

2013 ITDI ANNUAL REPORT



Our Business Is Industry...

Industrial Technology Development Institute

Department of Science and Technology

Vision
Excellence in
propelling development
as provider of
technologies and
services
for industry

Mission
To make
local industries
globally
competitive

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Hon. Mario G. Montejo
Secretary, DOST

Message from the Secretary

The Department of Science and Technology (DOST) strives to inoculate in all its agencies and institutes, the drive to keep our “Bosses”, the Filipino people, at the heart of everything we do. As such, much work is being done to help ensure the delivery of our products and services are always at par with world-class standards, and in tune with the needs of our stakeholders.

The Industrial Technology Development Institute (DOST-ITDI), as one of our S&T service institutes, has exerted efforts to realize our banner-call, by acting as a solution provider through innovations and breakthroughs that cover a wide range of areas, including, but not limited to, social development and economic growth.

The advent of the DOST eight (8) Outcomes, and the accelerating performance of the Philippine economy presents a good opportunity for the ITDI to establish its niche in our over-all framework of commitments to President Aquino and the Filipino people. I encourage you to continue initiating relevant R&D, strategic partnerships, and leveraging your relationships, within the country and beyond, towards the goal --- to work smartly, build on your strengths, and strive to deliver solutions that are even more reliable, cost-effective, flexible, and at its truest sense, world-class.

We are entering a new era, considering the great changes that the integration of the ASEAN Economic Community (AEC) will bring about in 2015. There is little doubt that Asia will steadily become the unprecedented growth engine of the world, and I count on the ITDI to help us ensure that Filipinos will not only take a greater slice of this pie, but perhaps, more importantly, contribute to making this pie even bigger, for the whole of AEC to share.

Mabuhay!


MARIO G. MONTEJO
Secretary



Dr. Nuna E. Almanzor
ASEAN Engineer & Director,
ITDI-DOST

Message from the Director

In a few more months, I will be taking my leave as Director of this Institution. As I bid you all farewell with fondness, I can't help also to look ahead to what the coming years hold for the ITDI, and remind us all of the challenges (which were also opportunities) and accomplishments we have shared.

Being at the helm of ITDI for 9 years has not been easy. Throughout my stint, we stood together through thick and thin, never giving up, for we were guided by a simple principle which is the heart of ITDI – live up to its vision-mission through consistently providing competitive and accessible innovations and services that lead to social development and economic growth. Looking back, it gives me immeasurable pride knowing that each day I spent at ITDI was meaningful for we had never wavered in our mission.

Over the years, we witnessed several milestones in our area of discipline that has entrenched the ITDI as an indispensable agent and partner of DOST, in its quest to make life better for the Filipinos. Through continuous innovation and implementation of R&D programs aligned to DOST priority areas, smarter technologies or innovations were developed that provided solutions to pressing national problems, created growth in the countryside, and improved the competitiveness of local industries. We also tapped the potential of emerging technologies like nanotechnology to boost national competitiveness and keep abreast with latest developments in the field. And our active pursuit of knowledge translation or commercialization of research results saw the growth and improvement of existing business firms and creation of new ones.

Recently, the DOST 8 OUTCOMES were launched and we continue to demonstrate our commitment to our various stakeholders in such fields as: Agriculture; MSMEs – to improve productivity and competitiveness; Industry – for its technical services requirements and value-adding; and in Health – to broaden access to health care.

For 2013, I take pride to report some of our most recent harvests.

The DOST-HITS (High Impact Technology Solutions) Project – Design and Development of Process Equipment for Food Processing Firms where seven equipment were designed and developed is now on roll out in cooperation with the regional offices. This is an opportunity to make our own technology work for the needs of our food processing industry and help make them competitive. We even moved up the ladder with the establishment of ADMATEL, or the Advanced Device and Materials Testing Laboratory to address the failure analysis and testing gaps plaguing the country's electronics and semiconductor industry. It was inaugurated by President Aquino on May 31, 2013 and is now servicing the major players in this sector.

Our National Metrology Laboratory or NML, also the Philippines' National Metrology Institute or NMI, capped 2013 with the acceptance of the country's Calibration and Measurement Capabilities (CMC) in the field of mass. CMCs are awarded by the Joint Committee of the Regional Metrology Organizations (JCRB) and the International Bureau of Weights and Measures (BIPM). The approved CMC is now

included in the BIPM global database and website (<http://kcdb.bipm.org/AppendixC>). With this recognition of the Philippines' competence in metrology, the country proudly joins the ranks of the world's premier NMIs (National Metrology Institutes), such as those of Germany, USA, Japan, UK, Korea, China, and Singapore, among others.

While establishing the national measurement standards for physical measurements, we are now expanding our metrological activities to chemical analysis. Our Standards and Testing Division (STD) started MiC activities under the program "Development of National Standards for Chemical Measurements" focusing on food additives and contaminants and metals in water. Our goal is to obtain Calibration and Measurement Capability (CMC), which is being issued by the Consultative Committee on Quantity of Matter (CCQM) – International Bureau of Weights and Measurements (BIPM). STD-ITDI is now a Designated Institute for Metrology in Chemistry and is listed in the BIPM website. Having established CMCs means the country has marked recognition to analyze specific analytes per matrix. This global recognition assures the client that STD's MiC results can demonstrate traceability and comparability to international standards which can be disseminated to local laboratories.

We also continued harnessing the potential of nanotechnology and its various industrial applications. We had developed this year a low-cost silver-filled epoxy/halloysite nanocomposite die-attach material that has improved reliability due to its enhanced thermal and mechanical properties. A die-attach material connects the chips and the substrate in a typical electronic or semiconductor device. Another is the novel electrospun nanostructured membrane from kapok cellulose acetate-chitosan blend that was found effective in removing toxic heavy metal contaminants from wastewater. We had started working also for the establishment of the Nanotechnology R&D Laboratory.

Likewise, our candle-type ceramic filters are now being rolled out in the regions. With this, we hope to address problems on the increasing number of households having no access to potable water, especially those in the far-flung areas of the country. Over time, this project could significantly contribute in attaining the Philippine Millennium Development Goal (MDG) of increasing the country's accessibility rate to potable water of 82.9% in 2007 to 86.6% in 2016.

We have several more to list in other areas such as our search for dietary antioxidants from local sources, food safety studies on our local foods, packaging interventions for our fresh produce and non-food products; and our various technical services (e.g., ETV, energy audit, troubleshooting/assistance), which all aim to make our industries competitive.

During the year, our knowledge translation initiatives enabled us to serve a total of 86 technology adopters nationwide. Two of our technologies were granted IP as utility model (portable biogas digester, coffee roasting machine) by the IPO while three more were filed as trademarks (Dreamweave logo, Rapyra logo, & Kape Primera).

The Institute generated a total income of P 23.290 million with earnings of P 18.184 or 78% from technical services with calibration and measurement posting the highest revenues at 42% or P 9.715 million, followed by test and analyses services (including formula of conversion) at 36% or P 8.470; and 22% or P 5.102 million for other specialized services. Meanwhile, ADMATEL posted an income of P 3,616,600.

It has been a fruitful year indeed and now that I am about to leave, I urge each of you to pause and appreciate just how much we have accomplished together. Take pride therefore in what the milestones say about you—you were relentless in reaching for new heights to better serve our stakeholders; providing competitive technologies and services to our various publics – industry/MSMEs, academe, and the communities around us and the countryside; helping make DOST relevant in almost all sectors of society.

I count working with you as one of the most satisfying and rewarding experience of my professional life. I thank you for your passion and commitment in creating and generating technologies and innovations that never fail to improve the lives of those we serve.

With so much gratitude and respect, I pass on the leadership of ITDI to my successor believing that ITDI will not only continue to grow, it will even soar as never before.

Congratulations everyone!



DR. NUNA E. ALMANZOR
Director

Outcome 2 & 3:

MSMEs / INDUSTRY COMPETITIVENESS

The DOST, in its commitment to upgrade local industries and keep abreast of global developments especially with the ushering in of AEC (ASEAN Economic Community) in 2015 has started pursuing /advocating employing science, technology and innovation to achieve eight outcomes or enhance the following key areas: agriculture; micro, small and medium enterprises; industry; IT-business process management; government service; healthcare; human resources; and weather and geologic hazards. For its part, ITDI plays a key/vital role to spur improvements in about four of these eight outcomes.

Manufacturing / Food

- Enhancing the competitive identity of unique Philippine products through the development of packaging design and appropriate packaging technology

There are many products that are unique to a specific town, province, region in the Philippines like food and beverage (e.g., coffee or wine, hand-woven textiles, souvenir items and accessories from indigenous materials). However, due to poor presentation, lack of product identity and visual impact, most of these unique products remain in their own limited market and unknown to many potential consumers. Through the development of packaging design, technology, and country branding, the competitiveness and market potential of these unique Philippine products can be enhanced.

In 2013, competitive packaging design and country brand for upland rice, sweet potato, queen pineapple and Philippine citrus were developed. The products in new packaging design and brand were introduced in national (e.g. Agrilink) and international trade fairs (e.g. Foodex Japan and ANUGA in Germany).

This development also enhances the identity of local products that can potentially expand their market and increase the income of farmers/growers. ▀

- Development of transport packaging technology for cutflowers (rose and chrysanthemum)

The developed transport packaging technology for rose and chrysanthemum using appropriate passive MAP (modified atmosphere packaging) application technology reduced the handling and distribution damage from 18 to 96 %, and from 12 to ~100%, respectively. MAP also prolonged the storage/shelf life of the



cutflowers up to 600 percent. Existing packaging design was also improved to enhance the quality, achieve brand recognition, and increase marketing opportunities for locally produced cutflowers. Such interventions could potentially result to increased income for both farmers and traders.

A brand name with logo was also developed so that cutflower farmers in the countryside can now compete in the market and potentially penetrate the export market that has strict packaging standards. Japan is said to be eyeing to import chrysanthemum from the Philippines.



compete in the market and potentially penetrate the export market that has strict packaging standards. Japan is said to be eyeing to import chrysanthemum from the Philippines.

The packaging technology was specifically developed for rose and chrysanthemum produced in Benguet. It can however be adopted by growers in Cebu and other areas with minimum modification e.g. depending on handling practices, mode/s of transport and market destination. ▀



▀ Data acquisition for distribution environment in different regions of the Philippines

An essential step to designing a cushioned package system is to determine the severity of the environmental hazards the product will undergo during distribution; or to evaluate the method of distribution to determine the hazards which are present and the levels at which they are present.

These environmental hazards may include accidental drops during handling, vehicle vibration, shock inputs, temperature extremes, humidity levels, and compression loads. The result of the study will provide data in terms of degree of shock and vibration on the quality of roads in selected regions in Luzon, Visayas and Mindanao. The study focused on measuring and analyzing the levels of shock vibration during land transportation from the different regions in the Philippines. The vibration levels absorbed by the packaged products being transported on different road surfaces e.g. asphalt, cemented, unpaved, rough and different terrains e.g. mountainous, winding etc. were specifically measured.



Data recorder used for measuring vibration shock during transport

The data/results gathered from the study will be useful to packaging engineers in terms of knowing the expected physical hazards that packages will undergo during distribution, allowing them to develop the right amount of protection or 'just right packaging'



Sample Activity Photos (actual measurement of vibration shock during transport)

needed by the product. The generated data are critically important in developing or designing structural and cushion for transport packaging of goods from the different regions to final point of destinations e.g. export; and for a product/package system to achieve protective performance.

Results from the study are also vital for: determining the distribution environment hazards for each identified transportation routes in the regions, developing test procedures/protocols for specific distribution system, optimizing product design reducing packaging cost, and achieving higher percentage of no product damage. 🚩

🚩 Effect of slots on compression strength of corrugated board panels

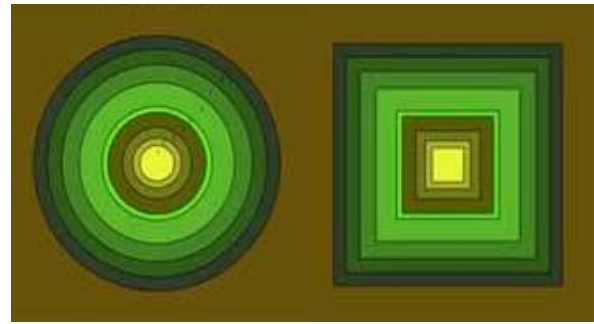
Philippine fresh produce and perishables are being exported by sea through cold chain environment that requires



Zund M-1200 digital plotter

corrugated boxes with venting slots to permit air circulation during transport and distribution. In most cases, carrying slots are also provided to facilitate manual handling and convenience both to stackers and consumers. The provision of ventilation and carrying slots might affect the compression strength of corrugated boxes and cause damage to its contents. Thus, the effect of different slots design on the compression strength of corrugated board panels was studied using available corrugated board sheets in the local market and the existing plotter at the Packaging Technology Division (PTD).

