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**PAGTANAW 2050: Agham Tungo sa
Mabuting Kinabukasan**
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PAGTANAW 2050:

Agham Tungo sa Mabuting Kinabukasan
(*FORESIGHT 2050: Science for a Sustainable Future*)

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AGRICULTURAL SCIENCES

ASD – 01

ADAPTABILITY PERFORMANCE AND GRAIN QUALITY ASSESSMENT OF SALT-TOLERANT RICE VARIETIES IN SALINE-PRONE AREAS IN ILOCOS

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Soil salinity is considered a major abiotic stress that limits rice productivity. Saline affected areas in the country are continuously increasing as aggravated by climate change. One potential solution to alleviate the problems of salinity is through genetic improvements. This study aimed to determine the effects of salinity on the grain yield and grain quality of 25 Salinas varieties and PSB Rc 82 (check). Two field setups (saline and non-saline environment) were established in Sta. Maria, Ilocos Sur in 2019 wet season (WS). The experiments were laid out in a Randomized Complete Block Design in three replications. Grain samples weighing 300g per entry from the experiments were also analyzed in a laboratory for grain quality and sensory evaluation following the National Cooperative Testing (NCT) standard protocols. Results showed that salinity was very dynamic during the growing period ranging from 0.6 to 6.0 desi Siemens per meter (dS m⁻¹). Yield reduction due to salinity ranged from 42 to 76% which was correlated to the lower survival rate (52 to 95%) due to the combination of salinity and submergence at early tillering stage of the entries. Salinas 1, 16, and 21 significantly outyielded the check, PSB Rc 82 with 19 to 28% yield advantage. Productive tillers and number of filled grains were reduced by 19% and 13.6%, respectively. Significant reduction in the seed weight (15.4%) was also observed. Plant height was also reduced by 18.8%, with delayed heading and maturity days by 18.8 % or 16 days and 7.1 % or 8 days, respectively under saline. Brown rice and head rice recovery, grain width and shape (L/W) and percent immature grains were not significantly affected by salinity. On the other hand, salinity reduced the milled rice recovery by 1% to 7%, except for Salinas 11. Percent (%) chalky grains was also reduced by 24% to 91%. Shorter grains (1% to 7%) and apparently lower amylose content (0.2% to 6.7%AC) were observed under saline condition. Salinas 1 and 25 were the most-preferred variety by farmers during the Participatory Varietal Selection (PVS). In conclusion, salinity reduces rice grain yield, agronomic parameters, and other grain quality traits. However, this was compensated by increasing the value of produce due to higher quality (low chalk grains and amylose content).

Keywords: soil salinity, Salinas, desi Siemens, grain quality, participatory varietal selection

ASD – 02

MINERALIZATION RATE OF FERTILIZER-ENRICHED COCONUT HUSK BIOCHAR IN AN ACIDIC CLAY LOAM SOIL

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Mineralization is an important phenomenon in the soil, in which nutrient elements present in the organic matter are decomposed or oxidized into easily available forms to plants. Nitrogen is the most limiting and most in-demand nutrient for plant growth and development. Biochar has been advocated as a potential tailored technology for mediating soil conditions and improving crop yields. However, the efficacy of biochar and biochar-based amendments (e.g., composted biochar and enriched biochar fertilizers) in agricultural soils remain uncertain. This study aimed to determine the Ammonium-N and Nitrate-N mineralization rate of the fertilizer-enriched biochar (FEB) in an acidic clay loam soil, and to investigate the amount of carbon dioxide evolution (CO₂) in the FEB treated soil. The preparation and development of FEB was conducted by post-treating the coconut husk biochar with phosphoric acid and chemical fertilizers. The enrichment formulation resulted a chemical grade analysis of 15%, 8% and 10% for total Nitrogen (N), Phosphorus (P₂₀₅) and Potassium (K_{2O}), respectively. The study revealed that the soil applied with FEB demonstrated 26 to 60% higher CO₂ evolution than the coconut husk biochar (CHB); and 9 to 33 % higher than commercial mineral fertilizer (CMF), in 5 cumulative days. The study also found that the FEB had more ammonium-N and nitrate-N in the system, higher than CHB (90-96% NH₄⁺; 8-45% NO₃⁻) and CMF (44-52% NH₄⁺; 22-30% NO₃⁻) which is assumed to be released in the soil in synchrony with crop demands. Results such as these confirmed that biochar can function as a nutrient storage holding mineral nutrients in the pore spaces and in its surface. Moreover, these findings suggest that FEB can be an effective slow-release fertilizer and could minimize losses of nutrients in an agricultural system, hence, will help enhance soil fertility and crop yield.

Keywords: biochar, fertilizer enriched biochar, mineralization, slow-released fertilizer

ASD – 03

OPTIMIZING WATER REQUIREMENT FOR CITRUS PRODUCTION

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Effective soil water management for citrus involves application of appropriate quantity of irrigation at various stages of production through drip irrigation system. This system was applied in a citrus orchard located in Kasibu, Nueva Vizcaya, Philippines. The established local irrigation parameters in the area such as Field Capacity (FC) and permanent wilting point (PWP) which serves as basis on water management was utilized.

Five treatments were evaluated and laid out using Randomized Complete Block Design (RCBD) with three replications. The treatments were as follows: (1) Farmer's irrigation practice, (2) 100% soil moisture content, (3) 75% soil moisture content, (4) 50% soil moisture content, and (5) 25% soil moisture content. The soil moisture in all treatments were maintained starting from the flushing stage to fruit development and maturity.

Nine trees were observed for each treatment ensuing to a total of 135 citrus trees. To maintain the treatments, a drip irrigation system was installed in the experimental field. Using the soil moisture sensors, the depleted water in each experimental unit was replenished when they reach 50% of the required moisture level in each treatment. For the soil moisture sensors, the Decagon 5TE® was used. The sensors were stored in two depths: 0-30 cm, and >30 cm to serve as soil moisture monitors for the top and subsoil, respectively.

The fruit yield under the drip irrigation experiment after two primings that also includes the number of fruits harvested have shown that Treatment 3 recorded the highest with total yield of approximately 28,450 Kg. This is approximately 164% higher than the yield obtained in Treatment 1. Treatments 2, 4 and 5 also posted higher yield than the control with an increase of approximately 70%, 125% and 95%, respectively. If the yield is classified according to sizes from small, medium and large, similar trend is also observed in terms of the number of fruits harvested. Treatment 3 is higher than Treatment 1 at 130%, 311% and 155% in terms of the number of fruits harvested and classified as large, medium and small, respectively. If the proportion of yield by size is to be considered, there are a greater number of fruits classified as large followed by medium then small. This trend is also observed in all of the treatments. For Treatment 3, large fruits numbered at 4920 or 59% of the total, medium fruits numbered at 2760 or 33% and small at 672 or 8%.

The overall results of the study would simply imply that maintaining 75% soil moisture level will result to higher yield and irrespective of what size classification as compared to the current water management practice by the citrus farmers.

Keywords: field capacity (FC), permanent wilting point (PWP), soil moisture, water management

ASD – 04

PERFORMANCE EVALUATION OF SPECIAL RICE VARIETIES AS AFFECTED BY FERTILIZER RATES UNDER RAINFED LOWLAND CONDITION

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The demand for special rice is increasing day by day and to meet this demand, a boost in the production is needed. This can be attained through proper selection of varieties coupled by appropriate cultural management such as the use of adequate fertilizer to suffice the needed nutrients of the crop.

A field experiment laid out in Strip plot randomized complete block design was conducted in the College of Agriculture, Food and Sustainable Development, Mariano Marcos State University, City of Batac, Ilocos Norte during the wet season to evaluate the performance of selected special rice varieties (NSIC Rc218SR, 242SR, 304SR, MS-11 and Maluit) treated with five levels of fertilizer application (120-60-60, 90-30-30, 90-0-60, 90-60-0, and 0-0-0 (control)). The objectives were to evaluate the growth and yield performance, and grain quality of special rice under rainfed lowland, to identify the best special rice variety in terms of growth and grain yield, determine the optimum fertilizer rate that would give the best performance for the special rice and determine the costs and returns involved in producing special rice affected by fertilizer rates under rainfed lowland condition.

Results showed significant differences among varieties affected by varying fertilizer levels in terms of all measurable parameters. Plants applied 120-60-60 fertilizer recommendation grew taller at 45, 60 and 75 days after transplanting and has produced a greater number of tillers compared to the control. NSIC Rc218SR applied with 90-0-60 fertilizer rate produced the highest yield of over 6 tons per hectare. Organoleptic evaluation and consumer preference showed NSIC Rc304SR was most preferred for brown rice and NSIC Rc218SR for regular milled rice. NSIC Rc304SR had the highest percent milling recovery of up to 73%. Economic analysis showed that among the special rice varieties, NSIC Rc218SR applied with 90-0-60 fertilizer rate obtained the highest yield hence obtaining also the highest gross income (₱ 307,328.00), net income (per hectare; ₱ 252,482.00, per day; ₱ 2,055.55) and return above variable cost (₱ 4.65).

Keywords: special rice, fertilizer

ASD – 05

SLOW PYROLYSIS OF AGRICULTURAL WASTES AND BIOCHAR PRODUCTION: INNOVATIVE SOLUTIONS FOR WASTE MANAGEMENT AND IMPROVEMENT OF SOIL HEALTH IN MODERN FARMING SYSTEMS

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The use of copious organic biomass for biochar production is a promising waste management option, and biochar is used in carbon sequestration. Numerous research on biochar have been published and proven its beneficial characteristics in agriculture for soil health improvement as well as enhancing crop yield and productivity. Slow pyrolysis is the most preferred method to produce biochar which feedstock biomass is combusted in the absence of oxygen. This study aims to summarize the indispensable properties of biochar derived from organic wastes and assess the application of these products in modern farming systems. Biomass of plant (coconut husk, corn husk, corn cob, rice straw, rice hull) wastes and animal (cattle, swine) manures were produced from slow-pyrolysis biochar producing stove under temperatures ranging from 300°C to 650°C at different residence time. The macro- and micronutrient analyses of biochars were carried out using conventional procedures. The morphological characteristics and physicochemical properties of biochars were studied using material imaging techniques (Field Emission-Transmission Electron Microscope for surface morphological changes of biochars; Scanning Tunneling Electron Microscope Analysis in obtaining High Angle Annular Bright Field images and Brunauer-Emmett-Teller Automated Nitrogen Multilayer Physisorption system for physical properties) in ensemble with spectroscopic techniques (Energy Dispersive X-ray analysis on the areas of interest of each biochar samples). The present study showed that slow pyrolysis affects the differences in bio-product production (amounts of feedstocks, residence time and biochar yield) of different organic resources. The images demonstrated that mineral components inherent in each of the biochars could influence their properties and thus the applications in soil and water. The physical and chemical characteristics of biochars influence their effectiveness in controlling the retention/adsorption of nutrients. The organic carbon is predominantly high in cattle manure with 18.9% and the least carbon (8.8%) was found in corn cob. The porosity of all biochars was highly variable. Comparison among the variety of origins, the highest surface area and pore size are derived from coconut husk (107.2 mg₂/g and 31.5nm), followed by rice hull (78 mg₂/g and 1.93nm) and cattle manure (68.0 mg₂/g and 1.91nm), respectively. The study demonstrated the importance of understanding the mechanisms controlling the mineral components of biochars, soil characteristics and plant performances after application of biochars. This information is essential to address soil constraints to attain better soil health status in modern agriculture.

Keywords: inherent mineral, soil health, carbon, C sequestration, biochar imaging

ASD – 06

**TECHNOLOGY WITHOUT A GRAIN OF SALT:
DEVELOPMENT OF AN INTEGRATED CROP MANAGEMENT PACKAGE
FOR SALINE RICE AREAS IN ILOCOS**

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With the changing climate, soil salinity is expected to be one of the major factors affecting the agricultural productivity in the coming decades. The project aimed to develop an integrated crop management (ICM) for rice in saline areas with focus on variety performance, seedling age and plant density, fertilizer management, and pest management. Field experiments were established in non-saline and saline areas in Sta. Maria, Ilocos Sur in 2017WS to 2019WS. Results showed that salinity was very dynamic across season ranging from 0.08 to 11 dS/m in 2017WS to 2019WS. The lowest yield (1917±364.42 kg/ha) was obtained in 2019WS attributed to partial submergence and high salinity resulting in 52 to 95% survival rate. The average yield in 2017WS was higher at 3947±698.76kg/ha despite the high salinity readings because the plants were not submerged. In 2017WS, Salinas 11, 12, 19 and 20 produced significantly higher yield than both check varieties, PSB Rc82 and Bigante Plus under saline condition, with the highest yield from Salinas 20. Under saline condition, three varieties (Salinas 1, 16, and 21) had significantly outyielded PSB Rc82 during the 2019WS. The farmers' most preferred varieties under saline in 2017WS and 2019WS were Salinas 5 and Bigante plus (farmers' variety) and Salinas 1 and 25, respectively. Seedling age significantly affects the heading and maturity of the test varieties in both environments but not the yield. Using older seedlings (25 and 35 day old seedlings) had higher survival rate compared to the 18-day old seedlings. Meanwhile, younger seedlings transplanted also resulted to earlier heading and maturity. Moreover, planting distance had no significant effect on the yield of rice under saline condition. Applying 80-30-60kgNPK in three splits gave the highest net income, with relatively higher investment cost, but with corresponding highest grain yield. Lowering N by 20kg per hectare (80-30-30 NPK) resulted in at least 10% yield reduction. Doubling the K application in the 80-30-60 NPK treatment increased slightly the yield by 3-9%, though not statistically significant. The population and incidence of insect pests and diseases in saline areas were very low and cannot be considered as contributory factor on yield loss.

Keywords: integrated crop management (ICM), participatory varietal selection (PVS), salinas varieties, salinity, salinity dynamics

ASD – 07

ABACA VIRUS DETECTION APP (AVDA)**Clark L. Llanera¹, Christalline Joie Borjal¹, John Roy V. Galvez², and Leny C. Galvez¹**

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One of the challenges in the sustainable abaca production is the widespread occurrence of the viral diseases abaca which can occur in single or mixed infections. Early diagnosis of these viruses is a critical part of the disease management system. Most of the time diagnosis is being undertaken by a trained technicians and detection is being done in the laboratories. In order to capacitate abaca farmers and field technicians to immediately report symptomatic plants, an Android-based viral detection Application was developed utilizing convolutional neural network. More than 3000 images from Luzon, Visayas and Mindanao was collected to cover wide range of viral symptoms expression of abaca viruses. These images were annotated using the labelIMG, an open source graphical image annotation tool. The images were further trained on an existing model *ssd mobilenet v2 fpnlite 640x640* (Single Shot MultiBox Detector *mobilenet v2 Feature Pyramid Network lite 640x640*) using transfer learning and were deployed to App processes. The developed Abaca Virus Detection App was capable of simultaneous detection of symptoms of abaca and banana bunchy top virus (A/BBTV), Banana bract mosaic virus (BBrMV) and Sugarcane mosaic virus virus in abaca (SCMV-Ab) with the classification loss of 0.069642656. AbaVDA is user-friendly, downloadable for free and useful for monitoring and reporting of abaca disease in the field without needing internet connectivity.

