> </ul>  | NRCP Annual Scientific Conference and 87th General Membership Assembly  | June 30, 2020        |
| <ul style="list-style-type: none"> <li>Release mechanism of titanium dioxide (TiO<sub>2</sub>) from paints using accelerated weathering experiment</li> </ul>   | 81st PiChE National Convention  | July 8-9, 2020       |
| <ul style="list-style-type: none"> <li>Development of silica/PLA composite for fused deposition modelling 3D printing applications</li> </ul>   | 81st PiChE National Convention  | July 8-9, 2020       |
| <ul style="list-style-type: none"> <li>Nano-enabled asphalt: Application and release studies of nanoparticles to the environment</li> </ul>   | 81st PiChE National Convention  | July 8-9, 2020       |
| <ul style="list-style-type: none"> <li>Fabrication of polylactic acid (PLA) filament reinforced with alumina (Al<sub>2</sub>O<sub>3</sub>) for fused deposition modelling (FDM) 3D printing using optimized parameters</li> </ul> | 81st PiChE National Convention  | July 8-9, 2020       |
| <ul style="list-style-type: none"> <li>Effect of gamma irradiation on the mechanical and physicochemical properties of stereolithography (SLA) 3D printed Formlabs grey resin</li> </ul>  | 3rd International Conference on 3D Printing, 3D Bioprinting, Digital and Additive Manufacturing (I3D20), Thessaloniki, Greece | July 8-9, 2020       |
| <ul style="list-style-type: none"> <li>Risk assessment of using nanomaterials to human health</li> </ul>  | 15th Chemical Engineering Week  | September 2020       |
| <ul style="list-style-type: none"> <li>Characterization of manufactured nanomaterials in the Philippines</li> </ul>   | Proceedings on the Latest Characterization Techniques on Nanomaterials, Caraga State University                               | September 2020       |
| <ul style="list-style-type: none"> <li>Abaca fiber-reinforced composite for boat applications</li> </ul>  | MSME Opportunities in Craft and Manufacturing Sector, TAPI  | September 2, 2020    |
|   | 2020 National Science and Technology Week in Region VIII  | November 11, 2020    |