The generated data will be useful in developing appropriate design for slot and carrying slots in terms of size, shape and location on the corrugated board panels. Stacking height could be designed according to the compression strength of the corrugated box with slots for ventilation and/or carrying slots as handle. It will also be useful to exporters of fresh produce in terms of evaluating different box slot design and sizes minimizing product damages due to compression. ▀



Circular slot side panel

Rectangular slot side panel

▀ Development of packaging technology for pork lechon

The packaging system for pork lechon was improved and has addressed problems on product shelf life, deformation, oil leakage, and safe handling and distribution. The study was limited to medium–size–whole lechon (9-12 kgs) and kilo-pack lechon (1-2 kgs), using the formulation and method of preparation of pork lechon in Leyte.

The improved structural design of the packaging system has prolonged the shelf life of lechon, from the original 15 hours (with oil leak and blotting) to 21 hours minus the oil leak and blotting. This was done by using a high-barrier material with good ventilation – a corrugated box lined with aluminum foil and placed inside an Oriented Polypropylene (OPP)/Clarified Polypropylene (CPP) in BC flute corrugated box.



The improved transport packaging system also protects the product from handling and transporting damages. Common problems of breakage or cracking of pork lechon skin was eliminated and it remains 'cracklin-crispy' or '*malutong*' even after transport or



travel. Likewise, packing time was shortened and packaging cost reduced. Product branding was also developed along with the packaging design. While the lechon used in the study was from Leyte results can be replicated or used as reference for further studies on pork lechon in other areas of the country. ▀



Effect of simulated sunlight on the migration characteristics of low density polyethylene (LDPE) packaging film

The project was implemented to determine the level at which migration, if there is any perceptible migration present that would take place between LDPE film and food simulants when exposed to artificial light source that closely mimics natural daylight. LDPE is the polymer or plastic commonly used in the packaging of food because it is cheap and readily available. Solar box equipment was used to simulate sunlight. Samples of LDPE packaging film was exposed to simulated sunlight for about 480 hours. Migration profile was gathered at different time intervals.

It is a known fact that people use as primary food packaging some plastic bags that were already long exposed



Solarbox 1500e (COFOMEGRA)

to sunlight. While recycling is recommended, some food safety issues should not be overshadowed since ultraviolet rays from the sun could react with polymer from LDPE bags yielding some products or by-products that would migrate to the food when in contact with the bag.



Food Simulants

The test results generated from the study would benefit MSMEs in assessing appropriate inventory of LDPE packaging material used in applications that might be exposed to direct sunlight either during storage or transit and using this material later on to pack food. Decision makers like managers or ordinary food vendors whose LDPE packaging are in frequent exposure to sunlight might find the results helpful in resolving issues involving a trade-off between the availability of packaging material and food safety. ▀▴

Food safety assessment of sodium and salt content of locally manufactured corn-based snack foods (cornick)

Cornick is a popular corn-based and salty snack food. And consuming too much salty food may lead to some illnesses.

The project assessed the salt and sodium content of locally manufactured corn-based snack foods or cornick sold in the public markets. Baseline information was gathered from cornick samples procured from public markets in Metro Manila and Laguna. The study also hopes to establish



appropriate salt concentration in cornick in conformity with RENI (Recommended Energy and Nutrient Intake) for Filipinos.



Sampled products have shown to have acceptable salt and sodium content based on the standards set by the World Health Organization. However, many more samples out in

the market need to be studied to get conclusive results or data. Results will then be disseminated for consumer awareness. ▀▴

■ Establishment of food safety system for traditional Philippine *sorbetes* in some small-scale manufacturers

The study determined the overall microbial quality of traditional ice cream being sold in Pateros by small scale producers, and the sources of microbiological contamination during production.

The results showed that all ice cream samples examined were not fit microbiologically although none were found to be contaminated with *Salmonella*. *Staphylococcus aureus* and *E. coli* counts were also within the safe limits.



It was also observed that the main sources of contamination during production usually involved improper handling of raw materials (such as coconut milk, powdered milk, and sugar) utensils/equipment, cleaning/sanitation in the facility/handlers, and inappropriate heating and cooling treatments. Coconut milk after manual or mechanical extraction is not pasteurized which may greatly contaminate the product. Although microbial results showed low levels of the pathogenic microorganisms i.e. *Staphylococcus*, *E. coli*, and no detectable *Salmonella* bacteria, the risk of high levels of contamination in tradi-

tional ice cream processing is great. It is therefore important for the LGU to pay attention or exercise greater control over its production. Processors must also be trained on the appropriate processing techniques and sanitary handling of *sorbetes* during preparation and vending. ▀ ▀



■ Processing of waste coconut water generated by copra processors as intermediate material for coconut beverage

Coconut water from mature coconuts usually discarded as waste by copra processors has been studied as a possible material for the production of coconut beverage. To establish an appropriate heat treatment method for coconut water for this purpose, its physico-chemical, microbiological, and sensory properties were determined during the study. A time and temperature combination of 5 minutes holding time at 70 °C has been established as acceptable for coconut water heat treatment. Samples processed at this schedule and stored at refrigerated condition ((15±5 °C) for more than two (2) weeks were still acceptable.



This established process for coconut water treatment however is limited only to laboratory scale and small scale field trials. Pilot scale trial is recommended to further determine the viability of the process. A food safety manual for heat-treated coconut water for further processing will also be prepared in the future. ▀ ▀

■ Fabrication of biomass-fired steam kettle for the production of concentrated coconut water as intermediate material for coconut beverage

A biomass-fired steam kettle has been designed and fabricated that can be used to cook and concentrate coconut water as an intermediate material for the production of coconut beverage. It can also be used to process surplus coconut water that only goes to waste due to lack of appropriate equipment and processing know-how. With this kettle and the developed processing method, coconut water can be processed more efficiently, its shelf life extended and preserved, leaving no room for wastage.

The biomass-fired steam kettle is a simple open-type evaporator pan suitable for concentrating coconut water in small farms. It is very simple to operate, cheap, and can be used in the middle of a coconut plantation even without electricity.

Based on field trials, the minimum load of coconut water for cooking per batch, is 60 kg, and maximum is 75 kg. Cooking time to concentrate the coconut water was established at 6-7 hours per batch while evaporation rate of coconut water per kilograms per hour is higher (11.83 kg/hr) at 30 psi (134°C). Biomass fuel also proved to be the most economical source of energy.



A ratio of one (1) part concentrated coconut water to thirteen (13) parts of pre-boiled water is needed to attain the original sweetness (5°Brix) of fresh coconut water. Further filtration is needed to remove the sediments. Compliance to Good Manufacturing Practices (GMP) is a must to avoid contamination during the processing of concentrated coconut water. Field test results were not conclusive so that more field trials should be conducted in order to attain reproducible results. ■

■ Development of natural food coloring from the agricultural crop *Tiesa*

A natural yellow food coloring that can serve as an alternative for the synthetic yellow food coloring FD & C Yellow 5 was developed from a locally grown and underutilized agricultural fruit crop *Pouteria campechiana*, commonly known as *Tiesa*. Standardized methods of extraction and purification of the carotenoid



pigments present in the fruit were developed to achieve maximum efficiency and yield. Solid-liquid extraction was employed using various solvents typically accepted for food use. The developed natural food coloring was then characterized and evaluated for its physico-chemical properties and acceptability in food application.

Of the eight extraction solvents studied, the ethanol - acetone (1:1) mixture was found to extract the most pigments from *Tiesa* fruit pulp

based on the b values of its L*a*b* color measurements. Four materials were also investigated as possible carriers for the pigments, namely: sunflower oil, an emulsifier mixture of polysorbate 80 - ethanol - propylene glycol with a ratio of 4:5:1, maltodextrin and modified cornstarch.

The natural food coloring developed in the emulsifier mixture was applied in food particularly in calamansi juice at 0.1% concentration and was compared against a control sample. The results showed an enhanced yellow color on the product and no immediate degradation of the color was observed during processing.

To improve the study, other methods of analysis such as UV-Vis spectrometry and HPLC should be conducted on the extracted pigments to get more details on their identities and of other compounds that were possibly co-extracted. In addition, other extraction techniques such as supercritical fluid extraction (SFE) and ultrasonic-assisted extraction (USE) should be studied to develop more efficient and greener standardized procedures in the production of natural food coloring from *Tiesa*. Other sources of natural pigments should also be investigated to have more identified sources for natural colorants. ▀

▀ Evaluation of quality profile and functional properties of *makapuno* (ECM and *Kabuwig*)



Makapuno is a mutant coconut that is native in the Philippines and classified into two - the natural mutant *Kabuwig* that is harvested together with the ordinary coconuts, and the Embryo Cultured *Makapuno* (ECM) that is propagated through its in-vitro cultured embryo.

It is considered to be of high economic value yet there are very few published studies on *makapuno* and its uses locally.

This study aims to compare, characterize, determine and evaluate the functional properties as well as the quality, aroma, and flavor profile of ECM and *Kabuwig* using standard analytical methods and modern instruments. A guide manual and best practices recommendations for the harvesting and storage of *makapuno* will also be developed based on the study.

Physico-chemical analyses were conducted while the sensory, flavor and aroma profiles of ECM and *Kabuwig* were determined using the Electronic Tongue (E-Tongue) and Electronic Nose (E-Nose) respectively. The results were then comparatively correlated with trained human sensory panelists for the E-Tongue, and through the use of a Gas Chromatography-Mass Spectrometer (GC-MS) for the E-Nose. In addition, quality changes at room temperature for both types at varying grade classifications and maturity were also determined and established in order to provide information in the rate of spoilage of *makapuno*.



The results showed that the aroma profiles of the ECM and *Kabuwig* varieties were distinct, while aroma profiles of the three ECM classes were similar yet still distinguishable from each other. In terms of flavor, the results of human sensory and e-tongue evaluations of the ECM and *Kabuwig* samples from three different farms corresponded well with each other. To improve the study, the particular aroma and flavor compounds that cause the similarities and differences between the different *makapuno* samples should be identified. ▀

Development of standards for ethnic foods: *Salabat* or instant ginger drink



The processing of *salabat* or instant ginger drink locally is often undertaken as a home or cottage-scale industry and inconsistencies in product quality and safety have been observed. This project therefore aims to prepare a draft standard and recommended code

of practice (RCP) for *salabat* or instant ginger drink for adoption as Philippine National Standard (PNS).

Baseline information were gathered on the physico-chemical properties and microbiological properties of *salabat* sold in the market as well as on the existing processing methods for *salabat* or instant ginger drink. Based on the gathered data, a preliminary draft was prepared following the Codex format. The ITDI Food Standards Technical Committee (FSTC) reviewed and finalized the draft through a series of monthly meetings. The final draft will be submitted to the Food and drug Administration (FDA) for adoption as Philippine National Standard (PNS).



The availability of the PNS or standards and RCP for *salabat*, will be a big boost to local *salabat* processors which they can use as reference in making their products more marketable and competitive in terms of safety and quality. ▀▹

Development of restructured steak

Meat processing is one of the livelihood training programs being offered by ITDI. To upgrade the product line-up being offered for training, research and development activities on meat restructuring technology was conducted. This technology makes it possible to produce value-added meat products from low quality cuts. This is a welcome development since there is no existing small-scale processing technology for restructured beef steak for possible transfer to SMEs.

Specifically, it aimed to determine the effect of different mechanical treatments for meat before restructuring and determine the effect of different binding agents. The mechanical treatments used were control (no mechanical treatment), slicing and chunking. The binders used were control (no binder), salt and phosphate, collagen, alginate. The effect of additional water was also investigated. The yield, purge loss, cook loss, and texture of the experimental samples were evaluated. Based on the results of the physico-chemical evaluation, the mechanical treatment and binder used in the scale-up processing like slicing, and salt and phosphate, respectively proved promising.