Keywords: abaca viruses, machine learning, convolutional neural network, computer vision, virus detection

ASD – 08

COMPUTATIONAL IDENTIFICATION OF HIGHLY CONSERVED CD8+ T-CELL EPITOPES AGAINST PP62 POLYPROTEIN OF AFRICAN SWINE FEVER VIRUS

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The African Swine Fever Virus (ASFV) is the only known DNA arbovirus, belonging to a group of nucleocytoplasmic large DNA viruses (NCLDV) and Asfarviridae family. It infects domestic pigs and wild boars resulting in 100% mortality rate, leading to major socio-economic loss. Its notable characteristic is the use of its polyproteins to produce structural proteins. Prior studies suggest that ASFV's virulence stems from polyprotein pp62 expression for its viral assembly and core maturation. Thus, an immunoinformatics-based method was performed to identify highly conserved cytotoxic T-cell epitopes for pp62 that could be used for future ASFV studies. The amino acid sequences of pp62 were procured, clustered, and aligned. The aligned sequences were analyzed and highly conserved epitopes binding promiscuously to swine allele's major histocompatibility complex I (MHC I) were determined. Peptides with MHC IC₅₀ > 500 nM and negative proteasome and TAP scores were excluded. Cross-reactivity was analyzed by blasting the sequences. The obtained candidate epitopes were docked with the swine leukocyte antigen-1*0401 (SLA-1*0401). The dissociation constants, binding energies, and root mean square deviation (RMSD) from the molecular dynamics' simulation were compared with the positive control. The analysis identified 21 highly conserved epitopes wherein four (FINSTDFLY, GTDLYQSAM, STDFLYTAI, TLESLILPF) were validated and displayed immunogenicity in accordance with the parameters. In conclusion, results demonstrate that in silico analysis may be used to identify highly conserved CD8+ T-cell epitopes as part of future vaccine formulations for ASFV. However, results are yet to be validated in both future in vitro and in vivo studies.

Keywords: african swine fever virus, epitopes, pp62 polyprotein, computational approach, promiscuously binding CD8+ T-cell epitopes

ASD – 09

DIVERSITY OF 'CARABAO' MANGO FUNGAL ENDOPHYTES IN RELATION TO LASIODIPLODIA THEOBROMAE ENDOPHYTIC COLONIZATION

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Lasioidiplodia theobromae causing stem end rot (SER) colonizes mango tissues endophytically. However, there has been no study conducted on the diversity of fungal endophytes as co-colonizers of L. theobromae during growth and fruiting stages of mango. Thus, this research aims to determine the correlation of diversity of fungal endophytes to L. theobromae endophytic colonization in mango cv. Carabao during two fruiting seasons. Isolation of fungal endophytes was performed from the sequential samples in the flush, flower and fruit panicles of mango obtained from two fruiting seasons. Colonization frequency (CF) and colonization rate (CR) was computed to determine the frequency of endophytes across all growth stages and to estimate the abundance of fungal endophytes in a particular tissue or segment of mango, respectively. Endophyte diversity was determined using Shannon-Wiener diversity index (H'), and Evenness (E). Penicillium (CF: 14.86%) and Aspergillus (CF: 12.67%) showed the highest colonization frequency for the 1st and the 2nd fruiting season, respectively. Stage 7 in the 1st fruiting season and stage 4 in the 2nd fruiting season showed the highest CR value, 42% and 50%, respectively. The lowest CR value was detected from stage 5 (1%) in the 1st fruiting season and stage 6 (23%) in the 2nd fruiting season. There is low diversity (1st fruiting season- H' :1.93; 2nd fruiting season- H' : 1.63) of fungal endophytes for both fruiting seasons on Carabao mango. Endophytic colonization of Lasioidiplodia is not affected by the presence of fungal endophytes. Likewise fungal endophyte colonization is not influenced by fruiting season and growth stages.

Keywords: fungal diversity, colonization, stem end rot, fruiting season, evenness

ASD – 10

IMMUNOINFORMATICS-BASED IDENTIFICATION OF HIGHLY CONSERVED CYTOTOXIC T-CELL EPITOPES AGAINST PP220 OF AFRICAN SWINE FEVER VIRUS ASFV

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High mortality rate among pigs was reported in year 2020, due to re-emergence of a deadly disease called African Swine Fever (ASF) which has also led to transcontinental outbreaks in Europe, Asia, and Pacific. In response, different mitigation plans and preventive measures have been implemented in the affected areas; however, these measures have been inadequate to resolve the spread of the disease. Thus, a vaccine that will prime the immunity of swine against this pathogen is a dire necessity. In this study, in silico identification and characterization of highly conserved cytotoxic T-cell (CD8+) epitopes derived from one of the structural protein of African Swine Fever Virus (ASFV) known as pp220 were determined using several immunoinformatics tools. Protein sequences of pp220 were retrieved, clustered, and aligned to obtain highly conserved sequences. These highly conserved regions were subsequently examined to identify epitopes that promiscuously bind to the most widely distributed swine major histocompatibility complex I (MHC I) alleles. Cross-reactive epitopes with the swine proteome sequences were filtered out. The remaining epitopes were docked with swine leukocyte antigen-1*0401 (SLA1*0401). Binding energies and dissociation constants, as well as eigenvalues acquired through molecular dynamics, were determined to further analyze the stability of docked MHCI-epitope complexes. Acquired values were compared to values of the positive reference, influenza epitope complex. Results showed that 20 highly conserved epitopes promiscuously bind to two or more SLAs and 9 of which epitopes (ALDLSLIGF, QIYKTLLEY, FLNKSTQAY, IADAINQEF, IINPSITEY, AINTFMYYY, SLYPTQFDY, RSNPGSFYW, and RLDRKHILM) that were validated exhibit potential immunogenicity based on the acceptable binding energy, dissociation constant, and eigenvalues. Equally important, this study has identified epitopes that show high conservancy, reducing the chance of epitope immune evasion. . It is anticipated that the identified epitopes must be further evaluated through in vitro and in vivo experimentation as potent immunotherapeutic agent in development of epitope-based vaccine against ASFV.

Keywords: immunoinformatics, ASFV, epitopes, epitope mapping

ASD – 11

INFLUENCE OF CULTURE MEDIA AND INCUBATION PERIOD ON GROWTH AND CONIDIAL YIELD OF BEAUVERIA BASSIANA AND METARHIZIUM ANISOPLIAE

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The virulence and production of infective propagules of entomopathogenic fungi are necessary in the development and utilization of mycoinsecticide against insect pests of crops. Growing the fungus in artificial culture media is the primary step in mass production of entomopathogenic fungi. This research was undertaken to assess the growth and conidial production of two entomopathogenic fungi, *Beauveria bassiana* and *Metarhizium anisopliae*, in three commonly used artificial media in culturing these biological control agents. Growth and conidial yield of *B. bassiana* and *M. anisopliae* in potato dextrose agar (PDA), oatmeal agar (OA), and Sabouraud Dextrose Agar (SDA) were determined at 7 days interval up to 28 days of incubation. Fungal growth was observed 1-2 days of incubation. *B. bassiana* sporulated in PDA and OA at 4 days of incubation while at 5 days of incubation in SDA. *M. anisopliae* sporulated in PDA and SDA at 4 days of incubation while at 5 days of incubation in OA. *B. bassiana* had white colony growth whereas *M. anisopliae* had green conidial growth. However, the cultural growth of these fungi varied in artificial media in terms of elevation, form, surface, and margin. Profuse mycelial growth of *B. bassiana* was favored in SDA, however, conidial production was higher in PDA and OA. Growth and conidial production of *M. anisopliae* were significantly highest in SDA. Further incubation of culture plates reduced the conidial yield and germination of the entomopathogenic fungi. Conidial production of *B. bassiana* and *M. anisopliae* was optimum at 7 and 14 days of incubation, respectively. Findings of this experiment provided information on the appropriate artificial media and incubation period for the maximum conidial production of *B. bassiana* and *M. anisopliae* that are essential in the mass production of these entomopathogenic fungi.

Keywords: mass production, entomopathogenic fungi, pest management

ASD – 12

DESIGN AND CLONING STRATEGY FOR CONSTRUCTING SHRNA EXPRESSION VECTOR TARGETING THE INFLUENZA-LIKE RNA-DEPENDENT RNA POLYMERASE (RDRP) OF THE TILAPIA LAKE VIRUS

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Tilapia lake virus (TiLV), also known as syncytial hepatitis of tilapia (SHT), is the etiological agent of Tilapia Lake Virus disease (TiLVD). Globally, this emerging and transboundary disease can cause a mortality of 90% in tilapia cultures. The first outbreak of TiLVD in the Philippines was in 2017. To date, no comprehensive control measures have been developed worldwide despite belligerent efforts made using advanced technologies and molecular approaches. RNA interference (RNAi) technology is an emerging modern vaccine technology to suppress infection or replication of many pathogens that cause severe economic losses in fish farming. TiLV is a negative sense single stranded RNA virus with a genome length of about 10,323 kb. In this study, we are taking advantage of the fish cell's endogenous RNAi apparatus, where small interfering RNA of ~21-22 bp can be introduced into cells to induce target specific mRNA degradation. Short hairpin RNA (shRNA) sequences targeting the RdRP-like segment 1 of TiLV were designed. The shRNA, containing the RdRP sense and antisense sequences are connected by a loop, and transported from the nucleus into the cytoplasm where the enzyme Dicer processes it into small or short interfering RNAs (siRNAs). We also designed a vector expressing the shRNA by constructing a short, double-stranded DNA oligo encoding a sense-loop-antisense sequence to the segment 1 target gene. Five double-stranded oligo sequences were each cloned into the vector producing an RNAi cassette that expresses the shRNA. Recombinant constructs were validated using polymerase chain reaction and restriction enzyme digestion and for use in bioassays checking RNAi efficiency in tilapia populations exposed to TiLV. This RNAi-based strategy may provide a promising lead to combat TiLVD and contribute to aquaculture vaccine development.

Keywords: tilapia lake virus, RNA interference, shRNA, RdRP

ASD – 13

MOLECULAR DIFFERENTIATION AND HAPLOTYPE DIVERSITY OF NILE TILAPIA (*OREOCHROMIS NILOTICUS*, L. 1758) IEXCEL STRAIN

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Nile tilapia (*Oreochromis niloticus*) from Family Cichlidae, is one of the most cultured fish commodities in the Philippines. The Bureau of Fisheries and Aquatic Resources - National Freshwater Fisheries Technology Center (BFAR-NFFTC) known as the breeding nucleus for tilapia, produced improved breeds, namely: Improved ExCEL (iExCEL) tilapia, Improved Brackishwater Enhanced Selected Tilapia (iBEST) and COLD Tolerant Tilapia. iExCEL tilapia, dubbed as “EXCEL” (short for EXCELlent strain), is known for its enhanced growth, more disease resistant characteristic, higher survival, and ability to withstand temperature fluctuations. Phenotypic profile, molecular identity, and haplotype diversity of iExCEL tilapia are vital in establishing baseline data for improved DNA-based tilapia breeding protocols, stock conservation and aquaculture production. Morphometric characteristics of 20 iExCEL families with a total of 600 samples were analyzed using univariate (ANOVA) analysis of variance. Results showed high variability primarily along body measurements. For molecular divergence, 20 iExCEL fin samples were extracted and processed for mtDNA amplification using cytochrome b gene with an amplicon size of 1134 base pairs. Amplified PCR products were sent for sequencing and for molecular data analysis. Phylogenetic results revealed that 13 families were 99.71%-100% gene sequence similarity to *O. niloticus* Philippine strain, *O. niloticus* haplotype HAP 1, HAP 4, HAP 8, HAP 13, *Oreochromis* sp. red tilapia, *O. mossambicus*, and *Oreochromis* sp. KM-2006 from Philippines, China, and Japan correspondingly. There were also 2 families were closely related to *O. niloticus* Egypt strain and Family 5 (99.90%) revealed closeness to *O. niloticus* HAP 9 from China. In addition, it can be inferred that the remaining six (6) families of iExCEL gave a closer association to *O. niloticus* mitochondrion, *O. niloticus* HAP 2 and *O. niloticus* GIFT strain from the NCBI-GenBank with 99.60-99.90% similarity. Furthermore, genetic diversity analysis of iExCEL families was also performed using bioinformatic programs such as MEGA-X, DnaSP6 and PopART programs resulting to the identification of six (6) unique haplotypes indicating genetic variability.

Keywords: iExCEL tilapia, phylogenetic analysis, cytochrome-b gene, haplotype

ASD – 14

**ARE ORGANIC-LABELLED VEGETABLES REALLY ORGANIC?
PRESENCE OF PESTICIDE RESIDUES IN ORGANIC PRODUCE AND ITS
IMPLICATION ON FOOD SAFETY**

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Concerns for safe quality vegetables has led to the rise of organic farming in the Philippines. Currently, checking of the validity of organic-labelled produce to risks of possible pesticide contamination remains minimal. This issue is very important in protecting consumer safety and in ensuring quality of vegetables in the market. This study is centered on the monitoring of organic-labelled vegetables sold in Metro Manila for the detection of pesticide residues. A total of 162 samples were collected from selected supermarkets, stalls and one vegetable consolidator from 2016 to 2018. Samples were then screened by Rapid Bioassay for Pesticides Residues (RBPR), a quick enzymatic assay for detecting organophosphate (OP) and carbamate (CM) residues. Samples having >20% inhibition were considered positive of OP and/or CM pesticides. Few samples were then analyzed using gas chromatography-mass spectrometry (GC-MS) as a confirmatory test. Results showed that 16 out of 162 (9.88%) samples gave positive results to RBPR, with 5 samples having >50% inhibition. According to the GC-MS analysis, one sample contained pesticide residue concentrations exceeding the existing MRL. Overall, the study presented the presence of pesticide residues in some organic-labelled produce sold in the markets. The results emphasize the serious concern of possible mislabeling and fraud which can be deemed to pose risk on food safety considering the claim of being organic-labelled. There is a critical need for the continuous monitoring of pesticide residues even in organic-labeled crops and addressing effective systems for investigating and correcting these incidences.

Keywords: organic, organic-labelled, pesticide residues, food safety

ASD – 15

FOOD SPOILAGE-CAUSING BACTERIA INHIBITION: SYNBIOTIC EFFECT OF BIFIDOBACTERIUM SPECIES AND PILI (*CANARIUM OVATUM ENGL.*) POMACE AS POTENTIAL BIOPRESERVATIVES

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Supplementation of a prebiotic component to a probiotic, or as previous studies call it – synbiotics, was studied to assess the inhibitory potential against common food spoilage-causing bacteria via in vitro studies. This research utilized Bifidobacterium species and Pili (*Canarium ovatum* Engl.) Pomace Powder (PPP) as the prebiotic. Pure cultures of Bifidobacterium spp. (*B. bifidum* ATCC 29521 ®, *B. breve* ATCC 15700 ®, *B. infantis* ATCC 15697 ®, *B. adolescentis* ATCC 15703 ®, and *B. longum* ATCC 15707 ®) were obtained from Japan Collection of Microorganisms (JCM) RIKEN BioResource Research Center in Koyadai, Tsukuba-shi, Ibaraki, Japan while pili was sourced from Sorsogon City. Three food spoilage-causing bacteria were isolated from spoiled fruits. The prebiotic effect of PPP on the growth of Bifidobacterium spp. was analyzed through the comparison of Bifidobacterium consortium only, as the control vs the synbiotic mixture to establish its effect with food spoilage-causing bacteria expressed in pH, optical density (OD) and viability (log CFU/ml). Inhibitory capacity of this synbiotic mixture with food spoilage-causing bacteria was presented in % survival rates. Finally, antimicrobial substances produced by the synbiotic mixtures were identified.

Fermentation was observed by a significant lowering of pH values of the synbiotic mixture (3.67 ± 0.58) vs Bifidobacterium consortium alone (5.00 ± 0.00). Population density and viability of synbiotic mixtures ($OD = 1.09 \pm 0.10$; 9.37 ± 0.02 log CFU/ml) were also significantly greater than Bifidobacterium consortium alone ($OD = 0.12 \pm 0.03$; 9.18 ± 0.04 log CFU/ml). The inhibitory capacity of the food spoilage-causing bacteria vs. synbiotic mixtures grown in MRS broth with 1% PPP, shown as % survival rates [*Staphylococcus* spp. (35.34%) vs. synbiotic mixture (77.37%); *Enterobacter* spp. (44.85%) vs. synbiotic mixture (91.87%); and *Staphylococcus* spp. (56.68%) vs synbiotic mixture (85.81%)] were all observed to be lower than those of the synbiotic mixtures which survived after a period of incubation. In addition, there was no observed antimicrobial effect of given by PPP alone against the three food spoilage-causing bacteria. The antimicrobial substance responsible was found to be organic acids as the by-product of bifidobacterial fermentation.