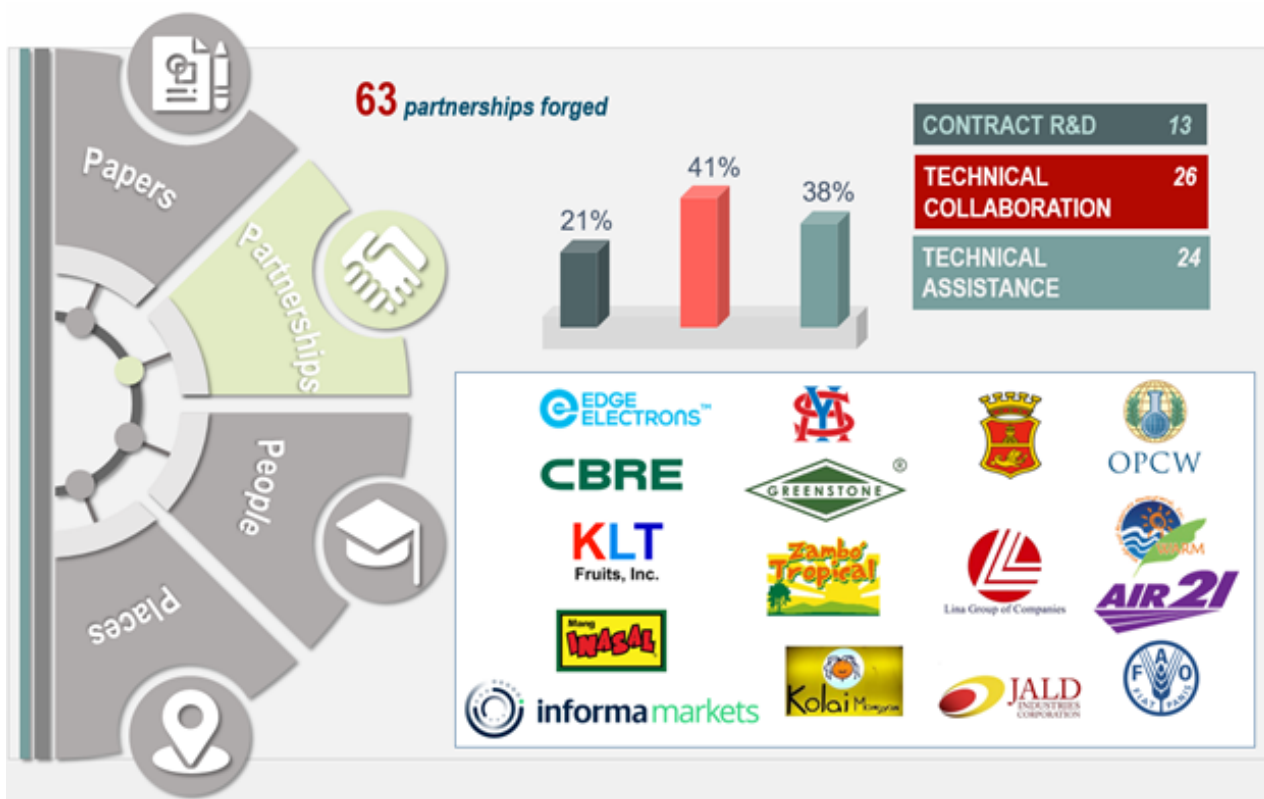
## Paper and Poster Presentations

| TITLE OF PAPER PRESENTED   | CONFERENCE/EVENT  | DATE                 |
|--|---|----------------------|
| <ul style="list-style-type: none"> <li>Formulation and safety assessment of Halal lipstick and toothpaste</li> </ul>   | 69th PhilAAST Annual Convention   | September 9-11, 2020 |
| <ul style="list-style-type: none"> <li>Modification of AOAC 986.15 for the analysis of total arsenic in rice using hydride generation – AAS</li> </ul>                     | 69th PhilAAST Annual Convention   | September 9-11, 2020 |
| <ul style="list-style-type: none"> <li>Preparation and characterization of an internal quality control material for total hardness as CaCO<sub>3</sub> in water</li> </ul> | 69th PhilAAST Annual Convention   | September 9-11, 2020 |
| <ul style="list-style-type: none"> <li>Alcohol, phytochemicals and antioxidant profiles of selected local wines</li> </ul>   | 69th PhilAAST Annual Convention   | September 9-11, 2020 |
| <ul style="list-style-type: none"> <li>Development of reference material for sulfite analysis of desiccated coconut</li> </ul>   | 69th PhilAAST Annual Convention   | September 9-11, 2020 |
| <ul style="list-style-type: none"> <li>Regression-based model for the estimation of higher heating values of solid fuels from proximate analysis</li> </ul>                | 69th PhilAAST Annual Convention   | September 9-11, 2020 |
| <ul style="list-style-type: none"> <li>Effect of storage conditions on the migration characteristics of benzophenone in paper-based food packaging</li> </ul>              | 69th PhilAAST Annual Convention   | September 9-11, 2020 |
| <ul style="list-style-type: none"> <li>AMCen: Response to COVID-19 pandemic</li> </ul>   | PCIEERD 10th Anniversary Webinar on COVID-19  | October 2020         |
| <ul style="list-style-type: none"> <li>An evaluation of acute toxicity and aquatic toxicity of titanium dioxide nanoparticles</li> </ul>                                   | Proceedings on the 4th EU-Asia Dialogue on Nanosafety   | October 2020         |
| <ul style="list-style-type: none"> <li>MATDEV COVID-19 initiatives</li> </ul>  | National R&D Conference (NRDC), Webinar   | November 2020        |
| <ul style="list-style-type: none"> <li>Nanotechnology and advanced nanomaterials: Recent research trends and publication potentials</li> </ul>                             | WEBINAR, Batangas State University  | November 13, 2020    |
| <ul style="list-style-type: none"> <li>Biodegradable polymers</li> </ul>   | Safe and Clean Environment: Technologies on Environment Management 2020 National Science and Technology Week in MIMAROPA                      | November 16, 2020    |
| <ul style="list-style-type: none"> <li>Importance of testing and calibration</li> </ul>  | DOST Regional Office No. 10 NSTW Webinar: "LAB for Everyone : A Guide to Testing and Calibration for the Filipino Researcher and Businessman" | November 25, 2020    |
| <ul style="list-style-type: none"> <li>Laboratory testing applications in academic research</li> </ul>   | DOST Regional Office No. 10 NSTW Webinar: "LAB for Everyone : A Guide to Testing and Calibration for the Filipino Researcher and Businessman" | November 25, 2020    |
| <ul style="list-style-type: none"> <li>MATDEV: The. R &amp; D Facility of AMCen</li> </ul>   | NSTW WEBINAR, AMCen: Manufacturing Beyond the Conventional  | November 2020        |



## Paper and Poster Presentations

| TITLE OF PAPER PRESENTED  | CONFERENCE/EVENT   | DATE                 |
|---|--|----------------------|
| <ul style="list-style-type: none"> <li>NANOCLAY: A multifunctional additive for polymers</li> </ul>   | DOST-ITDI Webinar on Nanoclay  | December 2020        |
| <ul style="list-style-type: none"> <li>Technology on natural fiber thermoplastic composites for various applications</li> </ul>                                 | DOST-ITDI WEBINAR on Natural Fiber Thermoplastic Composite Stakeholders Forum  | December 2020        |
| <ul style="list-style-type: none"> <li>Safe water for health</li> </ul>   | Philippine Alliance of Laboratory Equipment Users (PALUE) Zoominar on "Keeping the Laboratory Alive in the Light of COVID-19"            | December 2, 2020     |
| <ul style="list-style-type: none"> <li>Technology on natural fiber thermoplastic composites for various applications</li> </ul>                                 | Stakeholder's Forum  | December 18, 2020    |
| <ul style="list-style-type: none"> <li>A study on the release of nanoparticles to the environment from nano-enabled asphalt by weathering experiment</li> </ul> | Proceedings of the 7th International Conference on Advanced Engineering and Technology (7th ICAET) 2020 Conference, Incheon, South Korea | December 18-20, 2020 |



## PARTNERSHIPS

The Institution sustained its network and linkages by creating new and maintaining the previous partnerships consisting of **13 Contract R&D, 26 Technical Collaborations, and 24 Technical Assistance.**