The evaluation of the samples by the panelists from Tender Bobs, showed that the objective which is to bind the meat pieces together in order to form a restructured steak was achieved using sliced meat pieces and salt and phosphate as binder. Further study is needed for the improvement in the texture, juiciness and flavor of the product. ▀▹



Fuels / Biofuels

Characterization of *calumpang* seeds as potential source of biofuel and other oleochemicals

Calumpang seeds, *Sterculia foetida*, were studied to determine their characteristics as a potential source of biofuels and other oleochemicals. Extraction of seed oil using hexane was done after grinding and pre-heating at 60 °C. Analysis by Soxhlet extraction of the seeds showed that it contains 31.3% oil. The oil was then analyzed for acid value, saponification value, iodine value, density, kinematic viscosity and gas chromatography. Results of the analyses showed that *calumpang* seed oil was found to be rich in linoleic acid (48.09%) and palmitic acid (35.64%). Trans-esterification was conducted to produce *calumpang* seed oil methyl ester (CSOME) using the optimized parameters for coconut and Jathropa curcas oil. Based on the results, *calumpang* seed can be a viable feedstock for the production of biodiesel and other oleochemicals. Analyses showed that the oil is a viable substitute for diesel fuel based on PNS ASTM standards for biodiesel. ▀



Production of refuse-derived fuel (RDF) from biomass-plastic wastes as alternative fuel

Refuse-derived fuel (RDF) was produced from the mixture of biomass and plastic wastes. Biomass materials used were tobacco wastes and pine needles while the type of plastic wastes used was high density polyethylene (HDPE) plastic laminates. Optimization test runs were conducted at different ratios of 70:30, 60:40 and 50:50 blends of biomass:plastic wastes. Production of RDF was determined to be effective and optimum at an operating temperature of 110-120 °C at a proportion of 60:40 (by weight) blend of biomass:plastic wastes and at a feed rate of 12.75 kg/hr. Results of the analysis of optimized RDF showed that it has almost the same properties with Semirara coal in terms of proximate analysis and has a higher heating value of about 27,719 KJ/kg. This RDF would therefore provide an environment-friendly and cost-effective alternative fuel to coal for use in heat and power applications. ▀



■ Utilization of acid oil by-product from glycerin refining in the production of methyl ester using the continuous bio-fuel reactor

Combined acid-catalyzed esterification and base-catalyzed trans-esterification process was employed for converting acid oil into methyl ester. Acid oil was derived from the refined wastes of crude glycerin. The process involved adding an amount of methanol, acid and bases catalysts to the acid oil and subjecting the mixture to the conditions that allow methyl ester to form. A lipid phase was formed and separated from the rest of the reaction mixture which was subjected to conditions that will produce methyl ester.

This method is useful for a process that generates bio-diesel from starting material such as acid oil which is a by-product in the refining process of glycerin. The glycerin comes from the production of methyl ester using vegetable or animal oil. The newly-developed

continuous-type bio-diesel reactor which was fabricated by ITDI was used in this study. The reactor is capable of esterification or trans-esterification with a capacity of 100 liters per hour. Production time can be shortened as compared to the conventional batch-stirred tank. ■



■ Design of an energy- efficient reactor and boiler system and adsorption/desorption setup for surface-modified biomass activated carbon as adsorbent material and application for post-combustion carbon dioxide (CO₂) capture

The purpose of the study is to design an energy-efficient activated carbon (AC) production system (with the reactor and boiler system as main components) using steam activation and an effective adsorption/desorption setup and optimization of the quality of AC for post-combustion carbon dioxide capture application. An alternative system with the modified drum carbonizer and fluidized bed reactor system (with steam injection) was used for its separate carbonization and activation processes, respectively. The modified-drum carbonizer was used to convert biomass waste materials to charcoal which can be utilized as supplementary fuel for carbonization and activation. The activated carbon produced through steam injection in a fluidized- bed reactor can be utilized as filter medium for the removal of undesirable gas components from carbonization and activation and wastewater treatment.

The maximum yields of 30% both for the carbonization and activation were comparable to the yields of Effigen SDN BHD of Malaysia producing charcoal and activated carbon from coconut shell using the same process. Activated carbon produced at 795 °C has a maximum iodine value of 680.96 mg/g which is comparable to the standard for High Density AC at 700 mg/g and can possibly be used for wastewater treatment applications. The utilization of the system would contribute greatly in uplifting the industry since it could increase the income potential of the countryside especially in areas where biomass waste resources are abundant, thereby generating more job opportunities. It can provide additional benefits to companies already producing charcoal and activated carbon at present and small and medium-scale enterprises needing supplementary fuel and filter medium for a more energy-self-reliant and environment-friendly process. ■

Environment

Development of fatty acid grafted coir dust as oil spill adsorbent

The accidental spillage of crude oil in the sea causes serious damage to the marine environment. Sorption is a popular technique applied for the treatment of oil spillage. Among the various available sorbents that can be used for the treatment of oil spills, coir dust is the most attractive material in

terms of cost and versatility not to mention that it is locally available and abundant in many parts of the country. The study aims to modify coir dust to obtain a low-cost adsorbent for oil spill in seawater. It focused on the efficacy of surface modification of coir dust by fatty acids (oleic acid and stearic acid) and vegetable oil (coconut oil). Pelletized and powder-grafted coir dusts were both tested for their adsorbency. The tests for sorbent ability of grafted coir dust were conducted using seawater contaminated with crude oil and also weathered oil through sorption method. The results showed that grafted coir dust has the capacity to adsorb crude oil to its modified surface and therefore, a good sorbent material for oil spillage. ▀



Pelletized Fatty Acid Grafted Coir Dust

Removal and decomposition of water-soluble diesel fuel (WSDFF) fraction by TiO_2 photo-catalysis

Two types of immobilized TiO_2 photocatalysts in pure water, the commercially-obtained TiO_2 -coated silica gel beads and the laboratory-prepared N-doped TiO_2 -coated on borosilicate glass tubes were used to treat WSDFF. The use of the commercial TiO_2 -coated silica gel beads degraded as much as 85% of the WSDFF within 2.5 hours. The degradation of WSDFF in pure water can be attributed to adsorption (up to 28% total organic carbon (TOC) concentration removal) and to photocatalytic reaction (up to 86% TOC removal). The TOC data fitted the Langmuir-Hinshelwood kinetic model. Based on the results, TiO_2 catalysis using TiO_2 -coated silica gel beads is a promising treatment for degradation of diesel fuel oil-contaminated wastewater. ▀



Photocatalyst reactor

Atmospheric corrosion exposure study of structural/industrial steel in Philippine environments

A three-year atmospheric exposure study of structural/industrial steel under three aggressive Philippine environments namely, marine, industrial, and geothermal was conducted in collaboration with the National Institute of Materials Science (NIMS)-Japan and the Philippine Corrosion Society. Results of the study can greatly benefit the local infrastructure and manufacturing industries as it provided a good assessment of the corrosivity effect of these aggressive environments which included studies on the time of wetness, temperature, and relative humidity. Knowledge of the corrosion properties of different industrial/structural steels will also benefit industries aside from manufacturing and infrastructure, those engaged in power generation, shipping, distribution, and other related industries.



Inspection of exposure site with Japanese experts in Calaca, Batangas



Installation of Solar Panel which will supply power to the data logger in Kemwerke, Muntinlupa



Marine exposure site

Moreover, using the atmospheric corrosion monitor (ACM) sensor developed by NIMS-Japan, substantial data was generated that will allow these local industries to reduce life cycle costs of geothermal power generation operations, as well as the environmental impact to communities situated around these plants. Aside from saving money, the information will also help ensure the safety of workers and effective preventive maintenance schedule. The corrosion rates (in mm/yr) of structural steels including carbon steel, weathering steel, stainless steel, galvanized, Al-Zn alloy-coated steel exposed to the specified atmospheric environments over a period of time can also be measured in a simplified method at a shorter time. In addition, data generated from this study will be used in developing the corrosion map of the Asian region wherein participating countries like the Philippines can access atmospheric exposure data from other countries like Thailand, Vietnam, India, and Japan .



Exposed Test Panels with ACM Sensor in Bay, Laguna

■ Bench-scale treatment of tannery waste water using ITDI-isolated microbes



Wastewater treatment in leather tanneries requires a complex wastewater treatment facility which includes physical, chemical, biological and other wastewater management systems. The processing of raw hides into leather requires large volume of water and chemicals

such as sodium sulfide, salt, soda ash, surfactants, enzymes and others. The large amount of wastewater with high concentrations of organic pollutants and chemicals must be treated before it can be discharged. Conventional biological treatment was found to be difficult. This study observed that microorganisms are still viable during the treatment but no exponential growth was observed. The salinity of wastewater remained constant indicating the non-biodegradability of the salts and chemicals in the wastewater. Salt-tolerant strains are recommended for this particular type of wastewater. ■

■ Development of a bench-scale two-stage process for biogas production from swine waste effluent

A two-stage bioreactor system consisting of two 30L-plastic drum-digesters connected in series was setup and batch-fed with organic load of 17% organic swine manure, 30% inoculum and 53% water. The hydraulic retention time (HRT) for digester 1 was 6-8 days while digester 2 was 13-16 days. Results from principal component analysis (PCA) showed positive correlations in parameters of total solids (TS), total suspended solids (TSS), chemical oxygen demand (COD) and biochemical oxygen demand (BOD). The volume of gas was negatively correlated and increased twice compared to digester 1. Three of the parameters, TS, TSS, BOD exhibited significant percent reduction. The bioprocess efficiency for the two reactors was computed to be 73.89%. The average gas volumetric production rates were 15.875L/ LReactor1 or 30.45L/ LReactor2. Based in the cumulative gas production, the theoretical biochemical methane potential (BMP) was 880.2289×10^3 representing half of the methane value. ■

■ Comparative study on the effect of the use of different additive available in the market on the oxo-biodegradation of polyethylene plastic bags

The addition of specialized oxo-degradable additives in PE films accelerates the breakdown of PE but biodegradability of such materials is yet to be determined. Based on the manufacturer's claims, additives can be added to PE resins to enhance overall oxo-biodegradation. A comparative analysis of data obtained from the Environment Technology Verification (ETV) showed that Additive A performed better compared to the other additives as to the acceleration of PE breakdown. The limited pro-oxidant action of the additives in the PE is attributed to low oxygen permeability or recombination of polymer alkyl radicals at higher concentration. ■



■ Molecular characterization of EBD-isolated and developed microorganisms

Among the economically-important microorganisms isolated and developed by the Microbiology and Genetics Division, now the Environment and Biotechnology Division are the yeasts strains, *Saccharomyces cerevisiae*. Four yeast strains identified as high alcohol-producing isolates were characterized in this study.

Delta typing was performed to distinguish each of the EBD-developed *Saccharomyces cerevisiae* at the strain level by distinct molecular profiles. At least two strains showed polymorphisms in the amplified delta region of large sub-unit (LSU) of the ribosomal RNA. Three of the four strains were observed with spherical shaped-cells and one had elongated oval shaped-cells (Figure 1). One strain, LMJ-3 was found polymorphic at D1/D2 region while LMJ -2 strain showed polymorphism in the D21/D12 region. Phenotypic similarities in this case do not necessarily reflect genetic relatedness. The phylogenetic relationship should be reflected in similarities at the level of base composition of DNA and DNA sequence homology in different yeasts.

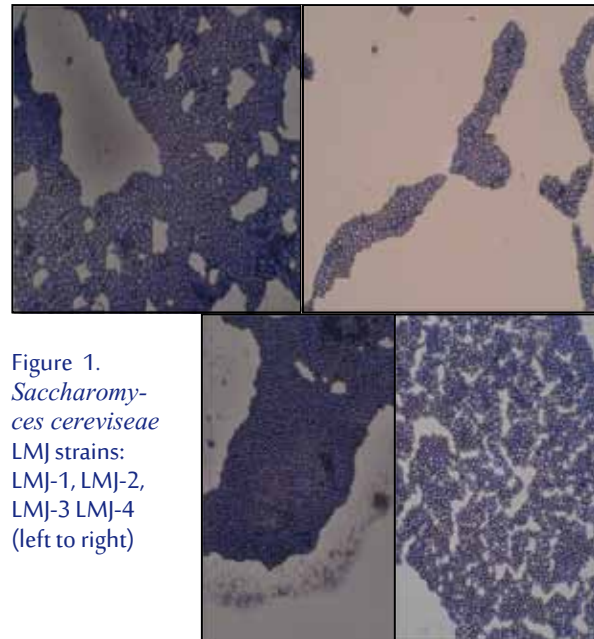


Figure 1. *Saccharomyces cerevisiae* LMJ strains: LMJ-1, LMJ-2, LMJ-3 LMJ-4 (left to right)

The ITS region showed fragments with the same molecular weight size marker for the four strains, indicating that they are under one species. LMJ-2, the parental strain can be distinguished from among the four evaluated isolates by the difference of one amplified band in the D21/D12 region at around 400 bp. The use of interdelta typing in yeast is a preferred method to discriminate yeasts at the strain level. ■

■ Isolation of beneficial microbes for biodegradation of animal and plant oil in fast foods wastewater effluents



Isolation of anaerobic microbes and screening for the treatment of fast food wastewater to reduce oil and grease under aerobic conditions were done. Of the 130 microorganisms from different wastewater of fast food chains, eleven isolates were found promising. Of the eleven isolates tested for oil and grease reduction, isolates T2W2/1 showed 90.81% and 98.25% reduction in wastewater effluent while isolate JB4/6 has 98.25% reduction in simulated wastewater. ■