The results of this study showed that the synbiotic mixtures of Bifidobacterium consortium and Philippine Pili (*Canarium ovatum* Engl.) Pomace were able to inhibit food spoilage-causing bacteria: *Staphylococcus* spp., *Enterobacter* spp., and *Streptococcus* spp. These findings suggest that this synbiotic mixture may have promising application in food biopreservation.

Keywords: bifidobacterium, probiotic, prebiotic, synbiotic, *Canarium ovatum*

ASD – 16

SUGARCANE PHENOLIC EXTRACTS AS SOURCE OF NATURAL ANTIOXIDANTS IN PRESERVING STORAGE QUALITY OF RAW GROUND PORK

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Lipids make the most of the desirable characteristics of meat, however, it is prone to oxidation primarily leading to deterioration of meat quality. Antioxidants are widely used in meat and meat products as an additive to preserve its quality from oxidative degradation during storage and processing. Naturally derived antioxidants have gained considerable attention in the food industry due to carcinogenic nature of some synthetic antioxidants. This study explored the use of sugarcane phenolic extracts (SCPE) as source of natural antioxidants for shelf-life stability and retardation of lipid oxidation in raw ground pork during storage. Phenolic extracts from sugarcane produced by Forever Nutriliving, Inc. (FNC) were analyzed for antioxidant activities using DPPH (2,2-diphenyl-1-picrylhydrazyl) and ABTS (2,2'-Azinobis-(3-Ethylbenzthiazolin-6-Sulfonic Acid)) radical scavenging activities, ferric reducing capacity, and lipid peroxidation inhibition assays. The phenolic extract showed radical scavenging activities against DPPH and ABTS with EC50 values of around 64-65 µg and 26-31 µg, respectively. Lipid peroxidation inhibition activity of SCPE samples revealed IC50 values of around 862-877 µg. Moreover, increasing concentration of these extracts up to 500 µg increases its ferric reducing capacity as measured by FeSO4 equivalent. The antioxidant effect of SCPE samples were evaluated in raw ground pork samples for 14 days at 4 °C. Different treatments were prepared: SCPE (100-400 mg/kg meat), butylated hydroxytoluene (BHT, positive control, 200 mg/kg meat) and control (no antioxidant added). Meat samples were analyzed for thiobarbaturic reactive substances (TBARS), metmyoglobin and haem iron contents, and color (L a* b*) values at defined sampling interval. Higher concentration of SCPE of up to 400 mg/kg meat showed to be efficient in delaying lipid oxidation of ground pork samples compared to BHT and control as determined by TBARS value. In addition, SCPE showed to be effective in inhibiting metmyoglobin formation, thus, stabilizing red meat color as exhibited by its color values and haem iron content. Hence, this study supports the use of natural antioxidants from sugarcane to improve lipid and color stability of raw ground pork during storage.

keywords: sugarcane phenolic extracts, lipid peroxidation, antioxidant activity

ASD – 17

HIGH QUALITY GENOME ASSEMBLIES OF TWO PHILIPPINE MANGOES ‘SWEET ELENA’ (*MANGIFERA INDICA* L.) AND ‘HUANI’ (*MANGIFERA ODORATA* GRIFF.) FOR MANGO GENETIC IMPROVEMENT AND GENE DISCOVERY

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Mango is one of the most important export fruit crops of the Philippines which provides major livelihood to around 2.5 million Filipino farmers and USD 91 million worth of export revenues. Here, we performed genome sequencing and assembly of two Philippine mango species, namely, ‘Sweet Elena’ (*Mangifera indica* L.), a strain of ‘Carabao’ mango and considered as one of the sweetest mango varieties in the world, and ‘Huani’ (*M. odorata* Griff.) which is believed to be a natural hybrid between *M. indica* and *M. foetida*. The mango genomes were sequenced using the PacBio Sequel II platform at ~250x coverage, then assembled and partially phased using FALCON and FALCON-Unzip, respectively. In *M. indica* cv. ‘Sweet Elena’, a diploid-aware genome assembly size of 366.2 Mb from 1,570 contigs was generated with N50 value of 548,183 bp. On the other hand, in *M. odorata*, a diploid-aware genome assembly size of 677.6 Mb from 3,855 contigs was generated with N50 value of 290,107 bp. Haplotigs representing the heterozygous regions of the diploid mango genome were also generated with assembly sizes of 235.8 Mb (N50=73,053 bp) in *M. indica* cv. ‘Sweet Elena’ and 247.9 Mb (N50=77,617 bp) in *M. odorata*. The genome completeness was evaluated in both genomes using BUSCO which showed >98% complete BUSCOs based on 1,614 plant-specific orthologs in the OrthoDB database. RNA-seq alignment using two mango transcriptome data from NCBI showed that 94-96% or 24-30 million reads were successfully mapped back to the generated genome assemblies indicating high degree of completeness. However, high rates of multi-mapped reads (~30%) were observed in *M. odorata* suggesting possible gene duplication events due to history of interspecific hybridization. With these results, the highly contiguous, phased, and near complete genome assemblies of *M. indica* cv. ‘Sweet Elena’ and *M. odorata* mangoes are established for structural and functional annotation of gene units, especially those with economic significance. These two high-quality reference genomes are the firsts in the Philippines which offer novel resources for genetic improvement and genomic studies of mango and related fruit species.

Keywords: genome assembly, genome sequencing, carabao mango, sweet elena, huani

ASD – 18

MULTILOCATION TRIAL OF SELECTED SPECIAL PURPOSE RICE GENOTYPES

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The response of each genotype or cultivar varies in every environment. The magnitude and patterns of genotype x environment interaction (GEI) is very important to be able to identify what specific or with relatively broader or wider range of adaptation of the rice genotypes across environment. Thus, through multilocation trial, this helps breeders to assess/identify the best performing special purpose rice (SPR) genotype/s for a specific location or in a wide range of agro-ecological conditions. The existing SPR genotypes developed by CLSU of the R & D teams namely; CLS-1, CLS-2, CLS-3, CLH 219, CLH 283-1, and CLH 295 were evaluated along with NSIC Rc 218 as a check variety in four locations (Science City of Muñoz and Guimba, Nueva Ecija, Tarlac and Zambales) in 2019-2020 DS and WS to identify SPR rice genotypes suitable for each location. The trials were laid out in RCBD with three replications. Pooled analysis of variance (ANOVA) was performed using the IRRI-STAR software and GGEbiplot v 4.1 for significant GEI and stability. Results of the combined ANOVA for grain yield for the seven genotypes of SPR in both seasons indicated highly significant ($P < 0.01$) for genotypes, environments and their interaction. The significant interaction indicated that the genotypes performed differently in different locations. The variation in grain yield of the SPR genotypes was largely contributed by the environment accounted to 75.02% while the variations due to genotype (G) and GEI were accounted to 9.43 and 13.02%, respectively. The result showed that CLS-2 was found to be the highest yielder in all locations, followed by CLH 219, CLH 283-1 and CLH 295. On the basis of the GGEbiplot, these varieties were more stable in all locations. CLS-2 was the most suitable for Tarlac and Muñoz, while CLH 219 and CLS-2 performed similarly at Guimba, while CLS-2 and CLH 219 at Zambales. Based on the trial, CLS-2 was found the most stable and desirable genotype and had wider range of adaptation across locations and seasons.

Keyword: genotype x environment, multilocation trial, special purpose rice

ASD – 19

GOLDEN RICE (PSB Rc82): GRAIN QUALITY, PROXIMATE COMPOSITION, AND CAROTENOIDS STABILITY OF THE FIRST BIOTECH RICE IN THE PHILIPPINES

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Vitamin A is known for its importance in preventing blindness but few people are aware of its critical role in strengthening resistance to infections/diseases that can lead to death. Despite food fortification, vitamin A supplementation, and promoting more consumption of fruits and vegetables, vitamin A deficiency (VAD) is still considered a significant public health concern in the Philippines. Thus, biofortification of rice with beta-carotene (provitamin A) was made to serve as a complementary approach to addressing VAD. Through the collaborative efforts of PhilRice and the International Rice Research Institute, the golden rice (GR) GR2E event has been successfully transferred to the popular variety PSB Rc82. This study aimed to compare the grain quality and proximate composition of PSB Rc82 GR and the background variety, and to evaluate the carotenoids stability upon storage. Two introgression lines (SO2 and SO4) and PSB Rc82 (control) were comprehensively characterized for milling recovery, physical attributes, color, physicochemical properties, cooking properties, texture, and proximate composition. The samples were packed in polyethylene, stored at room temperature for 12 weeks, and evaluated for carotenoids every two weeks. All samples had fair brown and premium total milled rice recovery. However, the two lines had medium and intermediate grains while the control were long and slender. They had intermediate amylose content with no significant difference in the gelatinization temperature. The samples had similar cooking water, cooking time, and weight increase. SO2 (1.53kg/cm²) and the control (1.51kg/cm²) had soft Instron texture but SO4 (1.98kg/cm²) was medium. No substantial change was observed in the proximate composition (moisture, fiber, fat, ash, and carbohydrates) except for the higher protein of SO4 (20.1%) than the other two (18.00-18.80%). Due to their distinct golden color, the introgression lines had significantly different color values: L*, lightness (SO2-73.56, SO4-71.15, Control-77.60), a*, redness (SO2-8.75, SO4-8.49, Control-0.64), and b*, yellowness (SO2-34.96, SO4-34.27, Control-15.06). For the most important trait, the carotenoids of SO2 (6.0 µg/g) and SO4 (5.8 µg/g) were significantly higher than the control (0.4 µg/g). Upon two weeks of storage, 25% (SO2) and 17% (SO4) reduction in carotenoids were observed but the values remained fairly constant throughout 12 weeks. This study showed that the introgression of GR2E to PSB Rc82 was successful as exemplified by the presence of the golden color and carotenoids, which can provide 30-50% vitamin A estimated average requirement from 1-2 cups cooked rice. Moreover, the generally similar grain quality and proximate composition with PSB Rc82 will ensure consumer acceptability. With the recent world's first approval for commercial propagation of GR, it offers a golden opportunity to become an effective delivery vehicle of vitamin A for better vision, stronger immune system, and healthier life of the Filipinos.

Keywords: golden rice, carotenoids, grain quality, proximate composition

ASD – 20

LOW COST VEGAN COOKIE: A SCHOOL FEEDING PROGRAM SNACKS FOR PHILIPPINE PUBLIC ELEMENTARY SCHOOLS

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The purpose of the study is to formulate an affordable feeding program food component which is appetizing to elementary pupils while utilizing non-animal product ingredients composed of sweet potato, margarine, sugar, vegetable, baking powder, baking soda and sea salt. An experimental and descriptive research is used to analyze quantitatively the iron, calcium and Vitamin B6 (pyridoxine HCl) micronutrient content of the cookies. The micronutrient mentioned is the identical micronutrient present in the Nutribun, a bread created by the USAID Food for Peace Program to alleviate the childhood malnutrition in the Philippines between 1968 and 1970. Conventional flour was substituted by sweet potato flour considering that it has iron, calcium, and Vitamin B6. The result shows that the cookie developed is extremely acceptable in terms of aroma, appearance, taste, and texture. Individually, the cookie weighs 170 grams and costs Php3.46. As for the laboratory result, the Calcium is 64.9 mg/kg and Iron resulted to 7.49 mg/kg with the same method of atomic absorption. The Vitamin B6 (as Pyridoxine HCl) resulted to 0.34 with a test method by high performance liquid chromatography. The RENI percentage of Calcium is 11.8%, Iron resulted to 83.2% and Vitamin B6 resulted to 34%. Thus, this cookie is recommended to the Department of Education as a feeding program component for Philippine Public Elementary Schools with majority of the students who are malnourished considering the sensory evaluation result and nutritional content of the Low-Cost Vegan Cookie.

Keywords: cookie, vegan food, sweet potato, feeding program food, low-cost cookie

BIOLOGICAL SCIENCES

BSD – 01

ANALYSIS OF LAND SURFACE TEMPERATURE, VEGETATION INDEX, AND BUILT-UP INDEX OF RIZAL PROVINCE, PHILIPPINES USING LANDSAT IMAGERY

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Rizal Province is undergoing urbanization processes and was subjected to major deforestation and land-grabbing practices throughout the years. To quantify the different environmental considerations that remained undocumented and unmapped for the area, this study utilized Landsat imagery and calculated three parameters namely, (i) Land surface temperature (LST), (ii) Normalized Difference Vegetation Index (NDVI), and (iii) the Normalized Difference Built-up Index (NDBI). Our result showed the following: (i) an increase in the vegetation cover from 1993-2000 showed a decrease in LST, (ii) the relationship between LST and NDBI is directly proportional, and (iii) there is a fluctuating LST due to the changes in the landcover of the study site for almost three decades. This implicates the extensive shift in the ambient temperature of Rizal which can further support the increase or decrease of certain land use land cover classifications. Substantial alterations in terms of the land cover with the decline or increase in vegetation brought about by anthropogenic and natural factors impact heat emission of land surface temperature.

Keywords: GIS, landscape ecology, remote sensing, satellite-based mapping, UHI

BSD – 02

CYTOTOXICITY OF EDIBLE PHILIPPINE MUSHROOM *OUDEMANSIELLA CANARI* EXTRACT ON HEMATOLOGIC MALIGNANT CELLS THROUGH ACTIVATION OF APOPTOSIS

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Cancer is one of the leading causes of death worldwide. Treatment of cancer is a formidable challenge and there is an urgent need to identify safe and efficacious agents. Mushrooms are important sources of pharmacologically-active metabolites including cytotoxic compounds. The Philippines is rich in macrofungal diversity which remains pharmacologically unexplored. Here, we report the cytotoxicity of *Oudemansiella canarii* (Jungh.) Höhn. extract against hematologic malignant cells and describe its molecular mechanisms. A total of nine hematologic malignant cell lines were exposed to the different concentrations of mushroom ethanol extract for 48 h and the cell proliferation and apoptosis parameters were determined. Western blot analysis was performed to determine the extract-induced changes in the level of apoptotic-related proteins of cancer cell lines and patient-derived mononuclear cells. Results revealed that *O. canarii* extract exhibited cytotoxicity with IC₅₀ values of 51.3 - 66.0 ppm in three acute myeloid leukemia cells, 26.8 - 62.2 ppm in three lymphoma cells, and 31.1 - 35.9 ppm in three multiple myeloma cells. Mushroom extract inhibited cell proliferation by 57.3-72.5%, which correlates to the activation of apoptosis as indicated by increase in annexin V-positive cells (68.2 - 82.5%), cells in sub G₀/G₁ phase (59.8 - 87.5%), production of reactive oxygen species (2.96 - 7.42-fold), and monomer/aggregate ratio (0.64 - 5.95), suggesting collapsed mitochondrial membrane potential. Western blot analysis showed increase in the expression of apoptotic markers (PARP1, caspase 3 and histone 2AX) and activation of the stress-activated protein kinase (SAPK/JNK) signaling pathway. The *O. canarii* activated apoptosis was also observed in mononuclear cells from the peripheral blood of the patients with leukemia and lymphoma. In conclusion, activation of pro-apoptotic markers is one of the mechanisms of cytotoxicity of *O. canarii* extract against hematologic malignant cells.