# Partnerships

Stakeholders from various local and international associations and industries with scientific linkages are as follows:

## 13 Contract R&D

- JALD Industries Corp. - Salt harvesting machine project
- WARM - Design, construction and operation of two-ton per day food waste biogas digester for power generation
- CENMACO - Post-treatment of food processing wastewater effluent for nutrient removal
- KLT - Development of plant-based meat products
- Greenstone Pharma - Halal shampoo
- Polo Services Incorporated - Enhancement of electrocoagulation technology for treatment of slaughterhouse wastewater
- OneLGC (Lina Group of Companies) – Alberto D. Lina, Chairman
- Philippine Army - Deployment of low cost type rainwater collection and treatment system using locally-available materials (2017-2020)
- Philippine Army - Development of portable drinking water treatment system for field troops of the Philippine Army
- San Miguel Yamamura Asia Corp. - Application of nanotechnology in glass container production
- Philippine Nuclear Research Institute (PNRI) - Development of porous tubular scaffold with intraluminal hydrogel filler as potential intervention for peripheral nerve damage
- Dietary fiber SCB (raw brown sugar (CRADLE)
- Green Life, Peter Paul, Phil Rice, VCO Phils. - Plant protein (CRADLE)

## 26 Technical collaborations

- FAO (Multi-stakeholder dialogue on coconut production, processing, packaging, marketing and innovation: opportunities and gaps) – Foreign Partnership
- Malacañang Anti-Terrorism Council (ATC) – Establishment of National Biosafety Framework
- Malacañang Anti-Terrorism Council (ATC) and Organization on the Prohibition of Chemical - Establishment of an OPCW-designated lab in the Philippines
- FAO – Letter of agreement - Consultative meeting and preparation of a strategy report on food packaging in the Philippines
- InformaMarkets – 2nd Propak Philippines 2020 – International Processing and Packaging Exhibition
- Chulalongkorn University, Thailand - Technical Collaboration of the Halal Science Center (in process)
- Department of Food Technology, Thailand - Technical Collaboration (in process)
- Philippine Nuclear Research Institute (PNRI) - Gamma Irradiation of SLA Printed Venturi Valves
- University of the Philippines Manila / PCHRD - Telepresence Robots
- KOICA – Training/Capability building on off-grid renewable energy for remote areas across the Philippines
- ASEAN Consultative Committee for Standards and Quality - 30th ASEAN Consultative Committee for Standards & Quality - Rubber-Based Product, 21st Task Force - Rubber-Based Product and 2nd ASEAN Rubber Testing Laboratory Committee
- PHILRubber - 24th Philippine Rubber Technical Working Group Meeting
- FDA-CDRRHR (Center for Device Regulation, Radiation Health and Research) Technical Committee 45-Medical Gloves - Standardization of rubber gloves which are applicable to Philippine setting
- FAST Lab Cagayan de Oro – new member of the DOST OneLab Network
- Department of Agriculture-Region IV-A Regional Animal Feeds Laboratory (DA-IVA RAFL) - new member of the DOST OneLab Network
- Tagum Agricultural Development Company, Inc. (TADECO) - new member of the DOST OneLab Network
- UPLB, UST, DLSU, ADMU and MSU-IIT - Academe collaborations (5 collaborations)
- DTI-BPS, DOH-FDA, DOLE and Occupational Safety and Health Center (OSHC) - Regulatory agency collaborations (4 collaborations)
- Iloilo Science and Technology University - Comparative Study on the Shelf Life of Rice (black variety) Using Green Packaging Technology developed by ISAT U and Active Packaging Technology developed by ITDI-PTD

## 24 Technical assistance

- Zambo Tropical Foods - Formulation and process of dietary fiber using calamansi wastes
- Edge Electrons – Energy audit supplies
- CBRE GWS IFM Phils. Corp. - Energy audit of Mondelez Phils. and EA training for Texas Instruments, Clark Freeport Zone
- Trastalk - Pilot-scale biogas production using kitchen waste
- Greenwood Resources, Inc. - Setting up an ITDI portable biogas digester system in Josef Cruz Farm at Mabato, Rosario, Batangas
- Kolai Mangyan Boracay Island – Development of compact wastewater treatment system for restaurants in Boracay
- Mang Inasal Caticlan, Aklan – Development of Compact wastewater treatment system for restaurants in Boracay
- Optiwhite - Production of nanoclay from local bentonite ore as additive in polymer-clay nanocomposite
- K&E Industrial Lime - Field testing of modified DOST-developed spray dryer cum trial production of food/industrial NPCC from local limestone
- Air 21 Global – Judy H. Ascalon, President
- Fish2Go Dasmariñas, Cavite
- University of Santo Tomas Hospital - Technical assistance on the characterization of heat and moisture exchange filter and recommendation to use alternative filter
- Heritage Veterinary - Renewal of Licensing Agreement for OL Trap (Extended for 3 yrs)
- DOE-EUMB – GEMP Compliance Assessment of LGUs
- Del Monte Philippines, Inc. – Consultancy for measurement uncertainty in chemical and microbiological testing
- Philippine Accreditation Bureau, Department of Trade Industry (PAB-DTI) – Management and technical assessor and technical experts - 17 remote assessments conducted to PNS ISO/IEC 17025:2017 accredited testing laboratories
- DOST-FNRI Nutritional Genomics Laboratory – Technical auditors for microbiological testing for PNS ISO/IEC 17025:2017 internal audit
- DOST-FNRI Service Laboratory – Technical auditors for microbiological testing for PNS ISO/IEC 17025:2017 internal audit
- DOST-FNRI Proficiency Testing Laboratory – Technical auditor for proficiency testing for PNS ISO/IEC 17043:2010 internal audit
- DOST-IV-A (CALABARZON) Regional Standards and Testing Laboratories – Technical auditor for chemical testing for PNS ISO/IEC 17025:2017 internal audit
- DOST-IX (Zamboanga) Regional Standards and Testing Laboratories – Technical (chemical testing) and management auditor for PNS ISO/IEC 17025:2017 internal audit
- DOST-V (Bicol) Regional Standards and Testing Laboratories – Technical (chemical testing) auditor for PNS ISO/IEC 17025:2017 internal audit
- DOST-X (Cagayan de Oro) Regional Standards and Testing Laboratories – Technical (chemical testing) and Management Auditor for PNS ISO/IEC 17025:2017 internal audit
- DOST-II (Tuguegarao) Regional Standards and Testing Laboratories – Consultancy on transition of laboratory quality management system to PNS ISO/IEC 17025:2017