Development of the ITDI Hazardous Waste Management Manual

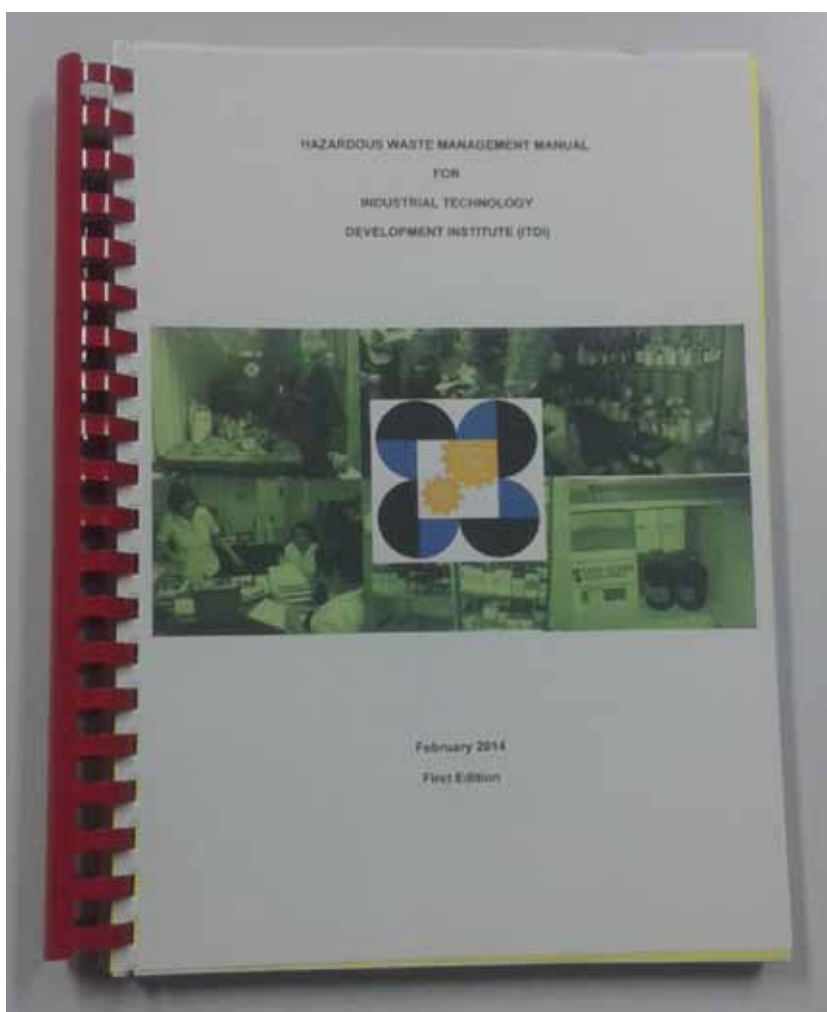
In 2011, an inter-disciplinary team composed of members from different divisions of ITDI was created to conduct an Environmental Impact Assessment on the ITDI operation and develop an Environmental Performance Report and Management Plan (EPRMP) document acceptable to DENR compliance requirements. The EPRMP document is one of the legal requirements for the Institute to secure a Hazardous Waste Generator ID. This will allow ITDI to legally outsource an accredited hazardous waste treater to properly dispose the Institute's toxic and hazardous wastes. Moreover, the preparation of the EPRMP will demonstrate ITDI's firm commitment towards sustainable development and will likewise guide the management in its decision in incorporating environmental considerations in planning its programs and projects.

After satisfying the requirements of the EPRMP, the Institute was finally granted an Environmental Compliance Certificate (ECC) on November 19, 2012. Since then, using the ECC as a planning tool, ITDI has religiously implemented the measures presented in the EPRMP, intended to protect and mitigate the project's adverse impacts on community health, welfare and the environment. Hence, environmental considerations were incorporated in all phases and aspects of the Institute's operation, and to date, all accumulated and hazardous wastes were already hauled.

The EPRMP team has also developed the Hazardous Waste Management Manual as a reference guide for the

proper implementation of the hazardous waste management program of the Institute. Emphasis has been placed on both chemical and biological wastes procedures in order to address highly-specialized operation of the different laboratories and facilities. It provides instructions to all personnel on the requirements in meeting the existing environmental regulations.

With the use of this guide document, the implementation of the ECC would be more sustainable and far easier. Thus, a number of benefits could be derived for the Institute such as: reduced penalty on environmental compliance; minimal hazardous wastes disposal and wastewater treatment costs; less medical expenses to the researchers, staff and the community; safe and clean workplace; and good corporate image. ▀

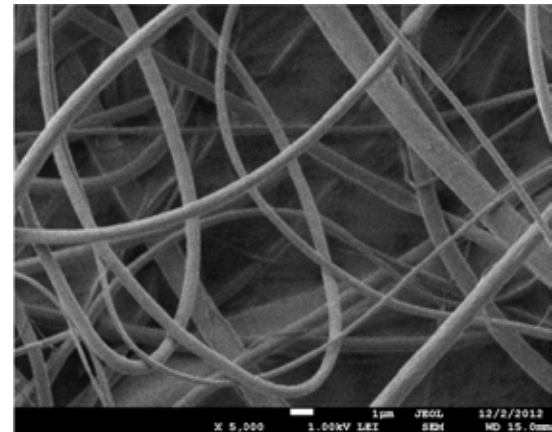


Nanotechnology

Development of electrospun cellulose acetate/chitosan nanofibrous membrane for removal of heavy metals from wastewater

A novel electrospun nanostructured membrane from *kapok* cellulose acetate-chitosan blend was found effective in removing toxic heavy metal

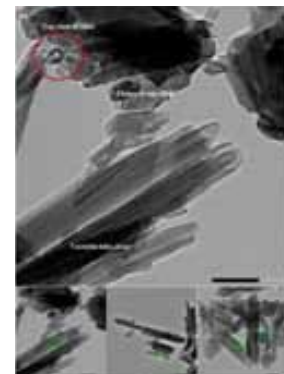
contaminants (such as cadmium, Cd^{2+}) in aqueous medium through membrane adsorption. The use of electrospun fibers in filter applications is of special interest because of their small diameter and ability to create a relatively more porous membrane than the conventional filters. This allows adhesion of particle units even in nanosize range. Such elemental units include heavy metal ions.



The study showed that increasing the amount of chitosan in the blend increased the number of adsorption sites and decreased the average fiber diameter but beads and junctions occurred in the membrane. The Cd^{2+} uptake analysis suited well the Ho pseudo-second-order model and showed that substantial increase in the adsorption capacity occurred up to 6 hours. ▀

Development of silver-filled epoxy (SFE)/halloysite nanotube (HNT) nanocomposite as die-attach material for semiconductor devices

A low-cost but improved silver-filled epoxy (SFE) die-attach material was developed incorporating the locally-produced halloysite nanotube (HNT). A die-attach material connects the chips and the substrate in a typical electronic or semiconductor device. In devices like those used in power electronics circuits, the chip attachment or die-attach must exhibit good electrical conductivity as well as good thermal conductivity for heat removal. The developed silver-filled epoxy/halloysite nanocomposite die-attach material showed an improved reliability due to its enhanced thermal and mechanical properties.



The use of HNT in developing the new die-attach material is advantageous since it is naturally-occurring and readily-available. It can be used as an excellent substitute for carbon nanotubes and is cheaper compared to carbon nanotubes and other inorganic nanotubes (e.g. silica nanotubes). HNT has also proved to be an effective modifier for polymers so that its application is not limited only to epoxies. ▀



Field Emission Transmission Electron Microscope used to view and analyze the nanostructure formed

TECHNICAL SERVICES



The Institute continued to render various types of technical services to its clients to help improve processes and enhance productivity and competitiveness.

For 2013, total income amounted to PhP 23.290 million with earnings of PhP 18.184 from technical services and PhP 5.102 million from other specialized services.

Revenues from calibration and measurement posted the highest at 42% or PhP 9.715 million, followed by test and analyses services (including formula of conversion) at 36% or PhP 8.470, and 22% or PhP 5.102 million for other specialized services. ▀▄

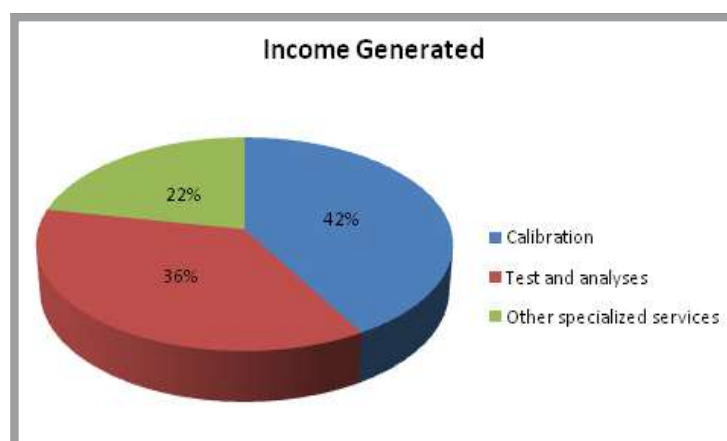


Figure 1 – Income generated from different technical services

Other Specialized Services Rendered

Type of Service	No.	Amount (PhP)
PACKAGE DEVELOPMENT	10	192,908.00
LABEL DESIGN	27	168,488.00
USE OF FACILITIES	309	967,075.00
TESTS & EVALUATION	247	3,414,208.00
LABORATORY QUALITY SYSTEM AUDIT	1	36,316.00
ENVIRONMENTAL TECHNOLOGY VERIFICATION	34	321,220.00
TECHNICAL ASSISTANCE	1	1,875.00
Total	629	5,102,090.00

Tests & Standards

The Institute is upgrading its tests and standards laboratories and is now establishing a national measurement infrastructure for chemistry or Metrology in Chemistry (MiC). This aims to ensure comparability and traceability in the results of tests done in different laboratories, regardless of country, field of application, or time performed, echoing the MiC mantra, "Once tested, accepted everywhere."

Through its Standards and Testing Division or STD, the ITDI is implementing the program, "Development of National Standards for Chemical Measurements" that aims to:

establish internationally recognized national measurement standards in chemical analysis, develop traceability and comparability of analytical test results, and disseminate the chemical measurement accuracy to the users in the country and other stakeholders.

To date, a clean room has already been established while MiC infrastructures in other countries were visited for benchmarking purposes and possible collaboration such as the Korea Research Institute for Science and Standards (KRISS), Health Sciences Authority (HSA) Singapore, National Measurement Institute of Australia (NMIA), and National Institute of Metrology Thailand (NIMT). Some staff



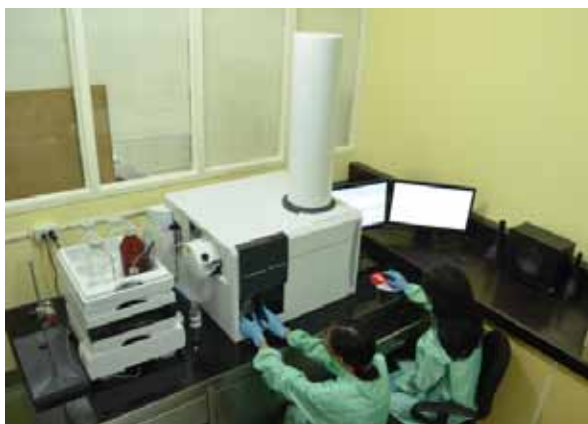
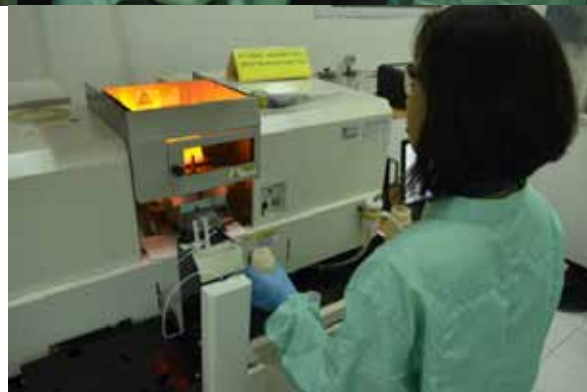
also trained on reference material preparation while others attended a training workshop on ISO/IEC 17043:2010 procedures, under the guidance of metrology experts from the Department of Science Service of Thailand's Ministry of Science and Technology and Germany's Physikalisch Technische Bundesanstalt (PTB).

The Chemistry Lab also participated in the Proficiency Program organized/offered by the following Institutions/laboratories: Jabatan Kimia, Malaysia, FODAS 8 (Caffeine); Jabatan Kimia, Malaysia, FODAS 1 (Benzoic

Acid, Sorbic acid); APMP-Hongkong (pH (25C & 35C); Jabatan Kimia, Malaysia (Cadmium, Copper, Chromium in water) (Lead, Zinc, Nickel, Iron, Manganese in Water); FNRI-PT in Milk Powder (Moisture, Protein, Fat Ash, Calcium, Iron, Sodium, Potassium & Zinc); and ERA, USA (Residual Chlorine, Color & Turbidity).