Keywords: Philippine *Oudemansiella* mushroom, hematologic diseases, apoptosis, SAPK/JNK signaling pathway

BSD – 03

FUNCTIONAL ANNOTATION OF AFRICAN SWINE FEVER VIRUS HYPOTHETICAL PROTEINS REVEALS THEIR ESSENTIAL ROLES IN DNA REPLICATION AND REPAIR: AN IN SILICO STUDY

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An effective treatment or vaccine against the African swine fever virus (ASFV) remains elusive, requiring a deeper understanding of the molecular biology of ASFV pathogenesis. For the first time, hypothetical proteins (HPs) of ASFV, which comprise 13% of the viral proteome, have been characterized. A total of 4,643 HP sequences of ASFV were data-mined and functionally annotated using in silico tools. ASFV-Sus scrofa (pig) protein-protein interactions (PPI), sub-cellular localization, homology models, and phylogenetic relationships with known proteins were studied. Of the 95 HPs with PFAM domains covering at least 50% of the protein, gene ontology terms were associated with the DNA repair and replication pathways: pyrimidine metabolism, drug metabolism, DNA replication, base excision repair, nucleotide excision repair, mismatch repair, and homologous recombination. Three HPs were phylogenetically related to ribonucleoside diphosphate reductase subunit 1, ribonucleoside diphosphate reductase subunit 2, and thymidine kinase. The importance of a highly efficient DNA replication mechanism by this double-stranded DNA virus underscored in the study is consistent with its high risk of transmission and pathogenesis where the pig host dies within just one week after infection.

Keywords: ASFV, hypothetical proteins, bioinformatics, pathway reconstruction, protein modelling

BSD – 04

ISOTHERMAL AMPLIFICATION PLATFORMS FOR BIOSENSING PATHOGENS *LEPTOSPIRA* SPECIES IN FLOOD AND ENVIRONMENTAL WATER

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Detecting the occurrence of pathogenic *Leptospira* spp. is vital for public health implications and epidemiological studies. Different isothermal-based techniques attributed to loop-mediated isothermal amplification (LAMP) to detect *Leptospira* spp. in black rats and spiked environmental waters were evaluated. The platforms were designed to detect the lipL32 gene encoding the major outer membrane lipoprotein of *Leptospira* spp. Standard and direct dry isothermal technique platforms exhibited high specificity. Analytical sensitivity was validated through 10.5 fg or 1×10^{-8} and 105 fg or 1×10^{-7} , respectively. In spiked flood water, assays revealed favorable results. Overall, the dry LAMP technique developed has proven a confirmatory on-site test for the target *Leptospira* spp. present in its host, flood, and environmental waters perfectly applicable in developing countries.

Keywords: isothermal amplification platforms; on-site biosensor, *Leptospira* species, environmental and floodwater

BSD – 05

**MOLECULAR BIODISCOVERY OF NOVEL ANTI-PROLIFERATIVE AND
CYTOTOXIC CYTOCHALASIN DERIVATIVES FROM *DOTHIDEOMYCETE*
FUNGUS, *SPARTICOLA TRISEPTATA***

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The monophyletic *Dothideomycetes* is the most diverse and one of the largest classes of Ascomycota. Several fungal metabolites possessing distinct molecular framework with significant bioactivities have been reported, yet natural products originated from plant-associated fungi remain untapped. The exploration study in the plant genera of *Tofieldia* has led to the isolation and structure identification of the chemical constituents that represent the first metabolites of an Alpine asphodel inhabiting saprobic fungus, *Sparticola triseptata*. Axenic solid rice fermentation afforded two novel rearranged cytochalasin derivatives, triseptatins A (1) and B (2), along with the known metabolite, cytochalasin B (3). The planar structures were elucidated through extensive NMR spectroscopic analysis, supported by high-resolution mass spectrometry (HRMS). The absolute configurations were determined using Time-Dependent Density Functional Theory (TDDFT) and electronic circular dichroism (ECD) experiments. In vitro biological assays revealed that compounds 1 and 2 exhibit promising cytotoxic activity against several mammalian cell lines, namely, myelogenous leukemia K-562, mouse fibroblasts L929, HeLa cells KB3.1, squamous carcinoma A431, human lung carcinoma A549, ovarian carcinoma SKOV-3, human prostate cancer PC-3, and human breast adenocarcinoma MCF-7 carcinoma cell lines with IC₅₀ values ranging from 1.55 to 11.28 μ M. In addition, the isolated cytochalasins 1–3 displayed moderate antiproliferative effect against leukemia K-562 cancer cell line with IC₅₀ values ranging from 3.34 to 8.31 μ M. Our findings establish the potential of cytochalasin derivatives as a possible drug inspiration for discovering new chemotherapeutic agents.

Keywords: *Sparticola triseptata*, structure elucidation, ECD-TDDFT, antiproliferative, cytotoxic

BSD – 06

PRODUCTION OF HIGHLY-DEACTYLATED CHITOSANS FROM *GANODERMA LUCIDUM* AND *RHIZOPUS ORYZAE*

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This paper describes the production of highly-deacetylated chitosan from locally sourced fungi *Ganoderma lucidum* and *Rhizopus oryzae*. The fungal species were identified using ITS sequence-based DNA barcoding. The production of chitosan starts from the culturing *G. lucidum* and *R. oryzae* in potato dextrose broth (PDB) for 7 and 21 days. Mycelial biomasses were processed into chitosan using a modified procedure that includes heat sterilization, deproteinization, demineralization, decoloration, and deacetylation. The Fourier Transform Infrared (FTIR) spectra of *R. oryzae* chitosan matched the precursor, poly-N-acetylglucosamine (chitin) with a Hit-Quality Index (HQI) of 80.29. *G. lucidum* chitosan FTIR spectra matched reference spectra of chitosan and poly-N-acetylglucosamine (chitin) with HQIs of 78.28 and 85.06 respectively. The degree of deacetylation (DD), one important parameter to characterize chitosan of the *R. oryzae* and *G. lucidum* chitosans were estimated at 98% and 87% respectively based on its Amide III (C-H stretch) band at 1320 cm⁻¹ and the methyl group (C-H bend) at 1420 cm⁻¹ reference band. Above 50% DD can be considered chitosan and the sought-after high-deacetylated chitosan can be produced from fungal sources which are *Ganoderma lucidum* and *Rhizopus oryzae*. Highly-deacetylated fungal chitosan is recommended in various studies and can suggest greater potential applications.

Keywords: chitosan, FTIR, deacetylation degree, *Rhizopus oryzae*, *Ganoderma lucidum*

BSD – 07

RISK ASSESSMENT OF SCHISTOSOMIASIS IN THE PHILIPPINES: AN ECOLOGICAL NICHE MODEL APPROACH

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Schistosomiasis remains a major public health concern affecting approximately 12 million people in the Philippines due to inadequate information about the disease and the lack of prevention and control efforts. *Schistosoma japonicum*, one of the causative agents of the disease, requires an amphibious snail, *Oncomelania hupensis quadrasi* (*O. h. quadrasi*), to complete its life cycle. The study aims to monitor the prevalence and density of schistosomiasis through predicting the potential high-risk habitats of *O. h. quadrasi* driven by environmental factors in the Philippines. Snail occurrence data were assessed and obtained from a biodiversity database and extracted from 18 journals. Risk mapping and predictive modeling were performed using the geographical information system (GIS) and the maximum entropy (MaxEnt) ecological niche modeling tools with 19 bioclimatic variables (temperature and precipitation) incorporated and downloaded from Worldclim database. A very high-performance model was generated (AUC= 0.907) with the mean temperature of driest quarter (25.3%) contributing significantly to the species distribution of *O. h. quadrasi*. Focal distribution of *S. japonicum* and *O. h. quadrasi* have high endemicity in areas with a pronounced wet season and high precipitation throughout the year. However, the findings provided evidence for snail adaptation to different environmental conditions. High suitability of snail habitats were found in Quezon, Camarines Norte, Camarines Sur, Albay, Sorsogon, Northern Samar, Eastern Samar, Leyte, Bohol, Surigao del Norte, Surigao del Sur, Agusan del Norte, Davao del Norte, North Cotabato, Lanao del Norte, Misamis Occidental, and Zamboanga del Sur. Furthermore, snail habitat establishment includes natural and man-made waterlogged areas. Climate fluctuation influences schistosomiasis transmission by affecting the snail and schistosome production, survival, and fecundity rate. The mean temperature of driest quarter majorly affected the distribution of *O. h. quadrasi* in the Philippines with temperatures ranging from 23°C- 29°C. Model developments predicting population dynamics of the parasite and the intermediate host, and mapping the locations where climate change can significantly impact disease transmission are essential in the prevention and control management of the disease. Although cases were lessened, schistosomiasis in the Philippines is still not completely eliminated.

Keywords: ecological niche, *Oncomelania hupensis quadrasi*, predictive model

BSD – 08

TAXONOMIC AND FUNCTIONAL DIVERSITY OF BENTHIC MACROINVERTEBRATES REVEALS HOW THE MARIKINA WATERSHED EXHIBITS THE SOUTHERN URBAN HYDROSYSTEM SYNDROME

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Urban-related activities have long been recognized to generate environmental stressors that increasingly imperil the bio-physicochemical conditions of lotic ecosystems. Although this general pattern is globally observable, the Southern Urban Hydrosystem Syndrome emphasizes the severity of the intensified environmental pressures and impacts experienced by the tropical rivers of developing countries. To examine the state of an urban-impacted river of a developing tropical country, this study aimed to examine the shift in the taxonomic and functional structure of benthic macroinvertebrates through the different environmental variables and land-use practices in the Marikina Watershed. A total of 21 stream sites in the Marikina Watershed with different land use classifications (7 undisturbed, 7 agricultural, and 7 residential) and its corresponding environmental and macroinvertebrates' taxonomic data ($n = 4739$) were analyzed. The identified macroinvertebrates were classified into their respective functional feeding groups (FFGs) using relevant articles and sources. Ultimately, multivariate analyses explained the possible relationships between variables. Post hoc and canonical correlation analysis results revealed that undisturbed sites hold the highest taxon richness ($p = 0.02$) and diversity indices ($p < 0.01$) and constitutes sensitive taxa such as *Afronurus* sp. as a result of its significantly higher dissolved oxygen (DO) ($p = 0.02$) and pH ($p = 0.02$) levels than residential and agricultural sites, respectively. By contrast, residential sites were represented by pollution-tolerant taxa such as *Chironomus* sp. and are signified by its lower DO ($p = 0.02$) and higher mean (\pm SE) conductivity (348.81 ± 42.20) levels indicating a disturbed stream condition. Significant differences in the FFGs percent abundance were observed among land uses except for shredders (SH). Collector-filterers (CF) were the most abundant in undisturbed sites ($p = 0.03$), scrapers (SC) ($p = 0.01$) and predators (PR) ($p = 0.02$) for agricultural sites, while collector-gatherers (CG) dominated the residential sites ($p = 0.01$). The redundancy analysis tri-plot provided evidence on how the trophic structure was altered by the riparian modified areas, as evident in the distinction of the undisturbed sites from the agricultural and residential sites. CF, CG, SH, and PR characterized the fast-flowing undisturbed streams, whereas the highly elevated agricultural streams having minor signs of contamination were associated with the presence of SC. Overall, the Marikina Watershed effectively illustrates how a tropical stream ecosystem in the Global South responds to the impacts of ongoing urbanization.

Keywords: functional feeding group, longitudinal variation, Philippines, urban ecology

**ENGINEERING
SCIENCES AND
TECHNOLOGY**

EST – 01

A MULTI-PERIOD MATHEMATICAL PROGRAMMING MODEL FOR IMPLEMENTING NEGATIVE EMISSION TECHNOLOGIES (NETS) PORTFOLIOS WITH FUZZY TARGETS

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Negative Emission Technologies (NETs) will help in economically achieving carbon neutrality by the end of the 21st century to maintain the global temperature increase within the Paris limits. NETs like bioenergy with carbon capture and storage (BECCS), afforestation/reforestation (AR), soil carbon sequestration (SCS), biochar (BC), enhanced weathering (EW), and direct air capture (DAC), remove carbon dioxide from the atmosphere through photosynthesis or chemical reactions and deposit them in biomass or geological storage. The IPCC reported based on physical science that the wide-scale implementation of NETs has the potential to offset residual emissions from fossil fuels. However, the wide-scale implementation of NETs throughout the 21st century will have environmental impacts that need to be managed. In this work, a mathematical program is used to optimize the implementation of a NETs portfolio in a multi-period model by considering technological readiness, varying lifespans, and environmental footprint of NETs. Limitations on the annual available land, water, energy, nutrients, and financial resources were considered as constraints in the model. A fuzzy negative emissions target was also implemented to consider the uncertainties in the target. An illustrative case study demonstrates the performance of the model using literature data. The optimal results show varying NETs are selected in different periods and that the model successfully met all the constraints.

Keywords: negative emissions technologies, linear programming, climate change, carbon sequestration, optimization

EST – 02

CHARACTERIZATION OF HEAT-TREATED DIATOMACEOUS EARTH: ITS POTENTIAL APPLICATION AS LIGHTWEIGHT AGGREGATE MATERIALS IN THE CONSTRUCTION INDUSTRY

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Diatomaceous earth (DE) is a naturally occurring material and it possesses excellent physical properties e.g. low density, high porosity, and mechanical strength when heated.

In this study, the heating was set to 850oC at 4.60oC/min. The material preparation and physical testing: moisture content (MC), total linear shrinkage (TLS), modulus of rupture (MOR), apparent porosity (AP), and bulk density (ρ) were done following ASTM Designation: C133-97 (1915) standards. The particle size (PS) was determined using Nanopartica-dynamic light scattering (DLS) analysis. The mineralogy, morphology, and chemical analysis were characterized using X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and X-ray Fluorescence (XRF) techniques.

The material was slightly wet containing moisture (MC) of 9.28% based on SMAPI. It has an average PS of 41.37nm, which is finer than 2000nm for an ideal clay particle size. The TLS (7.93%) was within the marginal limits for an earthenware body. The MOR (874.77 kPa) was above the minimum as defined by ASTM (827 kPa) for lightweight aggregates. The mechanical strength was attributed to the presence of kaolinite ($Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$), and Quartz (SiO_2) minerals in the sample as shown in the XRD graphs. The AP (61.57%) was above the minimum set by the ASTM standards of 45%. The pores were originated from the array of fossilized diatom cells as revealed by SEM images. The sample was too light and able to float on water for ~1.5 mins before saturation. This was due to the excessive number of light elements present as detected in XRF analysis. It has an average bulk density of 0.92 ± 0.11 g/cm³. Thus, the material has high potential use as lightweight aggregates supplement in the construction industry.

Keywords: diatomaceous earth, lightweight aggregate, porosity, density

EST – 03

EFFECT OF HOT OIL TREATMENT ON GIANT BAMBOO'S BOND STRENGTH

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The effect of hot oil treatment (HOT) on the bonding strength of giant bamboo [*Dendrocalamus asper* (Schult.) Backer] was investigated to determine how adhesion of the slats used for engineered bamboo production was affected. HOT was performed using a fabricated oil chamber where 8 ft long bamboo poles were submerged in spent cooking oil and exposed to 175°C and 200°C temperature for 30 min. Oil-treated bamboo poles were rip-sawn, planed and sanded to produce slats prior to lamination. The slats were glued on tangential face using different commercial adhesives [polyvinyl acetate (PVAc), polyurethane (PUR), urea formaldehyde (UF), and phenol formaldehyde (PF)]; glue spreads (100, 150, and 200 g/m²), and surface pairing combinations, i.e., outer-outer (O-O), inner-inner (I-I), outer-inner, (O-I) based on whether the bamboo slats were from the culm's outer or inner wall. Results showed the brownish color of the treated slats increased in intensity with rising temperature (control < 175 °C < 200°C). Laminates glued with PUR showed the strongest shear strength, followed by PF, UF and PVAc. HOT did not affect bond shear strength at 175°C but significantly reduced at 200°C. Generally, glue spread had little to no effect on bond strength for all adhesives. Among the surface pairing combinations, O-O showed the highest bond strength and I-I the lowest. Overall, oil-treated giant bamboo can be glued together to produce engineered bamboo with acceptable bond strength based on PNS ISO 12466-1 and 2 standards.