# INTELLECTUAL PROPERTIES

DOST-ITDI **secured 25 intellectual properties** for its developed technologies and **filed 25 applications** for IP this year. The DOST-ITDI technologies with IP now include food products such as okra sheets, nipa sap, and beef-filled rice cake; instruction manuals for salt equipment; materials processing and their novel applications; product packaging labels; and, service offering trademarks.

## Awards & Recognitions

DOST-ITDI's Deputy Director for Administrative and Technical Services, Dr. Diana L. Ignacio, was appointed as the new **Assistant Secretary for Human Resources Management, Management Services, and Special Concerns** of the Department of Science and Technology. Dr. Ignacio was one of the recently appointed officials who took their oath last January 8, 2020 at the Malacañang Palace then sworn in to office by DOST Secretary Prof. Fortunato T. Dela Peña on January 15, 2020.



DOST-ITDI's Continuous Screw-Type Salt Iodizing Machine was awarded **2nd Place for the Likha Award category at the 2020 National Invention Contest & Exhibits** after winning the same category during the National Capital Region's Regional Invention Contest and Exhibits (RICE). Both RICE and NICE are nationwide activities organized by DOST-TAPI recognizing Filipino inventions, innovations, and researches made by students, government researchers, and private institutions.

DOST-ITDI Director Dr. Annabelle V. Briones was awarded the **2020 Gregorio Y. Zara for Applied Research** by the Philippine Association for the Advancement of Science and Technology (PhilaAST) during its 69th annual convention in September. Among her notable contributions include: DOST mosquito ovicidal/larvicidal trap, utilization of carrageenan in drug and gene delivery systems, and iSalt processing equipment.

### 2020 GREGORIO Y. ZARA AWARD FOR APPLIED SCIENCE RESEARCH

**Dr. ANABELLE V. BRIONES**  
DIRECTOR  
DOST-INDUSTRIAL TECHNOLOGY DEVELOPMENT INSTITUTE

Her notable works include the development of DOST Mosquito Ovicidal/Larvicidal Trap System to reduce Dengue cases in the Philippines;

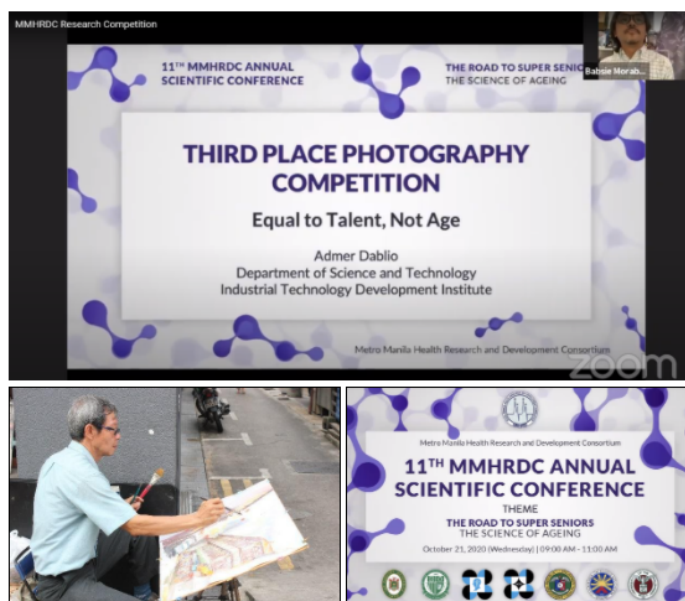
The use of carrageenan in drug and gene delivery systems as anti-bacterial coating for biomaterial surface;

And the design and prototyping of salt-processing equipment that includes evaporating set-up, washer, dryer, and iodizer to help the MSMEs comply with the ASIN Law and ensure adequate supply of iodized salt.