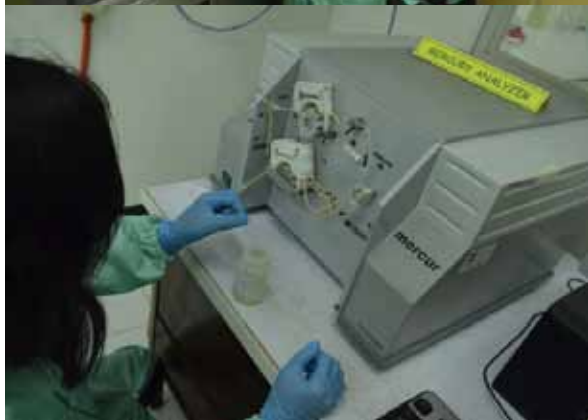
Among the MiC project's initiatives during the year is the conduct of Proficiency Testing (PT) services for contaminants in food and metals in water. This PT program aims to assist laboratories in evaluating their quality control measures and improving their measurements through inter-laboratory comparisons. In accordance to ISO/IEC 17025 accreditation requirements, PT is being done to gauge the laboratory's competence based



on pre-established criteria to ensure traceability and accuracy in measurements. Currently, the MiC program conducts PT on samples for benzoic acid in mango juice and metals in water.

Three assisted projects are now on-going at the Chemistry Laboratory namely:

- Binding Studies and Characterization of Tetracycline-Imprinted Polymer Sensing Layer for a Chemical Sensor Based on a Piezoelectric Quartz Crystal (NRCP).
- Metrology in Chemistry Project 1: Interlaboratory Comparison of Food Additives & Contaminants in Foods.
- Metrology in Chemistry Project 2: Production of Secondary CRMs & PT for metals in water. ■



ADMATEL

■ Establishment of ADMATEL - Phase 2 (Operation)

Startup operation of ADMATEL has been established as a service testing facility for the semiconductor and electronics manufacturing as well as other related industries. The major activities for the second phase consisted of

(a) test and analyses of samples from the industry, (b) promotion and marketing of ADMATEL services, (c) development of manpower competency, and (d) alignment of operation of the facility with International Standard ISO 17025.



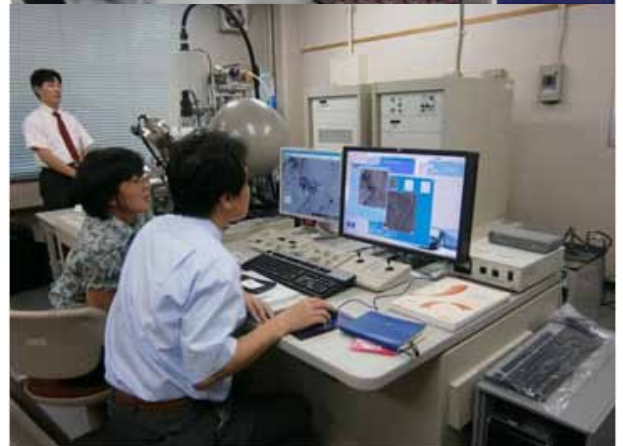
ADMATEL started operating in January and was later inaugurated by the President on May 31, 2013. Seventeen (17) contractual employees were hired for the full operation of ADMATEL. Some of the staff attended local trainings including in-house training by local and foreign experts, industry immersion at STMicroelectronics and FASTECH Synergy Phils., and advanced training abroad to enhance the manpower capability of ADMATEL.



Promotion and marketing activities through presentations to several semiconductor and electronic industries, namely, ROHM LSI, Lattice Semiconductor, HGST, AMKOR, NXP, BITMICRO, PEZA, and AIR21 were conducted. ADMATEL and its services was also presented during the regular monthly meeting of CFAR, and in several conferences and conventions like the PIChe 74th Annual Convention, Philjafa 74th Founding Anniversary, MICROSPHIL Conference, and the Philippine Semiconductor and Electronics Convention and Exhibition (PSECE).

The alignment of ADMATEL operation to International Standard ISO 17025 is also being worked on and involves trainings on awareness, documentation, internal quality audit and measurement of uncertainty, and preparation of required documents.

As of December 31, 2013, ADMATEL operation has generated a total income of PHP 3,616,600 driven by 44 clients, majority from the semiconductor and electronics industries. ■



Metrology



The National Metrology Laboratory or NML, also the Philippines' National

standards and the calibration and measurement standards it produces, is now mutually and globally recognized among its peers of NMIs. It is no doubt that the existence of internationally- recognized metrological competence within a country can positively influence investment decisions and is indispensable to participation in free trade.

Metrology Institute or NMI, capped 2013 with the acceptance of the country's Calibration and Measurement Capabilities (CMC) in the field of mass. CMCs are awarded by the Joint Committee of the Regional Metrology Organizations and the International Bureau of Weights and Measures (JCRB). The approved CMC is now included in the BIPM (International Bureau of Weights and Measures) global database and made public online in the BIPM website (<http://kcdb.bipm.org/AppendixC>).

Two NML staff were also featured in radio interviews where they talked about metrology and its importance especially in everyday life and the training on liquid-in-glass and digital thermometer.

The division also organized and participated in metrology awareness activities with secondary calibration laboratories in the Philippines, OIMB-DOE, and the academe, such as 1st Stakeholder's Consultation Workshop with Secondary Calibration Laboratories, World Metrology Day, and Consultation Workshop on Verification, Inspection and Sealing of Fuel Dispensers.

The Philippines now has 21 registered CMCs on the BIPM-KCDB (International Bureau of Weights and Measures - Key Comparison Database) database. With this recognition of the Philippines' competence in metrology as shown in JCRB's rigorous reviews, the country proudly joins the ranks of the world's premier NMIs (National Metrology Institutes), such as those of Germany, USA, Japan, UK, Korea, China, and Singapore, among others.

The NML has also established linkages with various institutions through the following activities:

- APMP (Association of Proposal Management Professionals) General Assembly and related meetings. 24-29 November 2013, Taiwan.

With a Mutual Recognition Arrangement (MRA) within the International Committee for Weights and Measures (CIPM) now in place, the signatory NMIs of this agreement can be internationally recognized for their technical competence in calibration and measurement. Being one of these signatories, the Philippines' NML, with the national measurement



- Asia-Pacific Symposium on Mass, Force & Torque (APMF). 20-22 Nov. 2013, Taiwan
- APLMF (Asia-Pacific Legal Metrology Forum) 2013, Indonesia.



- APLMF (Asia-Pacific Legal Metrology Forum) Annual Meeting. Indonesia, Nov. 5-8, 2013, Indonesia.
- Central Bureau of Weights and Measures-Thailand: Verification, Inspection and Sealing of Fuel Dispensers. 3-14 June 2013, Thailand.
- ACCSQ – PTB: Verification of Weighbridges/ Truck Scales according to NAWI Guidelines . 26-29 August 2013, Germany.
- KRISS, Global Metrology Academy course in Electricity & Magnetism. 24 June - 5 July 2013, and in Fluid Flow Metrology from 4-15 November 2013, South Korea
- NIMT-NMIJ Joint Seminar on Coordinate Metrology in Industry. 21-23 August 2014, Thailand.

NML's Thermometry Standards laboratories were also awarded their ISO 17025 accreditation by Germany's main accreditation body Deutsche Akkreditierungsstelle GmbH (DAkkS) after the surveillance visit last October 24-25, 2013 while the Thermometry (LIGT,

DT, and IPRT) Standards Section of NML successfully sustained its DAkkS accreditation. Both the Thermometry Section's technical capability and NML's quality system were assessed in accordance with the ISO 17025:2005 by Dr. Erich Tegeler, former Head of the Thermometry Lab of PTB (National Metrology Institute of Germany), who despite retiring from PTB still works as a technical assessor for DAkkS in Germany and across the globe. He thoroughly assessed the Laboratory's quality system then evaluated the technical competency of the Thermometry Laboratory. Based on his assessment, Dr. Tegeler commended NML for the perfect quality system it has documented and is implementing. Despite a few minor deviations issued on the technical aspect, none proved to be critical thus having no significant effect on the quality of calibration service the Thermometry Section provides to its customers. Likewise, the Pressure Section also underwent a lab surveillance visit in November 2013. ■





Knowledge Translation

Knowledge Translation or KT is now increasing in importance in Science and Technology particularly in the areas of research and development (R&D) by moving the results of research work from the laboratory into the hands of people and organizations that may have the potential to put these to good use. It is in this way that the public can get the most from national investments in R&D. ITDI finds KT as a valuable tool and uses it in making its developed technologies and other R&D efforts reach a wider range of prospects, and answer the needs of its stakeholders (i.e. academe, LGUs, private entities). KT initiatives in the forms of technology forum, social marketing, technical services, trainings, and consultation, are conducted that leads to eventual commercialization and subsequent business ventures. ▀▄



▀▄ Social Marketing

The Institute has sustained its passion in the research and development of new, relevant, and timely innovations/ breakthroughs and has succeeded in spreading these developments through various channels such as print, broadcast, cyber media, exhibits, and conferences. Through its various KT products and activities, stakeholders are encouraged to conduct business with ITDI and eventually venture into business with the Institute as partner. This was achieved through the use of sound promotional/communication collaterals among others, such as: newsletters - two issues of Techno Bulletin, 10 MiscellaNews (in-house), annual report, technology brochures (5 new titles), 25 press releases and 66 published stories (monitored in print and on-line), 11 tele-radio/radio guestings/interviews, 10 exhibits, 24 study tours/visits, and two technology fora. Approximately 90 inquiries either through email, phone, and walk-in were attended to during the year. A total of 6,056 complimentary copies of various IEC materials were disseminated and an income of Php 2,560 was generated from the sale of some technology livelihood series. ▀▄



Technology forum

One of the Institute's powerful tools in bringing together technology generators and stakeholders to disseminate new developments and facilitate the up take of research results or technologies/services is the technology forum. Over the years, such outings had been successful in staging high impact technologies and other R&D products, while promoting their competitive advantages and economic benefits.



This year, two technology fora were conducted. The first was a forum on government intervention for a safer and a cleaner *taho* processing in Quezon City with 50 participants. The forum aimed at educating *taho* producers on good manufacturing practices and proper food handling to ensure that *taho* products sold to the public are safe to eat.

The second, an exit forum on the DOST-High Impact Technology Solutions or HITS project entitled "Design and Development of Process Equipment for the Food Processing Firms" with 32 participants nationwide. The forum presented the project outcome - all seven locally fabricated prototypes of food process equipment and gave way to the meeting of Food Innovation Centers' managers and stakeholders from the different regions of the country. After the forum, a demo-operation facilitated by the project engineers at the pilot plant gave the participants the opportunity to view and examine the equipment's features and witness their performance.

The DOST-developed food processing equipment namely, the water retort, freeze dryer, vacuum fryer, spray dryer, vacuum packaging machine, immersion freezer, and vacuum evaporator are good substitutes to expensive imported ones thereby readily addressing local food processors' problem on the high cost of equipment acquisition. ▀



Training / demonstration and technical assistance

This year the Institute has captured relevant audience from both private and public organizations and affiliations through its promotion campaign via print and broadcast media. A total of 105 trainings/seminars were conducted which generated an income of Php 1,031,482.57 with 2,207 participants/beneficiaries from MSMEs, potential entrepreneurs, LGUs, NGOs, cooperatives, academe and other government and private sectors nationwide.

The trainings which comprised of regular (in-house), special (with conforme letter), international, regional, and DOST-NCR projects covered different technologies and/or services of the Institute among which include: food processing, packaging technologies, labeling, and services; the various fields of metrology; food safety, energy audit, and herbal products.

The Institute's training program is now crossing borders as it conducted a special training on food preservation and processing of vegetable, rootcrop, fruit, fish and essential oil at the Science Resource Center, Baucau, Timor Leste in July 2013, where 37 beneficiaries

from a Non-Government Organization (NGO) participated. The training was facilitated and funded by the Technical Cooperation Council of the Philippines (TCCP) of the Department of Foreign Affairs (DFA).



A total of 11 technology transfer agreements were implemented during the year, seven covered by conforme letter and four by memorandum of agreement (Table 1).

Likewise, 35 technology assistance (e.g., consultancy, assessment/evaluation, operation/installation and repair of equipment/machines) projects were rendered to 53 clients country-wide. Technologies/services included gasifier combustor; ceramic pot filter technology; energy audit; technical evaluation on kiln; steam boiler; CP for SMEs food processors; portable biogas digester; distilling equipment; spray dryer; bio-reactor; and food safety.