Keywords: *Dendrocalamus asper*, hot oil treatment, lamination, shear strength, thermal modification

EST – 04

IMAGE-BASED LEAF AREA MEASUREMENT IN GIS SOFTWARE

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A practical method of leaf area measurement that is intended to be suitable to diverse leaf sizes and shapes of forest tree species was created. This method is named LARGIS or short for leaf area measurement by raster GIS. Image from photograph is georeferenced and processed in a Geographic Information System (GIS) software. Cell value threshold separating non-leaf from leaf cells or pixels is manually selected. The total number of cells is multiplied to cell size to get the leaf area. The method is suitable to both destructive and non-destructive measurements, and can handle very large leaves and compound leaves with small and easily detachable leaflets. Leaf area measurement with this method is much faster than the two commonly used methods which are the grid count method and the paper weight method. Precision is higher as shown by smaller standard deviations observed in data consisting of estimates from many persons.

Keywords: leaf area measurement, practical GIS, forest tree leaves

EST – 05

MULTIPHYSICS MODELING OF A PROTON EXCHANGE MEMBRANE ACID-ALKALINE ELECTROLYZER

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Water electrolysis is a sustainable pathway for producing hydrogen, which is an alternative energy carrier to fossil fuels. The widespread application of electrolysis, however, is hampered by the large thermodynamic power requirement of the water splitting reaction. Acid-alkaline electrolyzers circumvent this limitation by employing an acidic catholyte and alkaline anolyte, thereby lowering the thermodynamic barrier towards water splitting. The basic operation of acid-alkaline electrolyzers with bipolar exchange membranes is well-known, but not for those with proton exchange membranes. In this work, we developed a multiphysics model of a batch acid-alkaline electrolyzer with a proton exchange membrane to understand its underlying reactions and ion-transport mechanisms. The model was simulated in COMSOL Multiphysics® and validation with experimental current vs. voltage data published in literature. The concentration profiles, ion fluxes, and electrolyte potential in the electrolyzer were analyzed to elucidate the reactions and ion transport. Lastly, a sensitivity analysis was conducted to determine possible improvements to the electrolyzer by varying the material properties of the proton exchange membrane. The main reactions consume H⁺ from the catholyte and OH⁻ from the anolyte to generate H₂ and O₂, respectively. The loss of ions results in a charge imbalance, which is counteracted by the transport of Na⁺ from the anolyte to the catholyte. This goes against the common hypothesis that the Second Wien effect, or the splitting of water into H⁺ and OH⁻ under high electric fields, retains electroneutrality in proton exchange membrane acid-alkaline electrolyzers. The crossover of Na⁺ would result in cross-contamination of the electrolytes over time. We also found notable H⁺ transport from the catholyte to the anolyte, which results in a parasitic acid-base neutralization reaction. Increasing the applied voltage from 0.8 V to 1.2 V decreases H⁺ crossover from the catholyte to the anolyte by 19.7%, thereby suppressing the unwanted acid-base neutralization reaction. Increasing the Na⁺ selectivity of the membrane (i.e., decreasing the H⁺ diffusion coefficient by 50%), also reduces H⁺ crossover by 60.7%, but engineering such a membrane would be challenging considering the smaller Stokes radius of H⁺. In future work, the proposed model can be improved by incorporating the formation of gas bubbles. This can be used to optimize the design parameters of the batch electrolyzer and aid in the design of a continuous electrolyzer stack.

Keywords: multiphysics modeling, numerical modeling, acid-alkaline, amphoteric, hybrid, dual electrolyte, electrolyzer, hydrogen, sustainability

EST – 06

PROBABILISTIC TECHNO-ECONOMIC ASSESSMENT OF LONG-DURATION FLYWHEELS, LEAD-ACID BATTERY AND LITHIUM-ION BATTERY FOR ISOLATED HYBRID MICROGRID ENERGY SYSTEM IN THE PHILIPPINES

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Interest in energy storage for microgrids has become more prevalent in recent years due to significant price drop in variable renewable energy generators and lithium-ion batteries. Persistent concerns on supply chain and safety of lithium-ion batteries prompted the development of new energy storage technologies including long-duration flywheels as they generally promise better technical performances and lower overnight cost. Typical deterministic techno-economic assessment provides instant results but the insights are not realistic enough due multiple uncertainties from publicly available data of energy resource assessment, load demand, and techno-economic parameters for energy components. To mitigate this, probabilistic techno-economic assessment was done using Monte-Carlo simulations to account for these uncertainties and therefore, provide better insights. The simulation was done by doing 100 runs in our in-house tool Island Systems LCOEmin Algorithm (ISLA) to generate probabilistic distributions of pertinent techno-economic results. In addition, techno-economic assessment was done across time to check the effect of price reduction of relevant energy components. An isolated hybrid microgrid system using real load data from Kalinga-Apayao Electric Cooperative, Inc. (KAELCO) is used as case study in this work. Results show that given the publicly available data accounting uncertainty, integrating long-duration flywheels to isolated microgrid has 58.7% chance to provide lower leveled cost of storage (LCOS) and leveled cost of electricity (LCOE) for the isolated microgrid. However, these chances rapidly diminish over time due to the rapid price drop for lithium-ion batteries which is consistent with the global forecast. Hence, long-duration flywheels can potentially capture microgrid market in the Philippines but they need to find ways to maintain the chance in the future.

Keywords: techno-economic assessment, isolated hybrid microgrid, lithium-ion battery, long-duration flywheel

EST – 07

PRODUCTION AND CHARACTERIZATION OF CELLULOSE NANOCRYSTALS FROM ABACA HYBRID 7

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The study dealt on the extraction of cellulose nanocrystals from Abaca hybrid 7. Fibers were subjected to pretreatment processes to remove all non-cellulosic materials. Soda pulping was carried out using 16% chemical charge and 4:1 liquor-to-fiber ratio. The pulp was treated with sodium chlorite and sodium hydroxide to produce α -cellulose. Cellulose nanocrystals (CNCs) were isolated using controlled sulfuric acid hydrolysis. The effects of the different treatment parameters: acid concentrations (45, 55, 65%v); temperature levels (40, 55°C); and durations (30, 60, 90 minutes) on the yield of the cellulose crystals were determined. Chemical transformations from raw abaca hybrid to cellulose nanocrystals were analyzed using Fourier Transform Infrared Spectroscopy (FTIR). Dynamic light scattering (DLS) and atomic force microscopy (AFM) were used to characterized geometrical dimensions of the produced CNCs. The degree of crystallinity of raw alpha-cellulose and CNCs were compares using x-ray diffraction (XRD). Results of the spectroscopic analysis indicate that nanocrystals were obtained from Abaca hybrid 7. The yields varied from 0 to 89.76 %. Size and distribution of the cellulose crystals ranged from nano- to macro-levels. Alpha cellulose hydrolyzed with 55% sulfuric acid concentration, temperature of 40°C for 90 minutes proved to be the optimum combination. The treatment yielded 20.6378% CNC. The nanocrystals are polydispersed with Z-average peaks contained between 10 to 100 d. nm. The treatment produced particles having rod-like crystalline structure based on AFM images with average diameter and length of 6.40 and 64.68 nm, respectively. The conversion from α -cellulose to CNC increased the crystallinity from 76.87 to 90.35%.

Keywords: FTIR, TGA, crystallinity, polydispersion, AFM

EST – 08

RADIATION SHIELDING PROPERTIES OF BULK METALLIC GLASSES AND HEAVY METAL OXIDES

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There are numerous researches on glass materials because of their transparency which is advantageous for applications requiring observation. For radiation shielding applications, aside from shielding properties, it is also necessary to investigate other characteristics such as the material's mechanical, optical, physical, and thermal properties. Previous studies have concluded that Zr-based bulk metallic glasses (BMG) with additional aluminum content enhanced the glass-forming ability of the material, while TeO₂-based (WMT) and Sb₂O₃-based (WMS) glasses with increasing MoO₃ content developed the thermal property of the glasses. In this study, the radiation shielding properties of the three different glass systems were investigated and compared using SRIM for mass stopping power (MSP) and ranges, EpiXS for MAC, and Phy-X/PSD for fast neutron removal cross-section (FNRCs). Results showed that BMG had the highest MSP with 0.8 MeV/(mg/cm²) MSP for alpha particles, while WMS had the highest range of 600 μm for protons. The addition of MoO₃ to WMS and WMT was found to be favorable for the MSP and range for both alpha and proton particles. On the other hand, the MAC of the glass systems reached 450 cm²/g in energies below 0.01 MeV, while the FNRCs showed almost constant values, ranging from 0.11 to 0.12 cm⁻¹ for all BMG samples. The MAC and FNRCs are comparable to other glass systems previously investigated, while the addition of MoO₃ provided significant improvement to charged particle shielding properties. Hence, the results proved that the investigated glass systems are suitable as radiation shielding materials.

Keywords: mass stopping power, mass attenuation coefficient, fast neutron removal cross-section, SRIM, EpiXS

HEALTH SCIENCES

HSD – 01

CARDIOVASCULAR DISEASES PREDICTION SYSTEM: A CLASSIFICATION APPROACH

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The health care field generates big data about clinical assessment, a report regarding patients, cure, follow-ups, and medication. It is complex to arrange in a suitable way. For effective diagnosis and cost-effective management, prediction systems that are based upon computers may play a vital role. This paper intended to develop a computer-based prediction system for diagnosing cardiovascular diseases based on thirteen collected attributes to serve as field names for data entries. The system used a data mining technique algorithm. This paper used Rapid Application Development (RAD) Software Development Life Cycle (SDLC) in designing and developing the system. Bootstrap, an open-source front-end framework was used mainly in building its User Interface (UI) while PHP, a web-scripting language tool used in manipulating data entries and selected algorithms for prediction. This web-based prediction system was tested using synthetic data sets from UC Irvine Machine Learning Repository and results were stored in a MySQL database. The system was simulated, and its performance and features were evaluated in terms of functionality, reliability, and usability. Results showed that the system provided adequate features for predicting heart diseases with a 4.8 overall weighted mean.

Keywords: data mining, prediction system, cardiovascular diseases

HSD – 02

CHONDROPROTECTIVE AND IMMUNOMODULATORY ACTIVITIES OF *TINOSPORA CORDIFOLIA* STEM EXTRACTS IN *MONOSODIUM IODOACETATE* (MIA)-INDUCED OSTEOARTHRITIS RAT MODEL

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Osteoarthritis (OA) is a chronic degenerative joint disease characterized with the increase of reactive oxygen species (ROS), pro-inflammatory cytokines and matrix metalloproteinases (MMPs) which are responsible for the cartilage degradation. Its increasing prevalence which mostly affects the elderly causing disability, loss of function and decreased quality of life has led to various investigations on its possible therapies, however, the current available treatments for osteoarthritis are limited only in relieving its symptoms while ineffective in delaying the progression of the disease. *Tinospora cordifolia* (TC), locally known as Makabuhay is recognized as health rejuvenator and immunomodulator and traditionally used for various metabolic disorders and bone-related diseases This study aims to evaluate the chondroprotective and immunomodulatory activities of the ethanol and aqueous TC stem extracts in monosodium iodoacetate (MIA)-induced osteoarthritis rat model through macroscopic and histopathological joint cartilage assessments and enzyme-linked immunosorbent assay (ELISA) of key indicators of osteoarthritis namely, catalase (CAT), superoxide dismutase (SOD), interleukin 1 β (IL-1 β), tumor necrosis factor alpha (TNF α), MMP 3 and MMP 13. Both ethanol and aqueous TC stem extracts have no toxicity effect on the test animals based on acute oral toxicity assay. Immunomodulatory and chondroprotective activities were exhibited by both ethanol and aqueous TC stem extracts through inhibition of the oxidative stress enzymes ($p = <0.001$), pro-inflammatory cytokines ($p = <0.001$), and cartilage degrading enzymes ($p = <0.001$). Furthermore, there is marked decrease ($p = <0.001$) in articular injuries and proteoglycan loss on the rat knee cartilages after ethanol and aqueous TC stem extracts treatment as presented in the macroscopic and histopathological evaluation based on OARSI grading system. These data prove that both TC extracts affect the pathogenesis of the OA by inhibiting the oxidative stress enzymes, pro-inflammatory cytokines and cartilage degrading enzymes indicating the potential application as safe and effective chondroprotective agent for OA prevention and treatment.

Keywords: chondroprotective, immunomodulatory, monosodium iodoacetate, osteoarthritis, *Tinospora cordifolia*

HSD – 03

ENHANCING SENSITIVITY OF AN ENZYME-BASED ASSAY SYSTEM OF A MICROFLUIDIC PAPER-BASED ANALYTICAL DEVICE (μ PAD) FOR THE DETECTION OF *ESCHERICHIA COLI* IN WATER

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The development of microfluidic paper-based analytical devices in diagnostics application have increased tremendously due to its properties as cost effective, easy to use, fast results and portability applicable for point-of-care use. Several μ PAD devices have been developed utilizing enzyme-based reactions for the detection of pathogenic *E. coli* in water resulting to a simple and rapid analysis as compared to the conventional method, however, the sensitivity of these type of reactions can be considered low at 10⁴ – 10⁷ cfu/ml. The purpose of this study is to develop a device that can detect pathogenic *E. coli* in water with increased sensitivity through an enhancement step where enzyme concentration is increased.

The device was developed by designing a template using drawing software and transferred on paper using inkjet printing method. Components of the detection mechanism such as the enzyme substrate, lysing agent and catalyst were optimized for their concentrations and drop volumes. Sensitivity was increased by incorporating an enhancement step in the detection mechanism of the device involving the growth and lysis of cells. The enhancement step was done in two possible ways; (1) Growth and lysis occurs prior to sample introduction and (2) Growth and lysis occurs separately. For both procedures, the Limit of detection (LOD) was determined from the created calibration curves. Data were quantitatively processed using IMAGE J software from captured images of the devices collected in a dark box using a DSLR camera with specified settings.

The developed device consists of a circular hydrophilic region within a hydrophobic barrier where a volume of chlorophenol red- β -D-galactopyranoside (CPRG) at an optimized concentration was deposited. An attached layer of circular Gel blot paper cut at 8mm diameter contains Ferrous sulfate and the lysing agent, Bacterial Protein Extraction Reagent (BPER). Sample solution was prepared by mixing water sample and the growth medium Lauryl Tryptose Broth and allowed to incubate for 12 hours at room temperature. In the first method, BPER is added to the sample solution with lysis of cells occurring prior to sample introduction, while in the second method, BPER was incorporated in the Gel blot layer allowing lysis to occur within the device. The LOD for each method was determined at 159 cfu/ml and 229 cfu/ml, respectively.

The developed device has increased sensitivity through the increased enzyme concentration during enhancement.

Keywords: microfluidic paper-based analytical devices (μ PADs), pathogenic *E. coli*, CPRG

HSD – 04

FIFTEEN MINUTE AEROBIC EXERCISE ENHANCES NEUTROPHIL PHAGOCYtic FUNCTION

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Aerobic exercise has long been considered beneficial to one's health. However, little is known about its exact effect on the immune system. The study investigated whether a short aerobic exercise would demonstrate quantifiable effects on innate immunity, specifically on neutrophil phagocytic function against bacteria.

Blood samples from 19 healthy volunteers were collected before and after a 15-minute session of aerobic dance exercise. Neutrophil Phagocytic Activity, Phagocytic Index, and Phagocytic Percentage were determined for each blood sample and compared.

A significant increase in all three parameters were seen following the exercise. Neutrophil phagocytic activity, phagocytic index, and phagocytic percentage increased by 45.8%, 35.2%, and 38.1% respectively.

It has been demonstrated that short moderate aerobic exercises have immediate benefits that may improve a person's neutrophil response to bacterial infections.

Keywords: exercise, neutrophil, immunity

HSD – 05

KALIMBAHIN AS AN ALTERNATIVE HEALTHY AND SAFE SPORTS DRINK**Anna Dominique Tallara-Salunga**, Freya Gay A. Jingco, Merlyn C. Cruz and Edwin R. Tadiosa

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Kalimbahin Sports Drink is an alternative to create a healthy and natural sports drink for athletes and a rehydration drink for recuperating patients without added artificial flavors, chemicals, and other additives. This drink provides nutrients, vitamins, minerals, and amino acids beneficial, especially for those exposed to heavy work. ingredients. Mainly to analyze the safety of the prepared sports drinks based on the microbiological test

This study formulated a safe and healthy sports drink from locally grown vegetables and natural and toxicity/heavy metal contamination and the physicochemical properties based on pH and titratable acidity; to evaluate the nutritional value and composition of the formulated drinks thru approximate nutrient calculator on total sugar, vitamins, and minerals; and to initially evaluate the shelf life of Kalimbahin.