PHILA AST  
PHILIPPINE ASSOCIATION  
FOR THE ADVANCEMENT OF SCIENCE  
AND TECHNOLOGY (PHILA AST) CONVENTION AWARDEES 2020

Department of  
Science and Technology  
f /DOSTph

Also awarded during the 69th PhilAAST convention was DOST-ITDI's Standards and Testing Division for bagging the **Top 1 Best Poster** in the Virtual Poster Contest, featuring their study entitled "Alcohol, Phytochemical, and Antioxidant Profiles of Selected Local Wines" done by the Organic Chemistry Section, Chemistry Laboratory.



Mr. Admer Rey C. Dablio, RCh of the Standards and Testing Division of DOST-ITDI won **3rd Place in the Photography Competition** of the 11th Metro Manila Health Research and Development Consortium (MMHRDC), conducted virtually on 21 October 2020, with the theme "The Road to Super Seniors." Mr. Dablio described his entry in relation to the conference theme as "Single-nucleotide polymorphism or SNPs are genetic material linked to various traits giving people their talents. And these talents are preserved even when people get old. The beauty of the painting in the photo is equal to the talent of the person through its genome-wide association study, and not to its age. Even as we grow old, a Super Senior will still express the same or even better artistic talent."

DOST-PCIEERD awarded the **Kabalikat Researcher Award** to Dr. Blessie A. Basilia, the Division Chief of Materials Science Division of DOST-ITDI, for her significant contributions as a best performing PCIEERD-GIA project leader for the past 5 years. Her research area includes nanofibers membranes, polymer nanocomposites, natural fiber composites for various industrial applications, nanomaterials for semiconductor and microelectronics industries, quantum dots for solar cell, biomineralized graphene sheets for medical and semiconductor applications, nonmetallic minerals processing, beneficiation, characterization, and materials development for additive manufacturing. The DOST-PCIEERD Kabalikat Awards is a recognition given to partners in enabling innovations in the Industry, Energy, and Emerging Technology fields.





The following DOST-ITDI entries were also recipients of the 2020 DOST Intellectual Property Awards.

The DOST Intellectual Property Awards (IPA) aims to give incentives to DOST researchers and technology developers to encourage them to publish on international referred journals; register their developed technologies; and boost the publication, patent and utility models outputs of DOST and its agencies. This also supports the goal of DOST to institute measures to improve the performance of Research and Development (R&D) institutions and to monitor and evaluate their R&D results.



#### **International Publication category:**

1. **"Functionalized Carbon-based Quantum Dots: Optical Characterization and Potential Application as Bio-fluorophore"**. Roland Andrew T. Cruz, Allan N. Soriano, Persia Ada N. de Yro, Gerald Mari O. Quiachon, Carlo S. Emolaga, Mertella Lenie M. Ysulat, Ursela G. Bigol, and Blessie A. Basilia. IOP Conference Series: Materials Science and Engineering 559 (1): 1-6, 2019.

2. **"Influence of Antemortem and Slaughtering Practices on the pH of Pork and Chicken Meats"**. Monica R. Manalo, and Alonzo A. Gabriel. Philippine Journal of Science 149 (1): 1-19, 2020.

3. **"Fabrication of Polythiourea-Copper Complex Composite Membrane and its Anti-fouling Property"**. Marianito T. Margarito, Arnel B. Beltran, Michael Angelo B. Promentilla, Aileen H. Orbecido, Blessie A. Basilia, Regina G. Damalerio, and Ursela G. Bigol. IOP Conference Series: Materials Science and Engineering 778 (012178), 2019.

4. **"A Study on the Effect of Argon-Oxygen Plasma Treatment on UltraThin Expanded PTFE Membrane"**. Naomi R. Nishiguchi, and Persia Ada N. De Yro. Materials Science Forum 972: 165-171, 2019.

5. **"Assessing the Performance of Thin-Film Nanofiltration Membranes with Embedded Montmorillonites"**. Micah Belle Marie Yap Ang, Amira Beatriz Gaces Deang, Ruth R. Aquino, Blessie A. Basilia, Shu-Hsien Huang, KueirRarn Lee, and Juin Yih Lai. Membranes 10 (79): 1-21, 2020.

6. **"Nanostructured Membrane of Sodium Montmorillonite Reinforced Cellulose Acetate for Adsorption of Ca (II) and Mg (II) Ions in Hard Water"**. Ruth R. Aquino, Marvin S. Tolentino, Diana Jean C. Ramolete, Arra M. Calingasan, Minerhiza N. Dela Cruz, and Blessie A. Basilia. Key Engineering Materials 801: 319-324, 2019.

7. **"Biodecolourization of Textile Dye and Wastewaters by Crude Laccase from *Pleurotus florida* ITDI 6003 Cultivated in Wheat grains"**. Emilio N. Montague, John Paul Matthew D. Guzman, Noel M. Unciano, Elizabeth G. Panerio, Ursela G. Bigol, Ian John L. Castro, John Paulo G. Jose, and Shiela D.A. Mantaring. Current Research in Environmental & Applied Mycology 10 (17): 167-175, 2020.

8. **"A Sulfur Copolymers (SDIB)/Polybenzoxazines (PBz) Polymer Blend for Electrospinning of Nanofibers"**. Ronaldo P. Parreño, Jr., Ying-Ling Liu, and Arnel B. Beltran. Nanomaterials 9 (11): 1526 (1-14), 2019.