The institute has served a total of 89 technology transfer beneficiaries/adopters nationwide of which DOST-RO supported accounted for 54 and ITDI direct clients accounted for 32. Technologies transferred included bioreactor, acetator kit, ebulliometer, styro plastic densifier, wine kit, biogas digester, vacuum packaging machine, water retort, vacuum fryer, vacuum evaporator, and ceramit pot filter. ▀ ▹



Knowledge Products

The Institute continues to expand and improve its knowledge bank. The various knowledge products are accessible for use by S&T oriented/inclined people, organizations, universities and colleges. During the year, efforts to build up and strengthen the Institute's in-house knowledge bank continued with its collection comprising of R&D terminal reports, thesis and dissertations of DOST-ITDI scholars, business portfolios (i.e. business opportunity plans/feasibility study, technology commercialization plan), techno-forum proceedings, and all the other IEC resources the Institute has produced. In 2013, 39 R&D terminal reports were ISBN-registered and 309 materials were inputted to SILMS (Science and Technology Integrated Library Management System); and two techno-forum proceedings were prepared. In addition, the collection is continuously enhanced with complimentary acquisitions like local and foreign journals and magazines from various sources/networks. A total of 68 e-books and 100 e-journals were downloaded from Science Direct adding to the current collection



for the ready reference of researchers. Library services were also provided to 194 users/researchers during the year.



Other in-house knowledge products in business portfolio forms were likewise developed which include 29 business opportunity plans (BOPs) and 14 market profiles on various technologies. ▀▸

Intellectual property

The institute ensures that the products of our expert's innovative and creative minds are protected and preserved under IP laws. In 2013, two intellectual property assets were granted patent rights while three were filed and awaiting grants. These knowledge products are as follows:

Granted – Utility Model:



Portable biogas digester



Coffee roasting machine

Filed – Trademarks:



Dreamweave / Rapya logo



Kape Primera

Table 1
TECHNOLOGY TRANSFER AGREEMENTS
Memorandum of Agreements

TECHNOLOGY	CLIENT/ADDRESS	STATUS
License to Market & Distribute OL Trap	Heritage Veterinary Corporation	On-going, Aug. 30, 2011 - Aug. 29, 2014
Design and Supervision in the Fabrication of Malunggay Roaster	Dr. Mylene V. Matti, Executive Director Greenearth Heritage Foundation, Inc. 1723 Dian St., Palanan, Makati City	On-going 7/17/2013
Establishment of Proc. Plant for the Production of Wine, Vinegar and RTD Pineapple Juice	DOST Region VIII Mrs. Benita L. Macatual, President Ormoc Farm Inc., Aviles St., Ormoc City	On-going 11/12/2012
Design, Construction and Operation of a 75 cu.m AFBRR	Engr. Jose Manuel Alvarez, President Waste and Resources Management, Inc., Pineapple St., Sitio Pag-asa, Brgy. Aguado, Trece Martirez, Cavite	Ongoing 12/3/2013

Table 2
TECHNOLOGY TRANSFER AGREEMENTS
Conforme Letters

TECHNOLOGY / CLIENT	STATUS
Methyl Ester from Used Cooking Oil (Production of Methyl Ester from 1000 liters of used cooking oil) Ms. Carina A. Agarao, AVP for Corporate Affairs Jollibee Foods Corporation, 5/F Jollibee Plaza, Ortigas Center, Pasig City	Completed 6.10 - 21.2013
Detergent Powder (Use of ITDI facilities for trial production of detergent powder for perfume testing based on client's formulation) Allan Abaygar, Firmenich (Philippines), Inc., 2/F UPRC III Bldg., 2289 Don Chino Roces Ave. Ext., Makati City	Completed 4.24. 2013
Use of facility for the Production of Smoked and Dried Fish Mr. Arnulfo Singca, Mica By the Sea, 609 Sirloin St., FTI, Taguig City	Completed 8.13 - 22. 2013
Production of Bottled Sardins in Oil Mr. Arnulfo Singca, Mica By the Sea, 609 Sirloin St., FTI, Taguig City	Completed 8.27 - 9.27. 2013
Preparation of 250 g Cream with 3% Acapulco Extract Dr. Joy A. Umali, Las Pinas Doctor's Hospital, Las Pinas City	Completed
Trial Production of Activated Carbon from Coco Peat & Carbonized Coco Shell Powder Mr. Noel T. Florido, CEO, Cocos Nucifera Pacific Enterprises, Gumaca, Quezon	Completed
Use of 15 kw Fluidized Bed System for Trial Gasification of Sugarcane Bagasse for Power Generation Atty. Alejandro Florian Alcantara, Raw Brown Sugar, Dumaguete City	Completed

Table 3

TECHNICAL SERVICES RENDERED FOR ITDI DIRECT CLIENTS

TECHNOLOGY		VENUE
1	Soapmaking	Navotas City Hall, Navotas
2	Hand Sanitizer Making	Mandaluyong City
3	Perfume Making	Mandaluyong City
4	Herbal Processing	CED-ITDI
5	Awareness/ Seminar on Packaging and Labeling Design	TSD-ITDI
6	Introduction to Metrology	NML, ITDI
7	Calibration of Electronic Balances	NML, ITDI
8	Mushroom Culture and Spawn Production	CED, ITDI
9	Soap Making	CED, ITDI
10	Calibration of Volumetric Wares	NMD, ITDI
11	Integrated Fruit and Vegetable Processing	FPD, ITDI
12	Energy Audit with Practicum	MWCo., Inc., Balara, Q.C.
13	Herbal Bath Soap Processing	Mandaluyong City
14	Extraction of Essential Oils	CED, ITDI
15	Mushroom Culture and Spawn Production	TSD/EBD, ITDI
16	Processing of Pickled Quail Eggs	FPD, ITDI
17	Operation of Vinegar Acetator Kit Technology	Koronadal City Laguna
18	Calibration of Digital Multimeters	NMD, ITDI
19	Installation/Training on the Operation of Vinegar Acetator Kit Technology	DTI, Kalinga
20	Pineapple Processing	Antipolo, Rizal
21	Dragon Fruit Processing	Jala-Jala, Rizal
22	Inspection, Testing, Start-up and Training on the Operation and Maintenance of Bioreactor	LGU Bayog, Zamboanga del Sur
23	Moringa Processing	San Antonio, Zambales
24	Fruit Processing	Candelaria, Zambales
25	Energy Audit	DOST, Baguio City, Benguet
26	Installation/Operation of Bioreactor	Carmona, Cavite
27	Herbal Tea Processing	Culasi, Antique
28	Fruit Processing	Laua-an, Antique
29	Bioreactor Technology	Provincial Government of Camiguin
30	Introduction to Metrology	NMD, ITDI
31	Calibration of Electronic Balances	NMD, ITDI
32	Testing of Commercial Balances	NMD, ITDI

Table 4
TECHNICAL TRAINING SERVICES FOR DOST-RO

TECHNOLOGY		VENUE
1	Assembly, Demonstration and Operation of Vinegar Acetator Kit and Training on GMP	Aglangao, Bengued, Abra
2	Calibration of pH Meter	Apokon, Tagum City
3	Coconut Oil Refining	Odiongán, Pangasian
4	Fish Processing	Paombong, Bulacan
5	Orientation Training/ Performance Testing of Fabricated Wine Distilling Equipment	Camarines Norte
6	Performance Testing cum Operator's Training on one (1) 1/2 to capacity Bioreactor	Burgos, Pangasinan
7	Processing of Bottled Fishery Products	Dagupan, Pangasinan
8	Production of Ceramic Pot Filters	Arayat, Pampanga
9	Vinegar Processing using ITDI Acetator	Tagbilaran, Bohol
10	Vinegar Processing using ITDI Acetator Kit	Capas, Tarlac
11	Calamansi Processing	Tagudin, Ilocos Sur
12	Emergency Food Reserve (EFR)	-
13	Energy Audit, Conservation and Efficiency	Peñafrancia, Legaspi
14	Energy Audit, Conservation and Efficiency	San Jose, Antipolo, Rizal
15	Installation/Training on the Operation of Vinegar Acetator Kit and Wine Kit	DAVECO Agrarian Reform Beneficiaries Cooperative, Pagadian City, Zamboanga Del Sur
16	Operations and Maintenance of the Bioreactor & Plastic Shredder	Mamburao, Occidental, Mindoro
17	Tuna Processing	E. Baluyut Pottery Plant, Arayat Pampanga
18	Production of Ceramic Filters (firing and application of anti-microbial agent)	Brgy. Buhay, Siniloan, Laguna
19	Installation/Training on the Operation of Vinegar Acetator Kit and Wine Kit	Diffun, Quirino
20	Fabrication/Operation of Portable Biogas Digester	NMD, ITDI
21	Calibration of Digital Multimeters	FPD, ITDI
22	Fish and Shellfish Processing	NMD, ITDI
23	Introduction to Pressure Measurements and Calibration	FPD, ITDI
24	Fruit Processing	FPD, ITDI
25	Sensory Evaluation Methods	NMD, ITDI
26	Calibration of Liquid-in-Glass and Digital Thermometer	FPD, ITDI
27	Determining Shelf Life of Foods	NMD, ITDI
28	Introduction to Metrology	NMD, ITDI
29	Calibration of Electronic Balances	FPD, ITDI
30	Sauces and Condiments	FPD, ITDI
31	Herbal Processing	FPD, ITDI
32	Plastic Styro Densifier	Provincial Government of Camiguin

TECHNOLOGY		VENUE
33	Bioreactor Technology	Provincial Government of Camiguin
34	Awareness/Seminar on Food Additives	Roxas, Capiz
35	Forum on Food Innovation Technologies	BSU, L.T.B.
36	Awareness/seminar on Determination of Shelf life of Processed Foods:	Iloilo City
37	Awareness/seminar on Introduction to Food Safety	Iloilo City
38	Seminar on Solid Waste Management	Botolan, Zambales
39	Mango Wine Processing	Jalajala, Rizal
40	Vinegar Acetator Kit	Rosario, Batangas
41	Food Safety and Introduction to HACCP	Subic, Zambales
42	Rootcrops Processing	San Clemente, Tarlac
43	Installation/Training on the Operation of Vinegar Acetator Kit Technology	Davao del Sur
44	Energy Management and Audit Processes with Practicum	USEP, Davao City
45	Calibration Electronic Balances	Malabon City
46	Dalanghita Processing	San Francisco, Tiaong, Quezon
47	Skills Upgrading Training on Wine (Bignay, Rice Wine)	San Emilio, Ilocos Sur
48	Energy Audit and Efficiency Training	Western Visayas College of Science & Technology, La Paz, Iloilo City
49	Installation and Operation of Vinegar	Splash, Valenzuela City
50	Production of 1.5 cap. Ceramic Pot	DARS Ceramics, Cagayan de Oro City
51	Techno - Forum on DOST Hits Projects	EBD, ITDI
52	Introduction to Pressure Metrology and Calibration of Pressure Gauges	Kamuning, Quezon City
53	ITDI Biogas Digester	Municipality of Pampolona, Negros Oriental
54	Calibration of OIML Weights	First Philippine Scales, Inc., Potrero, Malabon



Outcome 6:

QUALITY HEALTHCARE

Health Products from Natural Sources



■ Dietary antioxidants from plants

Seven plants (duhat, guyabano, mango, mangosteen, pomelo, rambutan and turmeric) were processed and studied for the development of dietary antioxidant. Crude extracts of the said plants were subjected to antioxidant assay and phytochemical screening to determine presence of flavonoids and leucoanthocyanins. Among the seven plants used

for the study, rambutan peels showed the highest antioxidant activity of 40.70% total phenolics expressed as gallic acid, followed by mangosteen pericarp/pulp (29.00%) and duhat (14.30%). Phytochemical screening of all plants gave positive results while TLC profile exhibited different chromatogram indicating uniqueness of each plant extract with mangosteen having the most number of components. With these results, initial products were developed in the form of capsule, teabag and chewable tablet. ▽



■ Extraction, characterization and bioassay for larvicidal activity of some Philippine medicinal plants



The use of natural alternatives such as plant extract for the development of vector control measures for mosquito-borne diseases is considered as one of the best options since it is accept-

able to the populace, cost effective, and safe for the environment. Crude extraction of 79 plant materials found in different localities of the country and determination of their larvicidal activity was carried out. Bioassay for larvicidal activity of the crude ethanol and hexane extracts against 3rd and 4th instars larvae of the vector *Aedes aegypti* was conducted following WHO bioassay test method. Bioassay tests revealed that the alcoholic extract of *Anacardium occidentale* fruit kernel showed the most remarkable larvicidal activity at $LC_{50} = 8.11$

mg/L, followed by the hexane extracts of *Anona muricata* leaves ($LC_{50} = 25.99$ mg/L), *Curcuma longarhizomes* ($LC_{50} = 39.35$ mg/L), and *Cinnamomum mercadoi* bark ($LC_{50} = 40.34$ mg/L). The ethanolic extract of *A. muricata* was likewise found to exhibit remarkable activity with $LC_{50} = 48.23$ mg/L. Results showed that *A. occidentale*, *A. muricata*, *C. longa* and *C. mercadoi* have remarkable larvicidal properties among the Philippine medicinal plants with *A. occidentale* exhibiting the most highly toxic effect against the larvae of *A. aegypti*. ▽





■ Isolation and characterization of bioactive chemical substances from *Andrographis paniculata* (Sinta) herbs

Bioactive chemical substances from the leaves and young stems of Sinta herbs were isolated through polarity-based fractionation. Major fractions of hexane (H), dichloromethane (D) and butanol (B) were qualitatively characterized by TLC. The results showed fractions of H, D and B to have phenolic compounds, tannins and flavonoids while only the hexane fraction indicated presence of alkaloid. Fractions of H and D showed presence of glycosidic flavonoids, triterpenes and steroids, higher alcohols and phenols. Likewise, H and D fractions appeared to have steroids and saponins as shown by the presence of fluorescense/dark spots in TLC. Repeated chromatographic techniques and TLC were conducted to isolate pure compounds present in the sub-fractions. ■

■ Production of dome - type ceramic water filter

A dome-type ceramic water filter with anti-microbial agent was produced using red clay from Ilocos Sur. The filtered water collected using the dome-type ceramic water filter passed the microbiological criteria of the Philippine National Standards (PNS) for drinking water.