This research was divided into three phases. Phase I includes an initial analysis of the microbial load, heavy metal contamination, and physicochemical properties. Phase II involves the evaluation of the nutrient contents of the formulated Kalimbahin sports drink. And Phase III finally analyzes the shelf-life and stability based on microbial load and nutritional components difference.

Initial evaluation of its safety showed a consistent microbiological result of <10 CFU/mL for coliforms, molds and yeasts, where it can be inferred that all results fall within the acceptable level recommended by the Food and Drug Administration (FDA) of the Philippines. This can be supported by the phphysico-chemical properties of the formulated drink, which gives a low pH and high titratable acidity. The moderate acidity of the sports drink may have naturally prevented microbial proliferation in the sample. These results imply that the homemade processing and handling of the initially formulated sports drink complies with Good Manufacturing Practice. More so, the components and composition of the beverage were well-formulated, which did not support the growth of any of the microorganisms that may affect the sensory properties of the freshly prepared sports drink, or compromise the health and safety of the consumers. Analysis of its components highlights the presence of the electrolytes sodium and potassium which are essential components for a sports drink. The drink also contains vitamin C and calcium as additional benefits, and sufficient sugar which is important for the absorption of the electrolytes. The formulated sports drink initially shows its potential to provide energy to individuals with active lifestyles, and may also be utilized for managing diseases that are commonly associated with risks of dehydration such as dengue fever and Covid-19. The formulated Kalimbahin sports drink prepared from fruits and vegetables, is a healthy and natural alternative rehydration drink not only for athletes but for the recuperating patients as well, which may be taken without risk of intoxication due to the artificial flavors, chemicals, and other additives.

Keywords : sports drinks, experimental, sweet potato leaves, hydration

HSD – 06

PRE-PANDEMIC LIFESTYLE STRATEGY OF PREGNANT WOMEN WITH GESTATIONAL DIABETES MELLITUS

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Gestational diabetes mellitus, a form of hyperglycemia recognized during pregnancy, increases the risk of short- and long-term complications for both the mother and the offspring such as pre-eclampsia, macrosomia, fetal malformation, obesity and type 2 diabetes. In order to reduce the risk of developing complications due to GDM, improvement in lifestyle activities is recommended. Maintaining a healthy lifestyle includes three important domains: 1. exercise, 2. diet, and 3. wellness; here, we aim to determine and evaluate the lifestyle strategies used by pregnant women during pre-pandemic period.

We gathered 914 informed and consented pregnant women to participate in the study. After following the set of inclusion and exclusion criteria, there were 695 accepted pregnant women, 222 were diagnosed with GDM and 473 have normal glycemic control based on 75-g oral glucose tolerance test. To evaluate their lifestyle strategies a validated questionnaire was used. Data analysis and calculations were performed in GraphPad Prism 9.

The BMI before pregnancy of women with GDM and without GDM were classified as significantly overweight and normal weight respectively, (23.43 ± 0.33 vs 22.19 ± 0.23 $p < 0.05$). The percentage of women with GDM and without GDM who exercises does not differ significantly (73.42% vs 74.21% , $p > 0.05$). Duration of exercise varies from one pregnant woman to another: 1-2H in a week (16.56%); 3-4H in a week (19.02%); 5-6H in a week (7.98%); >6H in a week (56.44%); most of them tried to perform exercises longer in a week. As with diet, unfortunately, only few pregnant women both with (27.93%) and without GDM (38.05%) were aware of proper food nutrition. Only 30.63% pregnant women with GDM and 16.28% pregnant women without GDM follows food plan such as calorie counting, low carbohydrate, reduced sugar intake and food pyramid proportions. Also, most of them (74.32% with GDM; 70.82% without GDM) frequently eat outside. In terms of wellness, 30.63% of GDM women had problems with sleeping well, 44.14% were disinterested in doing any form of activity, 26.13% had anxiety, 45.49% had experience financial difficulty, and 27.93% had a tendency for depression.

This study reveals that the lifestyle strategies of pregnant women during pre-pandemic period focuses on physical exercise. Pre-pandemic period allows pregnant women to do a lot of things and not be confined inside the house. Next direction of the study would be a comparison with pandemic and post-pandemic lifestyle strategies and assessment of factors affecting health and wellness.

Keywords: exercise, diet, wellness, lifestyle, gestational diabetes mellitus

HSD – 07

**VENOM FRACTIONS FROM PHILIPPINE *ORPHNAECUS TARANTULA*
EXHIBITED LIDOCAINE-LIKE NEUROBEHAVIOR IN ZEBRAFISH
(*DANIO RERIO*): EVIDENCE OF ANTI-NOICEPTIVE
MOLECULE IN PHILIPPINE SPIDER VENOM**

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Spider venom contains an array of neuroactive compounds that act on neuronal membrane proteins, voltage-gated ion channels (VGICs), and neurotransmitter enzymes which lead to regulation or dysregulation of synaptic transmission. Like other animal toxins which have been extensively studied, its components may possess neuromodulatory and nociceptive regulators that are potential drug candidate against human diseases. In this study, we analyzed the nociceptive activities of venom fractions of Philippine *Orphnaecus tarantula* species.

Venom from the spiders collected from Lanao del Sur in Mindanao were collected by electrostimulation and fractionated by reverse phase high-performance liquid chromatography (RP-HPLC) using linear gradient 0.1% trifluoroacetic acid (TFA) in water and 0.1% TFA in 90% acetonitrile solvent system. Lyophilized fractions were reconstituted in phosphate buffered saline and injected intraperitoneally in adult zebra fish. Neuromodulatory activity of the venom fractions was tested using Novel Tank Test (NTT), Fear Response, Social Interaction, and Mirror Biting. Behavioral responses of the fish were evaluated by monitoring and analyzing fish swimming activities using idTracker and GraphPad Prism, respectively.

Two out of the eleven peak fractions of the spider venom were observed to exhibit swimming behavior to Lidocaine, a nociceptive drug used as positive control in this study. Trajectory tracking and neurobehavioral endpoints used for venom injected zebrafish behavior assessment resulted to a dose-dependent response similar to Lidocaine. Freezing Time and Rapid Movement data indicate that 200 ppm concentration of both the fractions exhibit hypoactivity greater than the positive control. Presence of fear stimuli resulted to lidocaine-like results at 200 ppm, which was also observed when subjected to social stimuli. The observed neuroactivity of venom fractions in our study shows the fundamental proof of the presence of anti-nociceptive molecules in Philippine tarantula species which can potentially be studied for therapeutic use.

Keywords: spider venom, anti-nociceptive, neurobehavior, neuromodulatory, lidocaine-like

HSD – 08

THE DEVELOPMENT OF THE MINDFULNESS FOR MENTAL FITNESS PROGRAM (MIND-FIT): AN ONLINE MINDFULNESS-BASED COGNITIVE GROUP THERAPY PROGRAM FOR ANXIETY AND DEPRESSION AMONG FILIPINO COLLEGE STUDENTS

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Primarily, the study was conducted to test the efficacy of a newly developed Online Mindfulness-Based Cognitive Group Therapy Program for Anxiety and Depression among Filipino College Students known as Mind-Fit Program. Using One Group Pretest-Posttest Design, participants underwent 5-sessions (5 weeks with 45 minutes-2 hours duration per week). Measures such as Hopkin's Symptom Checklist, Patient Health Questionnaire, Beck Anxiety Inventory and Connor-Davidson Resilience Scale 10 were used as pre and post-test measures. Results revealed on the quantitative part using paired sample t-test and Cohen's d that there is a significant difference on the pre and post-test results on Hopkins Anxiety scale ($t(5) = 17.419, p = .000$) and Beck Anxiety measure ($t(5) = 5.466, p = .005$) with Cohen's d of 4.60 and 3.42 respectively. Same pattern was found on the difference of pre and post test on depression measures. Statistically significant findings on both Hopkins Depression subscale ($t(5) = 7.359, p = .002$) and PHQ-9 measure ($t(5) = 5.466, p = .005$) Cohen's d of 4.28 and 2.13 respectively. Moreover, participants significantly improved their resilience after the intervention ($t(4) = -13.01, p = .000$; Cohen's d = 5.15). Qualitative part of the study showed that participants experienced positive outcome on the effect of Mind-Fit Program. Using coding cycle, the qualitative part revealed five themes and 17 subthemes. The major themes are Awareness of Thoughts and emotion, Positive Coping, Mindfulness Practice, Positive Group Communication and relationship and Positive Intervention Outcome. Quantitative and qualitative data showed promising results on the effectiveness of the Mind-Fit program. Implications of the study were further discussed.

Keywords: online MBCT, anxiety, depression, resilience

**MATHEMATICAL AND
PHYSICAL SCIENCES**

MPS – 01

ANTICANCER PROPERTIES OF RING-TRUNCATED DEGUELIN DERIVATIVES

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One of the limitations of the currently available chemotherapeutic drugs is the severe unintended side effects. Researchers focused on the development of more selective compounds with fewer side effects and are cost-effective. Deguelin, a natural rotenoid widely used as insecticides and fish poison has been identified as a promising anticancer drug, but its toxicity has raised concerns due to its Parkinson's disease-like syndrome in rats. Various structural simplifications of deguelin have been reported including BC-ring truncation and removal of the E-ring. BC ring restricts the flexibility, and the E ring does not have significant effect to the compound's activity. The present study investigates the structure-activity relationships of ring-truncated deguelin derivatives by synthesis of carbonyl-modified BCE-ring truncated deguelin analogues. The compounds were characterized using various techniques such as ¹H and ¹³C Nuclear Magnetic Resonance (NMR), high resolution mass spectrometry (HRMS), and Fourier transform infrared (FTIR) spectroscopy. The anticancer properties of the synthesized analogues were tested using MTT Assay against A549 (lung cancer cells), HCT116 (colorectal cancer cells), and MCF7 (breast cancer cells). Derivatives that exhibit anticancer activity were tested for hepatotoxicity (HepG2 liver cancer cells) and nephrotoxicity (HK-2 normal kidney cells). Bioactive and non-toxic compounds will be subjected to further biological tests (absorption, digestion, metabolism, excretion, and toxicology).

Keywords: deguelin, anticancer drugs, ring-truncation, bioactive, structure-activity relationship

MPS – 02

DEVELOPMENT AND VALIDATION OF QUECHERS WITH EMR-LIPID METHOD FOR THE ANALYSIS OF ETHOXYQUIN IN CHICKEN BY ULTRA HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY – FLUORESCENCE DETECTION

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Ethoxyquin (EQ) is a synthetic antioxidant extensively used in feeds not only to preserve its high nutritional value but also to enhance the quality of meat produced by poultry. However, ethoxyquin residues from animal-derived food products may carry over to humans and become a pressing concern in food safety. Thus, a fast and reliable analytical method was developed and validated for the detection of ethoxyquin concentration in chicken. In this study, a Quick, Easy, Cheap, Effective, Rugged, and Safe (QuEChERS) extraction with dispersive SPE Enhanced Matrix Removal (EMR)-Lipid sample clean-up was optimized to extract ethoxyquin in the lyophilized chicken sample and eliminate possible interfering components from the sample matrix. A comprehensive validation of the method with gravimetric sample preparation was performed using ultra-high performance liquid chromatography with fluorescence detector (UHPLC-FLD) with 235 nm /480 nm as excitation/emission wavelengths. Various parameters assessed include limit of detection (LOD), limit of quantification (LOQ), linearity, intra- and inter- day precision, accuracy, and selectivity. The obtained LOD and LOQ of the method were 2.38 µg/kg (n=10) and 3.61 µg/kg (n=10) respectively. The method showed excellent linearity ($R > 0.999$) over a working range of 1 – 200 µg/kg in both standard and sample extracts. Intra- and inter- day precision results, expressed as relative standard deviation (RSD <6%, n=10) were within the acceptable % RSD calculated from Horwitz' equation. The range of recoveries (94 - 106 %, n=10) obtained at three fortification levels (200, 400, and 800 µg/kg) are in compliance with the performance criteria provided by the AOAC guide. Selectivity study revealed that the presence of other antioxidants commonly used in feeds such as butylated hydroxyanisole (BHA) and tert-butylhydroquinone (TBHQ) has no effect to the area response of 400 µg/kg ethoxyquin in the sample extract. The retention times observed using appropriate wavelengths for fluorescence detection are 6.3, 4.2, and 2.1 minutes for ethoxyquin, BHA and TBHQ respectively, indicating that the peaks are well separated. A very promising method was successfully developed and validated using QuEChERS and d-SPE EMR-lipid for efficient sample extraction and cleanup followed by UHPLC-FLD measurement. Hence, it is fitted for the determination of residual level of ethoxyquin in chicken samples.

Keywords: ethoxyquin, feed additives, food safety, QuEChERS, UHPLC-FLD

MPS – 03

DEVELOPMENT OF A MATRIX REFERENCE MATERIAL FOR SALBUTAMOL IN LYOPHILIZED MEAT

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Salbutamol (SAL) is a beta-agonist, a class of veterinary drug, that is used illegally as a growth promoter in farm animals to increase carcass leanness and reduce the fat deposition of meat. In the Philippines, salbutamol has been banned for use in meat, along with other β -agonists and veterinary drugs. High dosage of SAL drug residue may lead to side-effects like headaches, palpitations, tremors, tachypnea, muscular pain and moreover, serious health problem in the cardiovascular and central nervous system. The Metrology in Chemistry section under the National Metrology Laboratory of the Industrial Technology Development Institute aims to provide traceable matrix reference materials (RM) for local testing laboratories in the Philippines.

This will enable accurate measurement methods for the determination of salbutamol in meat, ensure food safety, prevent trade issues and compliance monitoring of meat growers. The RM was produced in accordance to ISO Guide 35. Preparation of the candidate RM includes freeze drying of fresh pork meat, then grinding and size reduction using a centrifugal mill of the dehydrated meat to obtain a powdered material. The bulk powdered material was spiked with salbutamol, then homogenized and bottled into individual units containing 20 g of the material. Homogeneity assessment was performed via ultra-high performance liquid chromatography (UHPLC) wherein no bottling trend and outliers were found using linear regression and Cochran's test, respectively. The RM was sufficiently homogeneous based on analysis of variance (ANOVA) and has an uncertainty from homogeneity (ubb) of 3.53 $\mu\text{g}/\text{kg}$. Short-term stability studies using t-test analysis proved that the RM was stable for transport at ambient conditions. Long-term stability study was performed and demonstrated stability for 7 months at $-20\text{ }^{\circ}\text{C}$ and has the uncertainty (ults) of 11.52 $\mu\text{g}/\text{kg}$. The material was then characterized using liquid chromatography-isotope dilution mass spectrometry (LC-IDMS) method with gravimetric sample preparation, which provided the uncertainty from characterization (uchar) as 5.41 $\mu\text{g}/\text{kg}$.

The assigned value of the RM is $227.1 \pm 26.4\text{ }\mu\text{g}/\text{kg}$ with a coverage factor, $k=2$ and a probability of approximately 95 %. The traceable matrix RM for salbutamol in meat was pioneered and successfully developed in the country and fitted for accuracy-based proficiency testing scheme for salbutamol. It is also a very good quality control sample and can be used in the assessment of method performance of chemical testing laboratories which are essential for their ISO/IEC 17025 accreditation.