9. **"Effect of a direct sulfonation reaction on the functional properties of thermally-crosslinked electrospun polybenzoxazine (PBz) nanofibers"**. Ronaldo P. Parreño, Jr., Ying-Ling Liu, Arnel B. Beltran, and Maricar B. Carandang. RSC Advances 10 (24): 14198-14207, 2020.

10. **"Sulfur copolymers (SDIB) from inverse vulcanization of elemental sulfur (S8) for polymer blend"**. Ronaldo P. Parreño, Jr., Ying-Ling Liu, and Arnel B. Beltran. IOP Conference Series: Materials Science and Engineering 778 (012023): 1-9, 2020.

11. **"Provision of proficiency testing for histamine mass fraction in canned tuna to improve the capability of chemical laboratories in the Philippines"**. Benilda S. Ebarvia, Aaron C. Dacuya, Sharlene R. Cabanilla, and Natividad R. Mamplata. Accreditation and Quality Assurance 24: 79- 84, 2019.

12. **"Matrix reference materials development for food safety application in Philippine products"**. Benilda S. Ebarvia, Sharlene R. Cabanilla, Aaron C. Dacuya, Alma B. Cruz, Alleni B. Tongson, Cyril C. Cortez, Kim Christopher Aganda, and Natividad R. Mamplata. 3rd IMEKOFOODS Conference Proceedings, 2017.

#### **Utility Model Registration category:**

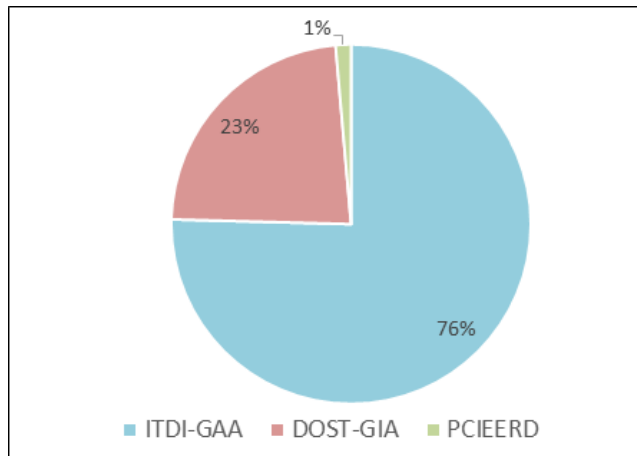
1. **"Process of Packaging Durian Flesh to Keep its Strong Flavor and Aroma"** Floridel V. Loberiano, Daisy E. Tañafranca, Dane Archibald G. Balanon, Ray Anne Grace M. Garalde, Allan B. Quirante, Hiroshi Ohsuga, and Takasuke Ishitani. Utility Model Registration Number: 2-2017-050090.

2. **"Process of Preserving Durian (*Durio zibethinus* L.) Flesh"** Floridel V. Loberiano, Daisy E. Tañafranca, Dane Archibald G. Balanon, Ray Anne Grace M. Garalde, Allan B. Quirante, Hiroshi Ohsuga, and Takasuke Ishitani. Utility Model Registration Number: 2-2017-050091.



# Financial Management Report

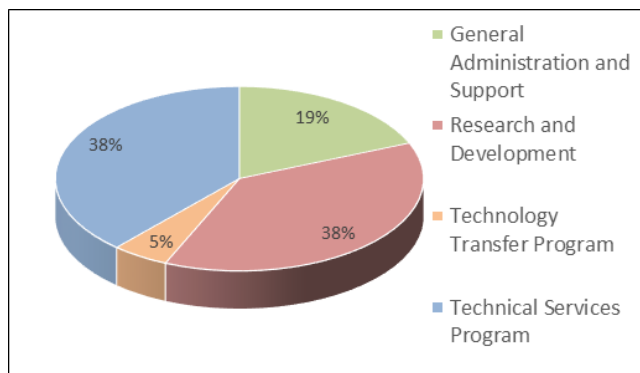
Amidst the crisis this year, managing the limited financial resources was just one of the many hurdles and challenges faced by the Institute. The institution only received PHP 524.2M funding from the Department of Budget and Management (DBM) General Appropriations Act (GAA) but was able to generate additional resources from project proposal-based funding of the DOST Grants-In-Aid (DOST-GIA) program in the amount of PHP 161.2M and from the Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD), PHP 9.6M. Altogether, a total of PHP 695M was generated to sustain operations of DOST-ITDI in 2020.