A memorandum of Agreement (MOA) between ITDI and Star Plastics, Inc. was also signed for the fabrication and production of 10,000 sets of plastic jug/pitcher with cover for the set-up/assembly of the pitcher-type water filter containing the dome-type ceramic filter.

The ceramic water filter systems were performance-tested at the Shelterville Resettlement Area in Vigan, Ilocos Sur. Microbial analysis of the filtered water from the systems passed the microbiological criteria of the Philippine National Standards for drinking water. Positive comments/observations were also obtained from



the beneficiaries some saying that the filtered water is clear and good for drinking, and can substitute for mineral water that could help lessen their expenses for mineral water. ■



Outcome 8:

S&T DISASTER PREPAREDNESS

Jarkko Mikkonen. Volunteers of the Philippine Red Cross pack food supplies for distribution.



Ready-to-Eat (RTE) chicken arroz caldo

RTE chicken arroz caldo is shelf stable for a year and is an ideal disaster mitigation/relief food that can immediately address hunger pains of disaster victims. It is ready-to-eat, needing no further preparation like adding water and heating which are often almost impossible to do because of utilities being cut off or destroyed during calamities.

Its packaging structure is lightweight and very handy, designed to withstand aerial distribution from about 800 to 1000 feet. Field testing and validation study of chicken arroz caldo using the DSWD's distribution protocols will soon be undertaken in collaboration with the Department of Social Welfare and Development (DSWD). Meanwhile, other RTE disaster preparation foods are also being developed. Process validation is on-going for chicken tocino rice meal, product development for beef tapa rice meal, and shelf life study for corn soup.



Financial Management

For 2013, the Institute's budgetary allotment amounted to PhP 338,490,103 broken down into:

- Personal Services (PS) with PhP 212,709,063;
- Maintenance and Other Operating Expenses (MOOE) with PhP 72,986,040; and
- Capital Outlay (CO) with PhP 52,795,000.

The largest allocation was for PS accounting for 63% of the total budget, followed by MOOE at 22%, and CO at 15% (Fig. 1). The PS allotment covered payments of terminal leaves of retirees and full implementation of the 2013 Magna Carta benefits. The CO is divided into Equipment Outlay at PhP 37,485,000.00 and Repair of Building at PhP 15,300,000.00.

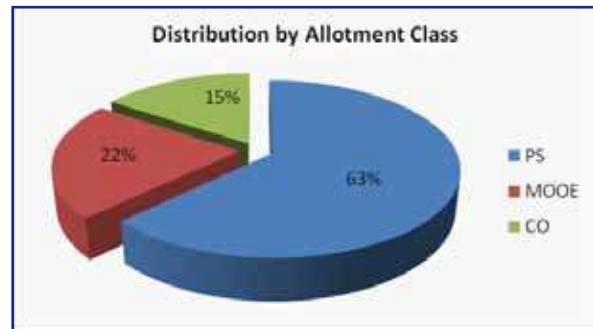


Figure 1. Graphical distribution by allotment Class

In terms of programs/projects/activities, 63% or PhP 213,248,765 was allocated for MFO1 or Research and Development; 10% or PhP 33,849,010 for MFO 2 or Technology Transfer and 27% or PhP 91,392,328 for MFO 3 or S&T Services (Fig. 2).

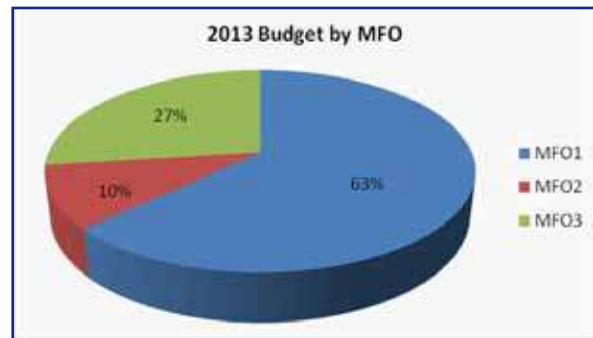


Figure 2. Graphical distribution of allotment by Major Final Outputs (MFOs)

Aside from GAA budget, ITDI received Grants-In-Aid (GIA) from DOST, other DOST agencies and various clients amounting to PhP 12,394,547.00, PhP 35,782,256.00 and PhP 7,182,210.00 respectively. Total resources received amounted to PhP 55,279,013.00 as shown in Figure 3. ▀

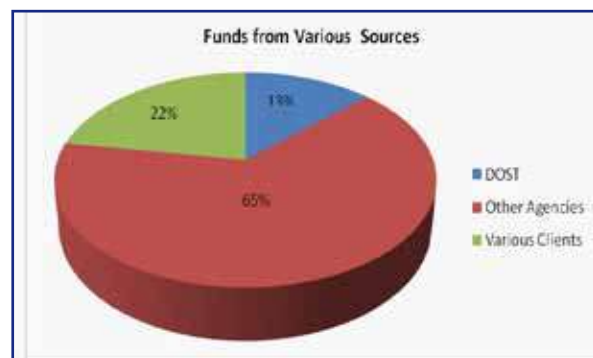


Figure 3. Resources Generated from Various Sources

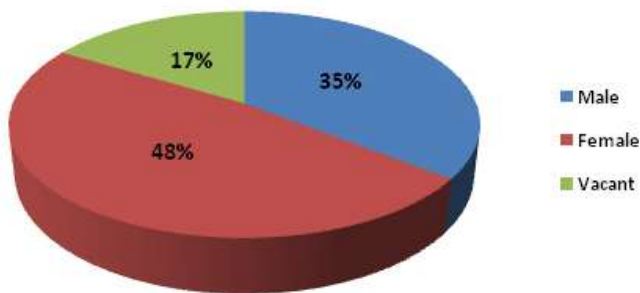
Human Resource Development

Manpower Profile

As of close of 2013, the ITDI's manpower profile distribution is as follows:

No. of Authorized Positions	369
No. of Filled Positions	308
No. of Unfilled Positions	61
No. of Contractual Employees	38
No. of Casuals	0
No. of Job Order	1

2013 Manpower Profile

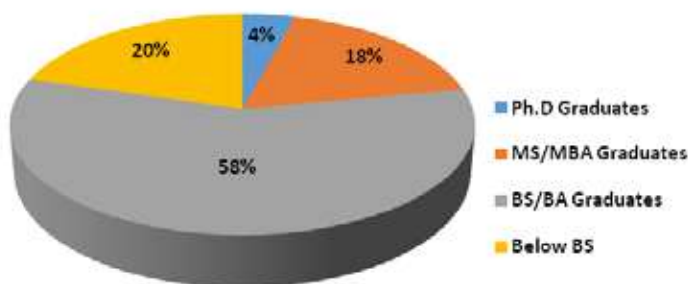


By gender numbers, 131 are male and 177 are female employees.

The workforce draws strength from its human resource' diverse educational attainment summarized as follows:

Ph.D. Graduates	13
MS/MA Graduates	55
BS/BA Graduates	177
Below BS	63

2013 Educational Profile



ITDI continued to enhance its manpower capacities through various forms of training and scholarships for advanced studies both for technical and non-technical staff. A total of 279 trainings/workshops/seminars were facilitated and attended, of which 106 were foreign and 173 were local. ▀

Awards



The Institute's award winning R&D works remained undisputed as these reaped awards/recognitions from reputable agencies in 2013, the honor brought home by its dedicated expert-researchers.

2013 DOST International Publication Awards (IPA)

■ Ms. Annabelle V. Briones, Chief SRS (Science Research Specialist), CED (Chemicals and Energy Division) for her paper, co-authored with Mr. Toshinori Sato, entitled, "Ability of Chitosan/Carrageenan Complex to Encapsulate Bovine Serum Albumin (BSA) for Potential Use in Protein Delivery." Granted its ISSN 2278-5957, the paper has been published in the Asian Journal of Biological and Life Sciences. 2(2): 163-169, 2013.



(L-R) Dir. Nuna E. Almanzor, USec. Fortunato T. dela Peña, A.V. Briones,

■ Dr. Marissa A. Paglicawan, SupSRS, with Chief SRS Dr. Blessie A. Basilia, Ms. Ma. Teresa V. Navarro (SSRS), and



(L-R) M.T. Navarro, Dr. M.A. Paglicawan, Dir. Nuna E. Almanzor, A.V. Briones, J. Pondevida, & C.E. Emolaga, all from ITDI

Mr. Carlo E. Emolaga (SRS I), all of MSD (Material Science Division), for their paper entitled, "Influence of Nanoclay on the Properties of Thermoplastic Starch/Polylactic Blends." The paper appeared in the Journal of Bio-based Materials and Bioenergy under ISSN 1556-6560.

■ Annabelle V. Briones, Chief SRS, CED; Hermelina H. Bion, Chief SRS, STD (Standards and Testing Division; Alicia G. Garbo, Senior SRS, STD; Edmar P. Casa, Senior SRS, MSD; Dr. Nuna E. Almanzor, ITDI Director; and Dr. Severino T. Bernardo, former ITDI Deputy Director for R&D; for their paper entitled



Dr. Lourdes J. Cruz, National Scientist, NAST, Annabelle V. Briones, Hermelina Bion, & ITDI Director, Dr. Nuna E. Almanzor

“Effects of Aqueous and Pelletized Admixture of *Piper nigrum L.* on the Oviposition Behavior of *Aedes aegypti* Mosquitoes and its Larvicidal-Ovicidal Activity”. Granted ISBN 0001-6071 and appeared in *Acta Medica Philippina*. 46(3): 55-58, 2012.

The awarding ceremony was held at the Traders Hotel Manila last December 12, 2013. The DOST IPA Awards are being given annually by the National Academy of Science and Technology (NAST), Philippines (NAST Phil), this time under the theme, “Evaluation and Improvement of the Research Publication and IP Productivity of the DOST R&D Institutes.”

Best R&D Paper, PCAARRD

■ Dr. Rosalinda C. Torres, Supervising SRS and Romulo R. Estrella, SA, CED for their paper entitled “Utilization of Mango Peels as Source of Pectin.” Awarded by PCAARRD on November 8, 2013, at Hotel Sofitel, Manila. ■



(L-R, 3rd, 4th) Dr. Rosalinda C. Torres and Romulo R. Estrella, ITDI

S&T Networks & Linkages

The image features a world map with the text "ITDI Linkages" overlaid at the bottom left. The map is color-coded by continent: North America (yellow), South America (green), Europe (orange), Africa (purple), Asia (red), and Australia (orange). Major oceans are labeled: Arctic OCEAN, North Atlantic OCEAN, Indian OCEAN, South Atlantic OCEAN, and South Pacific OCEAN. The map also shows Greenland (Denmark), Iceland, and Antarctica.

Surrounding the map are numerous logos of international organizations and institutions, including:

- Top Row:** ETV, Citem, PTB, DAkkS, NPL (National Physical Laboratory), DANETV, ETV, European Union, LNEC, ista.
- Left Side (Vertical):** NIST, fapas, ERA, ICETI, IFM (Quality Services), KAN, APLAC, CTS.
- Right Side (Vertical):** jica, JETRO, KIMS, KRIS, and several other national and regional logos.
- Bottom Row:** UNEP, nmisa, KIMIA, APCT, Australian Government AusAID, iaprs, NMIJ.