Keywords: reference material, salbutamol, veterinary drug residue, liquid chromatography, chemical metrology

MPS – 04

DURABLE HYDROPHOBIC SILICA SOL-BASED WATER-REPELLENT FINISHED WOVEN NATURAL TEXTILE FIBER-BLENDED FABRICS AND THE METHOD OF PRODUCTION AND THEREOF

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The use of natural materials is gaining ground in the textiles and garment industry. In the Philippines, natural textile fibers from *Musa textilis* Nee (abaca), *Ananas comosus* (pineapple leaf), *Bambusa* sp. (bamboo) fibers and *Musa* sp. (Bandala) are in the forefront of developing new textile materials as high-quality fibers. Serving as base materials, textiles may become ‘smart’ through functionalization which imparts various properties such as water repellency, which is most relevant for the development of masks and protective outwears during this health emergency. Water repellent finishing on woven natural fiber-blended fabrics was optimized. The woven natural fiber blended fabrics were functionalized via pad-dry-cure-method and the effect of tetraethoxysilane (TEOS) and octyltriethoxysilane (OTES) ratio, concentration of acid catalyst, and ageing time on the resulting water-repellent properties of natural fiber blended fabrics were investigated. The optimized parameters for water-repellent finishing of woven natural fiber blended fabric are 4:6 TEOS:OTES ratio, 0.01 M HCl and 48 h ageing time as these parameters exhibited satisfactory water-repellent properties in terms of high contact angle ($>130^\circ$), longer wetting time (>3 hrs), and high spray test rating (90-95). The fabrics were also durable up to 50 simulated hand washings. The establishment of the water-repellent finishing parameters for woven natural fiber blended fabrics would pave the way for the development of multifunctional woven natural fiber blended textile materials for community use facemasks and reusable protective personal equipment (PPEs) for community use or even for medical application.

Keywords: natural fiber blended fabrics, woven fabric, textile functionalization, water repellency, hydrophobic silica sol

MPS – 05

ELEMENTAL FINGERPRINTING OF PHILIPPINE LANTAKAS USING ENERGY DISPERSIVE X-RAY FLUORESCENCE SPECTROMETER

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Lantakas are a prominent intangible cultural heritage of the Philippines. These are small swivel cannons used by the early Filipinos as weapons for defense in merchant ships and warships. Studies have been made on the design of these ancient weapons, but very little information exists on the chemical composition of this important artefact. This study was carried out to establish an elemental fingerprint for these ordnance materials to obtain information on the provenance, level of technology, metallurgical process, authenticity, and metal identification. Twenty-two (22) Lantakas and seven (7) cannons in the Philippine National Museum collection were characterized through elemental fingerprinting using a portable Energy Dispersive X-ray Fluorescence (EDXRF) Spectrometer to carry out a non-destructive in-situ analytical measurements. Twenty elements were measured, and the measurement results were analyzed using multivariate chemometric techniques such as principal component analysis (PCA), hierarchical cluster analysis (HCA), ternary diagram, correlation plots, and heat maps. A radar plot was also used to aid pattern recognition. The PCA analysis distinguished a pattern that revealed the actual separation of European cannons and lantakas. It also determined three major groups of lantakas with their corresponding subgroup verified by HCA and heatmap dendrogram. The ternary diagram disclosed three major classifications of lantakas: bronze, brass, and iron, which revealed ancient metallurgy and technology. Elemental fingerprinting identified several groups for the lantakas and cannons, including a group of high-tin and low-tin leaded and unleaded bronze lantakas and cannons, high-zinc and low-zinc brass lantakas, and a ferrous lantaka. Furthermore, this fingerprinting revealed interesting information. One lantaka was found out to be grey cast iron, while another lantaka was found to be a unique bronze breech-loading swivel gun. One brass lantaka was manufactured by the latest brass-making technology, and the sixteen (16) brass lantakas went through traditional cementation metallurgy. Additionally, authentication using trace elements Nb and W, which could be the fingerprint of brass lantaka and Zr for European bronze cannons confirmed differences of materials which can lead to the history of local technology and metallurgy of making weapons. Very minimal information is available on the provenance and age of the artifacts, and the elemental composition is being explored as a means to provide this information.

Keywords: Energy Dispersive X-Ray Fluorescence Spectrometer, lantakas,, elemental fingerprinting, chemometrics, archaeochemistry

MPS – 06

HYDROTHERMAL SYNTHESIS OF ALPHA-CELLULOSE BASED LUMINESCENT CARBON QUANTUM DOTS (AC-CQDS)

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Carbon quantum dots (CQDs) are 0-dimensional carbon-based nanoparticles with strong emission in the blue region, possess useful properties such as low toxicity and chemical stability, and are promising biological, optoelectronic, and anti-counterfeiting materials applications. Luminescent carbon quantum dots (CQDs) were produced from a readily available source, alpha-cellulose (AC) via the hydrothermal method. Several synthetic conditions were investigated systematically to optimize the preparation of alpha-cellulose-based carbon quantum dots (AC-CQDs) to enhance the luminescent emission, reduce and homogenize the size distribution, and improve the surface oxidation of CQDs. The formation mechanism, photoluminescence, and surface chemistry of the AC-CQDs were evaluated using different characterization techniques, such as dynamic light scattering, fluorescence spectroscopy, Fourier transform infrared spectroscopy, X-ray diffraction, and Ultraviolet-visible spectroscopy. Hydrothermal synthesis of AC in aqueous solution and AC in citric acid (CA) were carried out to provide AC-CQDs in 6 h and 10 h reaction time, respectively. Aqueous and citric acid-based suspensions of AC-CQDs gave blue luminescence at 435 nm and 490 nm, respectively. The citric acid incorporation and the length of the reaction time are important in contributing to the formation of blue emissive AC-CQDs products for covert textile authentication systems.

Keywords: alpha-cellulose, citric acid, carbon quantum dots, hydrothermal synthesis

MPS – 07

HAS FUKUSHIMA CONTAMINATION REACHED THE PHILIPPINES? INVESTIGATING THE IMPACTS OF THE FUKUSHIMA ACCIDENT USING IODINE-129 IN THREE CORAL CORE SITES ALONG THE NORTH-EASTERN COAST OF THE PHILIPPINES

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Iodine-129 is a known effective proxy for human nuclear activities (HNAs) such as nuclear accidents, nuclear fuel reprocessing, and nuclear weapons testing. Here we present how ¹²⁹I concentrations in three coral core sites along the north-eastern coast of the Philippines (from 14.5°N to 18.6°N latitude) recorded the impacts of HNAs, particularly from the Fukushima Accident.

Coral cores were taken from Vinzons, Camarines Norte (14.5°N), Baler, Aurora (15.8°N), and Sta. Ana, Cagayan (18.6°N). The coral cores were cut into slabs and analyzed via 3D X-ray Computed Tomography to reveal growth bands and allow gray value vs. SST matching for the construction of coral chronology or age model. Subsamples were prepared for subsequent ¹²⁷I and ¹²⁹I/¹²⁷I measurements using inductively coupled plasma mass spectrometry (ICP-MS) and accelerator mass spectrometry (AMS) following the method developed in Bautista VII et al. (2017). Results were reported as ¹²⁹I/¹²⁷I ratios calculated from the results of ICP-MS, AMS, and the known amount of iodine carrier added.

In at least two (2) coral sites (Baler and Vinzons), a prominent peak in the year 2014.7 is observed, possibly from the 2011 Fukushima Accident. If this is correct, then there is an apparent 3.5-year transit time from the Fukushima Accident site to the north-eastern coast of the Philippines. The mode of transport is most likely through the Kuroshio recirculation gyre and the North Pacific mode waters, previously credited for the southward transport of radiocesium from Fukushima by Kumamoto et al. (2015). Based on the magnitude of the observed ¹²⁹I peak in the coral and published ¹²⁹I/¹³⁷Cs ratios, an estimated 5.4-8.0 Bq/m³ of Fukushima-derived ¹³⁷Cs reached the north-eastern coast of the Philippines, consistent with the published levels of radiocesium observed traveling southwards through the mode waters.

Aside from the Fukushima Accident signal, the ¹²⁹I coral data provided important information on the magnitude, timing, and transport pathways of the impacts of other HNAs, such as nuclear weapons testing and nuclear fuel reprocessing.

Keywords: Fukushima, I-129, coral core, accelerator mass spectrometry, ICP-MS

MPS – 08

**IN VITRO ANTIPROLIFERATIVE AND APOPTOTIC EFFECTS
OF C12-MODIFIED ROTENONE ANALOGUES
AGAINST HUMAN CANCER CELLS**

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Cancer treatment via chemotherapy has several limitations such as toxicity, undesirable side effects, and drug resistance. Thus, it is vital to develop new chemotherapeutic drugs with improved toxicity and efficacy. Studies have shown that the natural product rotenone can selectively kill cancer cells through inhibition of the mitochondrial electron transport chain. However, rotenone is highly toxic and can induce Parkinson's disease-like symptoms in rats. In this study, structural modifications of the carbonyl group of rotenone were performed to improve the anticancer activity and lower the toxicity profiles. Eighteen (18) rotenone derivatives were synthesized, and their anticancer activity was evaluated in vitro against MCF7 human breast cancer cells, A549 human lung carcinoma cells, and HCT116 human colorectal cancer cells. The hepato- and nephrotoxicity of the active compounds were examined using HepG2 and HK2 cells, respectively. Active and non-toxic compounds were subjected to caspase-3/7 assay to determine their ability to induce apoptosis. The data obtained in this study showed the chemotherapeutic potential of rotenone derivatives that warrants further evaluation.

Keywords: rotenone analogues, anticancer, structure modification, natural products, antiproliferative

MPS – 09

OPTIMIZING NIXTAMALIZATION OF PHILIPPINE QUALITY PROTEIN MAIZE IPB VAR 6 IMPROVES ITS NUTRIENT PROFILE

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Nixtamalization is a corn processing method which involves cooking the corn grains in calcium salt solution at 85-100oC for 10-40 mins followed by steeping for 8-16 h (Milan-Carrillo et al., 2004). This process has shown to increase the mineral contents of corn, especially calcium, as compared to their raw counterparts since alkaline cooking tends to eliminate the pericarp, thereby allowing further absorption of calcium from the medium into the grain. Optimization of the ecological nixtamalization procedure in the study of Mariscal-Moreno et al. (2015) was conducted in an attempt to maximize the nutritive values of NSIC Cn2008-224 (IPB Var 6). This was done by boiling the kernels in 1% CaCO₃ at a constant time of 30 mins and then varying the steeping time from 2 to 16 h with increment of 2 h in between. Selected mineral analysis using Atomic Absorption Spectroscopy (AAS) showed that the steeping hours which resulted to the highest concentrations of Ca (55.4mg/100g), Mg (46.3mg/100g), and Zn (1.8mg/100g) were 14, 16, and 2 h, respectively. The boiling time was then varied by cooking the kernels in 1% CaCO₃ solution for 10, 20, and 30 mins followed by steeping for 2, 6, 14, and 16 h at which the highest concentration of selected minerals was initially obtained. The nixtamalized corn samples were analyzed for apparent amylose, crude protein, and crude fat contents. Results revealed that the highest amylose content (21.9%) was observed after 10-min boiling and 2-h steeping. On the other hand, protein content was highest (8.0%) after cooking for 30 mins and then steeping for 16 h, while the crude fat content (11.3%) was highest after 20-min cooking and 6-h steeping. Statistical analyses showed that these combinations of cooking and steeping times have no significant difference (P < 0.05) with the treatment involving 20-min cooking and 2-hr steeping in terms of the three nutrients. Thus, it could be deduced that a relatively shorter period of cooking and steeping during nixtamalization could already yield acceptable levels of protein, fat, and amylose. These findings not only show improvement in the nutrient profile of nixtamalized IPB Var 6, but also provide a more optimized protocol that utilizes less processing time, energy, and cost.

Keywords: nixtamalization; IPB var 6; cooking time; steeping time; mineral content

MPS – 10

PYROLYZED IRON-COBALT POLYPYRROLE / GRAPHENE OXIDE (FECO/PPY/GO) AS CATHODE ELECTROCATALYST FOR OXYGEN REDUCTION REACTION (ORR): ELECTROCHEMICAL AND X-RAY PHOTOELECTRON SPECTROSCOPY STUDIES

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The oxygen reduction reaction (ORR) catalyzed by cathode electrocatalysts in fuel cells and metal-air batteries, is of great interest from the viewpoint of clean energy research. Research interests to seek less expensive alternatives to platinum (Pt) cathode electrocatalyst are gaining attention, such as those based on non-precious iron (Fe) and cobalt (Co) metals supported on nitrogen-containing carbon-based nanomaterials. In this study, Fe and Co metals were dispersed on polypyrrole (PPy)/graphene oxide (GO) via in-situ polymerization and subsequent NaBH₄ reduction, as effective electrocatalyst for ORR. Pyrolysis of the resulting composite was performed using a tube furnace under N₂ atmosphere by heating the electrocatalyst at 900°C at a rate of 5°C/min. Electrochemical characterizations of the pyrolyzed FeCo/PPy/GO catalyst gave an onset potential of -0.13V vs. Ag/AgCl reference electrode with a cathodic reduction peak potential at approximately -0.26V vs. Ag/AgCl reference electrode and a limiting current of 5.47 mA in 0.1 M KOH. The linear sweep voltammetry (LSV) profile and Koutechy-Levich (K-L) analysis demonstrated a 4-electron transfer.

The X-ray Photoelectron Spectroscopy (XPS) studies revealed the presence of C, N, O, Fe and Co elements in FeCo/PPy/GO catalyst composite. The C 1s core level XPS spectrum indicate the carbon and nitrogen bonding from the GO and PPy with the following binding energies and peak assignments: 284.6 eV (C-C/C=C); 285.2 eV (C-N/C-O); 286.4 eV (C=N); 287.8 eV (C=O); and 291.4 eV (O-C=O). On the other hand, the N 1s core level XPS spectrum was deconvoluted into three components with the main nitrogen peak assigned to pyrrolic nitrogen (400.1 eV) and two other peaks at binding energies of 398.2 eV and 402 eV assigned to pyridinic and graphitic nitrogen, respectively. The N 1s XPS results indicate that pyrrolic nitrogen formed through PPy in the catalyst aids in the ORR activity.

The electrochemical data have demonstrated that the pyrolyzed FeCo/PPy/GO can be used as cathode catalyst for ORR. The XPS data have paved the way in understanding the surface chemistry of the FeCo/PPy/GO composite, giving insight into the catalyst's active site.

Keywords: FeCo cathode catalyst, oxygen reduction reaction, fuel cells, electrocatalysis, XPS

MPS – 11

RAPID ANALYSIS OF RICE PROTEIN AND AMYLOSE CONTENT USING NEAR-INFRARED REFLECTANCE SPECTROSCOPY

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Grain quality evaluation is an integral part of the rice breeding program in producing new rice varieties with premium eating characteristics preferred by the consumers. The cooking and eating quality of rice is determined by its starch physicochemical properties, particularly amylose content (AC) and protein content (PC). The conventional methods used for the analysis of these parameters are laborious, require enormous resources (e.g., human, time, supplies), and generate a large volume of toxic chemical waste. Therefore, there is a need for a fast, high-throughput, cost-reducing, and reliable alternative method to expedite the delivery of grain quality data useful for the breeding program and other stakeholders. In this study, near-infrared reflectance spectroscopy (NIRS)-based automated method was optimized by creating calibration models for AC and PC using diverse rice samples from NSIC-approved varieties and elite lines. Modified partial least square regression method was employed to develop an optimal calibration model based on milled rice and flour spectral data. Results indicated that calibration models made with flour set were more reliable than milled rice set, as indicated by the higher coefficient of determination, lower standard error of calibration, and standard error of prediction for both parameters. Furthermore, the developed calibration models for rice flour provided good predictions for PC and AC with a relatively acceptable ratio of prediction to deviation (RPD) values of 4.0 and 2.5, respectively. External validation test results showed that the prediction accuracy of PC and AC calibration models were 96.46% and 95.84%, respectively, suggesting that these calibration models can accurately predict the PC and AC values of unknown samples. These findings demonstrate the feasibility of the NIRS-based method for high-throughput and reliable measurement of rice physicochemical properties. Shifting to an automated NIRS-based screening system will significantly reduce the time and cost of developing new rice varieties with excellent eating quality.