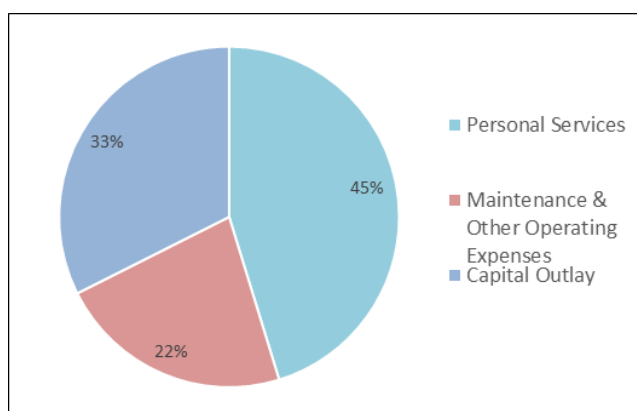
**Funding Sources in 2020**

This year, the Industrial Technology Technical Services Program (TSP) had the lion's share with a total amount of PHP 201.3M while the Research and Development Program (RDP) at second, received an allocation of PHP 198.5M. The General Administration and Support Services (GASS) was third with PHP 98.1M. The Technology Transfer Program (TTP) continued to receive the lowest budget allocation with PHP 26.4 Million or 5% of the total GAA budget of the Institute.

For the GAA budget allotment, the Personal Services (PS) expense item received majority of the funds at 45%, which amounted to PHP 237.2M; Capital Outlay (CO) at 33% or PHP 169.9M; and Maintenance & Other Operating Expenses (MOOE) at 22% or PHP 117.1M.



**DOST-ITDI Specific Budget by Program**



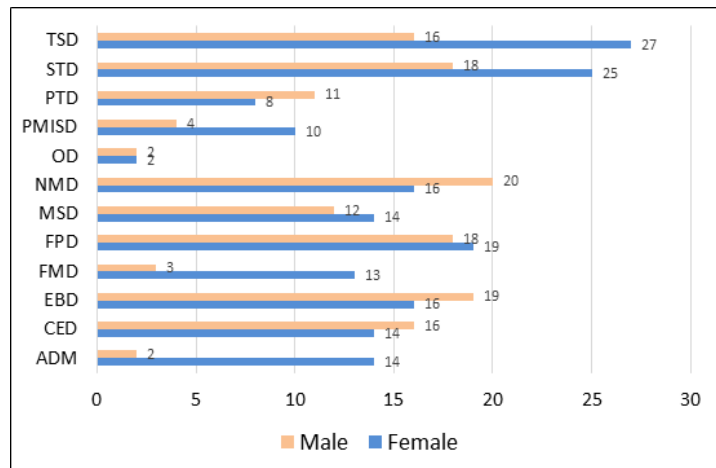
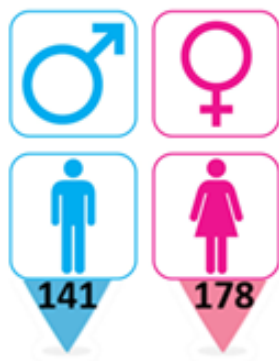
**Budget Allotment by Class (%)**

However, due to the COVID-19 pandemic, the financial resources of the Institute were redirected to fund the response needed to this national health emergency. In compliance with the National Budget Circular No. 580 (Adoption of Economy Measures in the Government Due to the Emergency Health Situation), the DOST-ITDI discontinued a total amount of PHP 32.3M to support the implementation of the necessary interventions of the National Government.

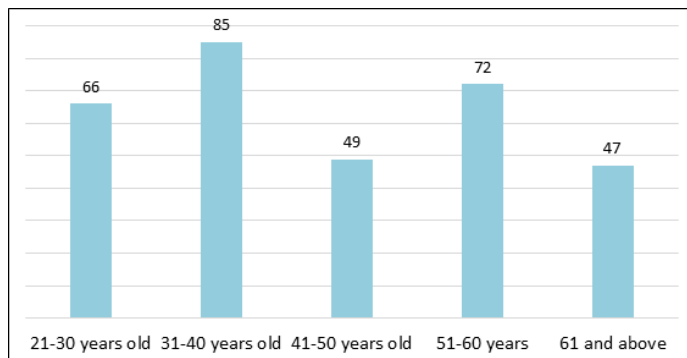
# Human Resource Report

As of December 2020, the Institute has a total of 319 employees. In terms of number, female employees dominate the male employees by the number accounting for 56% or 178 employees with the largest share at 15% from the Technological Services Division. The National Metrology Division is male-dominated and accounts for 14% of the total number of male employees of the Institute.

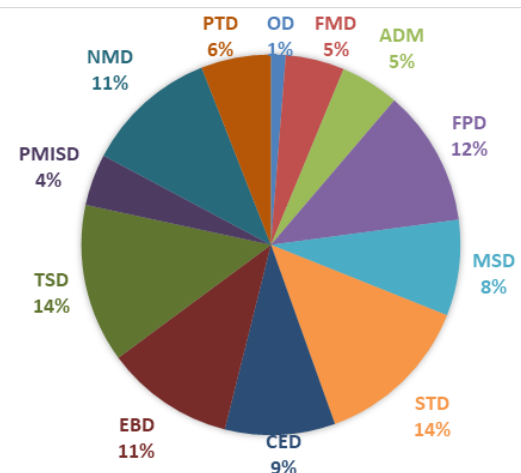
A large portion of the current DOST-ITDI human resources falls within the 31-40 age bracket with 85 employees. This is followed by the 51-60 and 21-30 age brackets with 72 and 66 employees, respectively.