Annex 1
PUBLISHED TECHNICAL PAPERS
 2013

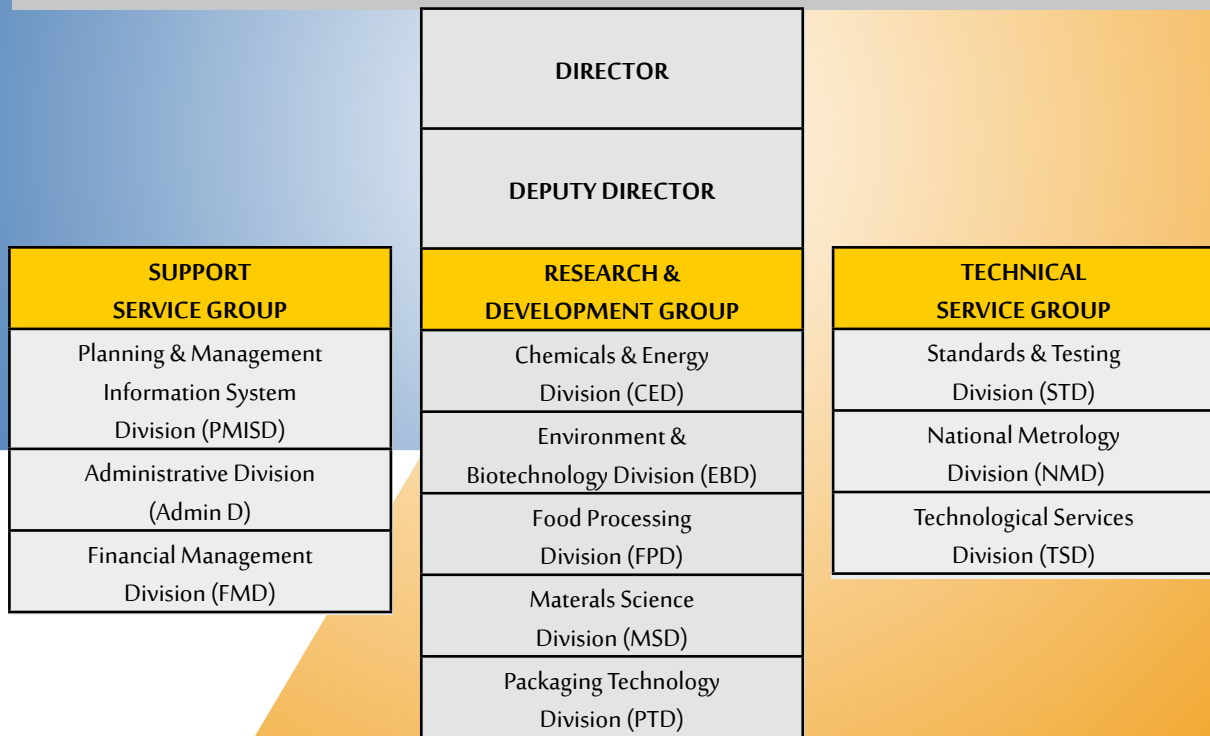
TITLE	PUBLICATION
Influence of Nanoclay on the Properties of Thermoplastic Starch/Polylactic Acid Blends (Dr. M. Paglicawan)	Journal of Biobased Materials and Bioenergy, vol 7, page 102-107, 2013
DOST-ITDI Energy Audit Technical Service (Joseph Herrera)	UP-IISI February 14, 2013
Field Testing of Ovicidal-Larvicidal Trap System with Pelletized Extracts of <i>Piper nigrum L.</i> for <i>Aedes</i> Mosquito in Quezon City and Marikina City - A. Briones	.In press, Acta Medica Philippina 2013 June 2013
Facile in situ Thermolytic Growth of ZnS Quantumdots Impolystyrene Matrix from Zin Pyrrolidine Dithiocarbamate as Single Source Precursor - M. Que, B. Basilia, et al.	Materials Letters Journal July 2013
Oil Removal Capacity of Nanoclay Materials for Industrial Wastewater Treatment - MSD	Accepted for the 2013 ICSET (International Conference) held in Manila, Philippines, September 30 - October 1, 2013
Effect of Alkali Treatment of <i>Eicchorinia crassipes</i> Fibers on the Properties of <i>Eicchorinia crasipes</i> /HDPE Biocomposite - MSD	Accepted for the 2013 ICSET (International Conference) held in Manila, Philippines September 30 - October 1, 2013.
Adsorption Properties of Bentonite and Activated Carbon in the Treatment of Oil-Seawater Emulsion - oral presentation (MSD)	Accepted for the 2013 ICSET (International Conference) held in Manila, Philippines September 30 - October 1, 2013
Structural Studies on Carrageenan Derived Oligosaccharides and Its Application	Advances in Chemical Engineering and Science (CES) doi:10.4236/aces. 2013; http://www.scirp.org/journal/aces In-press (accepted for publication) October 29, 2013
Dried Sea Cucumber	"Philippine National Standard PNS/BAFPS 128:2013 ICS 67.120.30"

Annex 2
R&D PROJECTS COMPLETED
2013

PROJECT TITLE	PROJECT LEADER
Development of VCO-Based Personal Care Products for Hair and Skin (PCHRD)	R.Torres
Improved Technology for Slow-Release Fertilizer	J. Pondevida
Synthesis of Eicosapentaenoic Acid from Crude Glycerol	L. Hermosura
Fertilizer Formulation for Coconut Using Salt Bitterns and Indigenous Materials	J. Pondevida
Utilization of Lyophilized Coconut Water for Personal Care Products	R.Torres
Isolation and Characterization of Bioactive Chemical Substances from <i>Andrographis paniculata</i> (Sinta) Herbs	R.Torres
Utilization of Acid Oil from Glycerin Refining in the Production of Methyl Ester using the Continuous Bio-Fuel Reactor	C. de Vera
Production of Refuse Derived Fuel (RDF) from Biomass-plastic Wastes as Alternative Fuel	A. Bawagan
Recovery of Phosphate in Glycerin from ME Production for Additives in Fertilizer	E. Genato
Characterization of <i>Calumpang</i> Seed as a Potential Source of Biofuels and other Oleochemicals	C. Bulan
Synthesis of Methyl Ester from Spent Coffee Grounds	L. Hermosura
Development of Fatty Acid Grafted Coir Dust as Oil Spill Adsorbent	A. V. Briones
Dietary Antioxidants from Plants	R. Torres
Design of an Energy Efficient Reactor & Boiler System & Adsorption/Desorption Set-up for Surface Modified Biomass AC as Adsorbent Materials & Application for Post-Combustion CO ₂ Capture	J. Herrera
Development of ITDI Database on Philippine Medicinal Plants	R. Torres
Molecular Characterization of EBD-developed and Isolated Microbial Strains	B. Conoza
Garbage/Waste Disposal Biogas and Composite Materials from Household Wastes	R. Esguerra
Bench-Scale Treatment of Leather Tanning Wastewater using ITDI - Isolated Microbes	S. Oredina
Conduct of Third Nation PCDD/PCDF Inventory in the Philippines	R. Esguerra
Bioremediation of Mercury-Contaminated Sites in ITDI	C. Gacho
Treatability Study of Wastewater Generated from ITDI Laboratory	C. Gacho
Development of a Bench-Scale Two-Stage Process for Biogas Production from Swine Waste Effluent	F. Cubol
Removal and Decomposition of Water-Soluble Diesel Oil Fraction by TiO ₂ Photocatalysis	G. Echavia
Development of Calcium Carbonate-Chitosan Composites from Wastes for Spill Treatment	E. Ongo
Development of Hazardous Waste Management Manual for ITDI	C. Gacho
Comparative Study on the Effect of the use of Different Additives in the Market on the Oxobiodegradation of Polyethylene Plastic Bags	G. Sikat
Isolation of Beneficial Microbes for the Biodegradation of Animal and Plant Oil in Fast Foods Wastewater Effluents	F. Coronado
Biological Treatment of Meat Processing Wastewater using Anaerobic Sequencing Batch Reactor	M. Tansengco
Identification and Characterization of Beneficial Microbes for the Biodegradation of Animal and Plant Oil in Fast Foods Wastewater Effluents	F. Coronado

PROJECT TITLE	PROJECT LEADER
Lab-Scale Treatment of Wastewater from Fast Foods Containing Oil and High Organic Pollutants	S. Oredina
Mass Transfer Rates During Vacuum Frying of Selected Fruits: Mango	N. Ambagan
Processing of Waste Coconut Water Generated by Copra Makers as Intermediate Raw Materials for Coco Beverages	M. E. Falco
Edible Film from Cassava and Sago and its Application	T. Palomares/A. Flores
Establishment of Processing Methods for the Production of Natural Sweetener from Nipa (<i>Nipa fruticans wurmb</i>)	C. Villaluz
Development of Restructured Steak	R. Gomez
Development of Natural Food Coloring	C. A. Bilbao
Evaluation of Quality Profile and Functional Properties of <i>Makapuno</i> (ECM and <i>Kabuwig</i>)	T. S. Palomares
Application of ITDI-Developed Food Service-Type Vacuum Fryer (FSTVF) in Food Establishment and their Selected Products	R. Belandres
Application of Developed Wine Barel on Local Wine and Spirit	O. Evangelista
Food Safety Assessment of Ready-to-eat (RTE) Spaghetti	J. V. Alejo
Establishment of a Food Safety System for <i>Sorbetes</i> (Pinoy or Dirty Ice Cream) Manufacture	L. S. Montevirgen
Development of Standards for Ethnic Foods: Ginger Brew	T. S. Palomares
Food Safety Assessment on the Sodium Content of Locally-Manufactured Cornick	M. E. Falco
Fabrication of Biomass-Fired Steam Kettle for the Production of Concentrated Coconut Water as Intermediate Material for Coconut Beverage	M. E. Falco
Determination of Corrosion Performance Properties of Zinc and Zinc Alloy Coated Steel Exposed under Different Types of Phil. Environment	A. Monsada
Atmospheric Corrosion Exposure Study of Structural Steel in Philippine Environment	A. Monsada
Modification of Natural Zeolite for Industrial Separation Process	J. Celorico
Development of Cellulose Acetate/ Chitosan Nanofibrous Membrane for Wastewater Treatment	E. Casa
Development of Disposable Foamed Food Containers and Cutleries from Biodegradable Nanocomposite	M. Paglicawan
Development of Silver-Filled Epoxy (SFE) / Halloysite Nanotube (HNT) Nanocomposites as Die Attach Material in Semiconductor Devices	B. Basilia
Formulation Optimization of Concrete Products using BETOCARB as Concrete Filler	J. Celorico
ADMATEL Phase 2 - Operation of ADMATEL (PCIEERD Assisted)	B. Basilia
Development of Electrospun Zeolite-Filled Composite Membrane for Biogas Quality Improvement	A. Calderon
Prototyping of Ceramic Based Micro-Filtration for Potable Water	J. Celorico
Production of Dome-Type Ceramic Water Filter	B. Basilia
Effect of Storage Time and Temperature on the Properties of Selected Flexible Materials	C. M. Bihis
Effect of Simulated Sunlight on the Safety of Low Density Polyethylene (LDPE) as Food Packaging Film	D. Alcarde
Development of Packaging Technology for Pork Lechon (Regular to GIA)	C. Bihis
Effects of Slots on the Compression Strength of Corrugated Board Panels	E. Orendain
Establishing Normal Reference Values for Hematology and Clinical Chemistry in Selected Animal Models: An Aid to Natural Drug Discovery	C. M. Nalo-Ochona
Design and Development of Process Equipment for Food Processing Firms (DOST-GIA)	N. Florendo

Organizational Chart



Key Officials



Seated L-R: **Dr. Janet F. Quizon**, Chief-FMD; **Engr. Reynaldo L. Esguerra**, Chief-EBD; **Dr. Nuna E. Almanzor**, Director-ITDI; **Engr. Melchor C. Valdecañas**, OIC-ODD; **Ms. Teresita Palomares**, OIC-FPD;
Standing L-R: **Ms. Daisy E. Tañanfran**, Chief-PTD; **Dr. Diana L. Ignacio**, Chief-Admin; **Ms. Lydia M. Ablaña**, Chief-PMISD; **Ms. Hermelina H. Bion**, Chief-STD; **Ms. Nelia Elisa C. Florendo**, Chief-TSD; **Ms. Annabelle V. Briones**, Chief-CED; **Ms. Aurora V. Kinura**, Chief-NMD; **Dr. Blessie A. Basilla**, Chief-MSD

About the Cover

The cover essays in action, ITDI's commitment in achieving the DOST Outcomes for improved productivity and competitiveness, and move up the value chain.



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