Human Resources Profile, by Gender (as of December 2020)

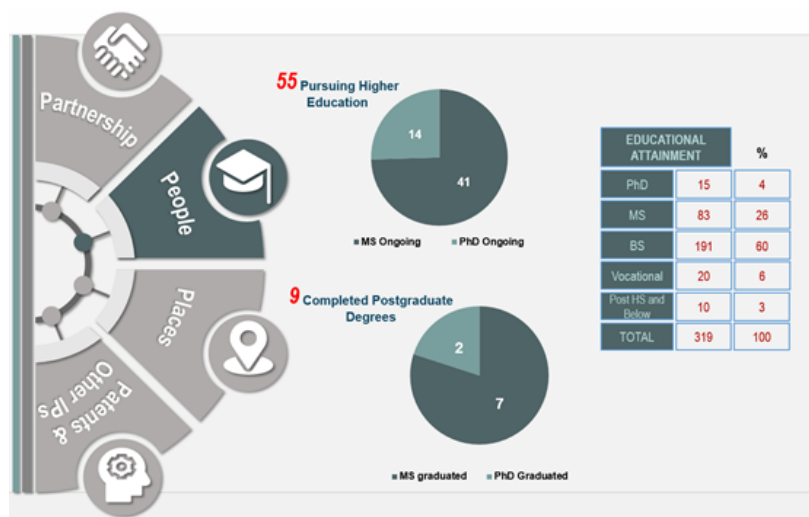


Human Resources Distribution, by Age Bracket (as of December 2020)



Human Resources Distribution, by Percentage and by Division (as of December 2020)

A total of 55 DOST-ITDI staff are pursuing their higher education with 14 on their Doctorate degrees and 41 on their Master's degrees on various fields of specialization including analytical chemistry, biology, biotechnology, business analytics, chemistry, chemical engineering, engineering management, electrical engineering, industrial engineering, information technology, materials science, environmental science, management technology, packaging technology and engineering, and law.



This year, nine (9) DOST-ITDI staff had completed their graduate studies in various fields of specialization.

**Human Resources Profile by Educational Attainment**

| Master Degree Holder         | Field of specialization                                      |
|------------------------------|--|
| ARNAO, Arjay S.              | Master of Science in Food Science and Technology Engineering |
| BIHIS, Cynthia M.            | Master of Science in Technology Management                   |
| BUENO, Frederick C.          | Master of Science in Industrial Engineering                  |
| CRUZ, Roland Andrew T.       | Master of Science in Chemical Engineering                    |
| DIOPOL, Garry A.             | Master of Science in Biochemistry                            |
| ENCARNACION, Elyson Keith P. | Master of Science in Environmental Science                   |
| PAREJA, Jovielyn R.          | Master in Business Administration                            |

| Doctorate Degree Holder | Field of specialization  |
|-------------------------|--|
| BARACOL, Lorelle A.     | Doctor of Philosophy in Environmental Science minor in Agribusiness Entrepreneurship Program |
| PARREÑO Jr., Ronaldo P. | Doctor of Philosophy in Chemical Engineering   |







Front row (L-R): Dr. A.V. Briones, Dr. J.F. Quizon

Middle row (L-R): Engr. R.L. Esguerra, Dr. N.G. Ambagan, Engr. M.M. Ruiz,  
Engr. A.V.O. Bawagan, Dr. Z.V. Ang, Ms. N.E.C. Florendo

Back row (L-R): Dr. R.C. Torres, Dr. B.A. Basilia, Ms. D.E. Tañafranca, Ms. M.M. Regonda

## 2020 DOST-ITDI Executive Committee

**DR. ANNABELLE V. BRIONES**  
Director

**MS. DAISY E. TAÑAFRANCA**  
OIC-Deputy Director for R&D  
& Chief, Packaging Technology Division

**DR. NORBERTO G. AMBAGAN**  
Chief, Food Processing Division

**DR. BLESSIE A. BASILIA**  
Chief, Materials Science Division

**DR. ROSALINDA C. TORRES**  
Chief, Standards & Testing Division

**ENGR. MANUEL M. RUIZ**  
OIC, National Metrology Division

**MS. MERLITA M. REGONDA**  
OIC, Administrative Division

**DR. ZORAYDA V. ANG**  
OIC-Deputy Director for ATS  
& Chief, Planning & Monitoring  
Information Systems Division

**ENGR. APOLLO VICTOR O. BAWAGAN**  
OIC, Chemicals & Energy Division

**ENGR. REYNALDO L. ESGUERRA**  
Chief, Environment & Biotechnology Division

**MS. NELIA ELISA C. FLORENDO**  
Chief, Technological Services Division

**DR. JANET F. QUIZON**  
Chief, Finance Management Division

*“Inspired by Technology,  
Driven by Innovation.”*

BSL3 , BSL4 , Animal Lab.  
(1973.2 SQ.M.)

26-unit(24sqm)  
Dormitory  
(542.0 SQ.M.)



Contact us:



**DR. ANNABELLE V. BRIONES**  
Director, DOST-ITDI

**Department of Science and Technology**  
**INDUSTRIAL TECHNOLOGY DEVELOPMENT INSTITUTE**  
DOST Compound, Gen. Santos Ave.,  
Bicutan, Taguig, Metro Manila 1631 Philippines



(02) 8837-2071 to 82  
[www.itdi.dost.gov.ph](http://www.itdi.dost.gov.ph)



DOST ITDI Updates  
ITDI DOST