Keywords: near-infrared spectroscopy, protein content, amylose content, calibration model

MPS – 12

REFERENCE MATERIAL PRODUCTION AND CHARACTERIZATION OF LEAD, CADMIUM, COPPER, AND IRON IN DRINKING WATER FOR USE ON PROFICIENCY TESTING STUDIES

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Drinking water is essential and access to clean water is a universal right. The Philippine National Standards for Drinking Water (PNSDW) was published to ensure the quality and safety of drinking water for local consumers. The Metrology in Chemistry (MiC) section of the National Metrology Laboratory, DOST-ITDI aims to provide reference materials (RMs) and proficiency testing (PT) services to laboratories in the Philippines. The use of locally produced reference materials and participation to accuracy-based PT are essential to chemical testing laboratories for cost-efficiency and analytical test proficiency. In this study, trace metals (lead, cadmium, copper, and iron) in drinking water RM was produced and characterized for its suitability for PT use through assessment of its homogeneity and stability using flame and graphite atomic absorption spectroscopy (AAS). Samples and standards were gravimetrically prepared prior to instrumental measurement and ensured traceability to SI unit using NIST Standard Reference Material counterpart of each metal. The drinking water RM (100ml/bottle) was produced by batch in accordance to ISO Guide 35. Homogeneity study of the prepared RM showed no bottling trend ($t_{\text{calc}} < t_{\text{crit}}$: 2.16) for Pb, Cd, Cu, Fe which obtained a t_{calc} values of 1.47, 0.91, 1.77 and 0.069, respectively on trend analysis by linear regression. The prepared RM also passed the homogeneity tests using ANOVA ($F_{\text{calc}} < F_{\text{crit}}$: 2.30) wherein the obtained F_{calc} values are 1.89, 1.35, 1.15 and 1.11 for Pb, Cd, Cu, and Fe, respectively. Short-term stability studies using trend analysis by linear regression proved that the RMs produced was stable for transport at ambient conditions. Long-term stability studies were performed and demonstrated that the RM is stable for 12 months at storage (4 °C) and room (29 °C) temperature. The metrologically-traceable mass fractions of the metals (Pb: 10.467 ug/kg, Cd: 2.857 ug/kg, Cu: 578.5 ug/kg and Fe: 932 ug/kg) were determined by the National Measurement Institute of Australia (NMIA) using Isotope Dilution Mass Spectrometry (IDMS), which is a high-order measurement method for reference value assignment. The locally prepared RM for trace metals in drinking water was made available and effectively used as material for an accuracy-based PT scheme organized in the country by DOST-ITDI. The said PT scheme was participated by ten participants from different sectors of water/chemical testing laboratories in the Philippines. The developed RM for trace Pb, Cd, Cu and Fe in drinking water has metrological traceability and has important application in method validation, quality control, PT exercise and RM requirements for accreditation to ISO/IEC 17025 of local testing laboratories.

Keywords: reference material, characterization, heavy metals, drinking water

MPS – 13

**SYNTHESIS AND CHARACTERIZATION OF 4-SUBSTITUTED
CYCLOPENT-2-ENONES VIA LEWIS ACID PROMOTED
MUKAIYAMA-MICHAEL ADDITION WITH ANTIMICROBIAL
AND CYTOTOXIC ACTIVITIES**

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The cyclopent-2-enone moiety is found in several natural products with anticancer, anti-inflammatory, and antimicrobial activity against various Gram positive and Gram negative bacteria. The presence of the Michael acceptor enone group is implicated in the activity of these compounds and substitutions to the cyclopent-2-enone substructure often occur at the 4-position leaving the enone group unhindered. With this knowledge, a library of novel 4-substituted cyclopent-2-enones was synthesized using the Mukaiyama-Michael addition reaction on (tert-butyloxycarbonyl)-protected 4-hydroxycyclopent-2-enone as the starting material. The derivatives were screened for their antimicrobial, antiproliferative, and cytotoxic activities. Prior to the synthesis of the derivatives, the Mukaiyama-Michael reaction was optimized for the following factors: Lewis acid, solvent, and temperature using a chosen model reaction. The highest yield was observed when the reaction was catalyzed by BF₃·OEt₂ and run in dichloromethane at -78 °C. These reaction conditions were used for all subsequent reactions. The product 4-(2-oxo-2-phenylethyl)cyclopent-2-en-1-one exhibited high antiproliferative activity against the human leukemia cell line K-562 (GI₅₀ (μg/mL) = 4.1 ± 0.1) and human umbilical vein endothelial cells or HUVEC (GI₅₀ (μg/mL) = 7.2 ± 0.4), and moderate cytotoxic activity against HeLa cells (CC₅₀ (μg/mL) = 18.4 ± 0.3). It was also tested against Mycobacterium tuberculosis H37Rv but showed no significant inhibitory activity. Several of the synthesized derivatives similarly possessed moderate to high antiproliferative and cytotoxic activities highlighting the potential of these cyclopent-2-enone derivatives as anticancer drug candidates.

Keywords: 4-substituted cyclopent-2-enone derivatives, anticancer, antimicrobial, drug discovery, Mukaiyama-Michael reaction

MPS – 14

UTILIZATION OF WASTE POLYETHYLENE TEREPHTHALATE (PET) AS ADDITIVE IN BITUMEN: PHYSICOCHEMICAL PROPERTIES AND THERMAL BEHAVIOR ASSESSMENT

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The waste generated by single-use plastic bottles increases the plastic pollution problem in the world. This study aims to help address this problem and understand the effect of utilizing waste polyethylene terephthalate (PET) as an additive to bitumen by assessing its physicochemical and thermal behavior. PET-modified bitumen samples were prepared using three different additive sizes (≤ 0.50 mm, $>0.50\text{--}\leq 1.00$ mm, and $>1.00\text{--}\leq 2.36$ mm) and additive percent compositions (4%, 9%, and 14% by weight of bitumen-additive mixtures). The addition of PET decreases the penetration grade and increases the softening point of base bitumen resulting in an optimum mixing condition of 14% PET additive and ≤ 0.5 mm PET size. In understanding the chemical composition of PET-modified bitumen, Saturates, Aromatics, Resins, and Asphaltenes (SARA) fractionation was performed and was analyzed by Infrared (IR) spectroscopy. The separation in PET-modified bitumen resulted in clear light-yellow liquid saturates, reddish viscous liquid aromatics, fine black solid resins, and dark brown to black solid asphaltenes. IR analysis shows the presence of PET in the asphaltenes fraction of PET-modified bitumen. The thermal behavior of PET-modified bitumen was also assessed by thermogravimetric analysis (TGA) using the Starink-modified Kissinger-Akahira-Sunose method wherein it showed an increase in thermal stability and physical interaction of PET in all four fractions of bitumen. Its performance against flood simulated conditions, evaluated by density and IR analysis, showed that the addition of PET in bitumen does not weaken the water-resistance properties of bitumen.

Keywords: polyethylene terephthalate, bitumen, SARA fractionation, thermogravimetric analysis

MPS – 15

VISCOELASTIC PROPERTIES OF BIS-UREA-BASED SUPRAMOLECULAR GELS IN SURFACTANT FORMULATIONS

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Low molecular weight gelators (LMWGs) are able to form structured supramolecular networks and respond to external stimuli making them suitable for various high-end applications. Incorporation of urea groups into these compounds induces a one-dimensional self-assembly stabilized by hydrogen bonding, resulting in the formation of supramolecular architectures. In this study, a library of LMW bis-urea compounds bearing amino acid moieties was synthesized and evaluated as gelators in surfactant solutions. Facile synthesis of the compounds was carried out by coupling between readily available amino acids and diisocyanate linkers. Structures of the synthesized bis-urea compounds were confirmed using ^1H and ^{13}C NMR, FT-IR and high resolution mass spectrometry. Supramolecular gels were obtained in sodium dodecyl sulfate (SDS) and Polysorbate 80, which were characterized using imaging technique and rheological measurements. SEM micrographs of the gels showed the self-assembly of the gelators into networks of cross-linking elongated fibers and tubular-like structures. Rheological oscillation amplitude measurements showed a higher storage modulus (G') compared to loss modulus (G''), indicating the solid-like behavior of the gels in the viscoelastic region. The data on the morphology and properties of the gels obtained in this study can be used as basis for their practical applications.

Keywords: supramolecular gels, bis-urea compounds, surfactants, rheology, gelators, viscoelastic properties

MPS – 16

VISIBLE LIGHT-TRIGGERED DIMERIZATION OF ANTHRACENE-CONJUGATED LINEAR

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Anthracene is a photoreactive substance that is known to reversibly dimerize when irradiated with UV light. Conjugating anthracene to linear polymers is interesting because of its potential of producing phototunable materials needed in a wide array of applications. One of the challenges in extending these applications to a biological setting is avoiding the use of harmful UV light as a trigger in dimerizing anthracene. In this study, anthryl-polymer systems that can be activated using biocompatible visible light were synthesized. Two synthetic strategies were used to functionalize Jeffamine-ED-2003, a linear polymer, with anthracene groups. One is through amide bond formation and the other approach is by using an electron-rich triazole to end-cap the polymer with anthracene units via click chemistry. ¹H nuclear magnetic resonance (NMR) and FTIR spectroscopy confirmed the formation of the desired anthracene-conjugated polymers. UV-vis spectroscopy showed the shift of the pertinent anthryl peaks to the visible region when triazole was incorporated in the polymer system. Irradiation of the polymer solutions at 462 nm for 4 hours led to the fast dimerization of the anthryl groups bound to the triazole-containing polymer as manifested in the decrease in the UV-vis absorbance and intensity of the ¹H NMR peaks of its anthryl groups. Heating the dimerized polymer at 80 °C for 2 hours resulted in the increase in the UV-vis absorbance of anthryl groups confirming the cleavage of the dimer. The results showed that the anthracene-functionalized Jeffamine-ED-2003 can be reversibly dimerized by sequential irradiation to visible light and heating once the anthryl groups conjugated to it are appended to an electron-donating moiety. This makes the synthesized polymer system a suitable precursor in fabricating biocompatible phototunable materials.

Keywords: Jeffamine-ED, triazole, anthracene, photodimerization, click chemistry

MPS – 017

PREDICTING THE NEXT SARS COV 2 VARIANTS USING LONG SHORT-TERM MEMORY NETWORKS

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Mathematical modeling of genetic mutations of viruses using machine learning have become a powerful tool to predict evolution of new variants. In the last decade, this aided scientists to identify evolution of possible variants of the continuously mutating pathogen and understand their biological characteristics. In this study, we attempt to predict possible mutations of the spike glycoprotein of the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS CoV 2), the virus responsible in the COVID 19 pandemic, using long-short term memory (LSTM) neural networks.

Genomic sequences of the SARS CoV 2 were acquired from EMBL and NCBI GenBank. These sequences were fed into LSTM and Bi-Directional LSTM (BiLSTM) networks. The LSTM provided the hypothetical sequences of potential SARS-CoV-2 variants by using one-hot encoding vectors as input which retained the fundamental details of the position of each nucleotide sequence. The BiLSTM identified which of the hypothetical sequences were closest to that of the SARS-CoV-2 spike glycoprotein by converting the sequences into semantic embeddings through the Leiden clustering algorithm for the classification of sequences while the validation process was performed from high scores for semantic and grammatic changes.

Accuracy and validation accuracy of the LSTM models resulted to 97.18% and 82.67%, respectively. Our results suggest that the demonstrated LSTM and BiLSTM networks may be used as an algorithm to forecast mutations in the SARS-CoV-2 spike protein sequences or new COVID-19 variants.

Keywords: SARS CoV 2 mutation, COVID 19 variants, long short-term memory, neural network

MPS – 18

WETTABILITY AND SURFACE ROUGHNESS OF GIANT BAMBOO THERMALLY MODIFIED IN AN OIL ENVIRONMENT

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The study explored the effects of oil-heat treatment (OHT) on the wettability and surface roughness of giant bamboo [*Dendrocalamus asper* (Schult.) Backer] slats. OHT was performed by submerging 8-ft bamboo poles at 175°C and 200°C for 30 minutes. Treated poles were rip sawn and planed to produce slats, then sanded (180-grit) prior to testing. The roughness was taken perpendicular to the grain on both inner and outer surfaces using a stylus-type portable tester. Wettability was obtained through sessile drop method, where commercial adhesives [polyvinyl acetate (PVAc), polyurethane (PUR), urea formaldehyde (UF), and phenol formaldehyde (PF)] were dropped onto the surface of the slats. Drop images were captured at 15, 60, 120, 180, 240, and 300 seconds, then images were analyzed using the ImageJ software (version 1.52a) to obtain the contact angle. Results showed that surface roughness of bamboo slats decreased at increasing temperature exposure with the outer side exhibiting smoother surface than the inner side. Contact angle measurements revealed an improvement in wettability among oil-heat treated bamboo as indicated by lower values relative to the control. PUR having the lowest contact angle showed the best wetting behavior, followed by UF, PF, and PVAc. Overall, OHT of giant bamboo resulted in a smoother surface and an improved wettability. The information acquired in this study will help in understanding the bonding characteristics of oil-treated giant bamboo for the manufacture of laminated or engineered bamboo products.

Keywords: *Dendrocalamus asper*, oil-heat treatment, surface roughness, thermal modification, wettability

MPS – 19

ZNO-SNO₂ THIN FILM DEPOSITION BY SPRAY PYROLYSIS TECHNIQUE FOR ANTI-REFLECTION COATING APPLICATION

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Thin film technology is an essential field that promoted the development of electronic science and engineering surfaces. For anti-reflection coating application, thin film deposition of transparent conducting oxides (TCOs) such as zinc oxide (ZnO) and tin dioxide (SnO₂) are utilized since these semiconductors have wide optical band gap and exhibit high optical transmission at visible wavelengths. Combination of these oxides may have promising property enhancement for such application. In this study, thin films of pure zinc oxide, pure tin dioxide, and 50:50 zinc oxide-tin dioxide were prepared using the spray pyrolysis technique (SPT) on a glass substrate. The microstructural and optical properties of the three samples were characterized using scanning electron microscopy (SEM) and UV-vis transmission spectroscopy, respectively. SEM micrographs revealed that combined ZnO and SnO₂ thin film manifested an almost homogeneous and densely packed surface morphology, showing an island-like surface structure. All the samples established a relatively high transmittance in the visible and near-infrared regions. The average transmittance values of all the samples in the visible region of the films ranged from 75%-85% but the 50:50 zinc oxide-tin dioxide sample showed the highest transmittance of 85 % at 760 nm. This confirms the optical property enhancement in the visible region for the combined ZnO-SnO₂ thin film which is suitable for anti-reflection coating application.

Keywords: thin films, zinc oxide, tin dioxide, semiconductor

SOCIAL SCIENCES

SSD – 01

ACCESSIBILITY AND AVAILABILITY OF DRINKING WATER IN BUENAVISTA, QUEZON

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Access to safe water and sanitation is recognized by the United Nations as a basic human right. One of the targets of SDG 6 is “to achieve universal and equitable access to safe and affordable drinking water for all by 2030”. Information on the accessibility and availability of water to specific areas is essential in assessing the progress in attaining this target especially in rural municipalities. Hence, this study was conducted to determine the accessibility and availability of drinking water sources in Buenavista, Quezon, a 4th class municipality. About 94% of the total households in the municipality reside in rural barangays and only six percent are in the poblacion barangay. Face to face interview with 374 household respondents which were randomly selected was conducted from March to August 2021. The accessibility to drinking water was classified into four categories: basic, limited, unimproved and surface water based on the WHO/UNICEF JMP Report of 2017. The availability of was considered high if there is a continuous supply for more than 12 hours in 4-7days/week.

Results showed that 25% of the households obtain their drinking water from improved sources such as piped water into the yard/plot, piped water into dwelling, boreholes and protected dug wells, 65% from the refilling stations and 10% from unimproved sources (unprotected dug wells, unprotected springs) and surface water (streams and rivers). In terms of water access, 61% of households in the municipalities have basic water service levels - i.e. they can gather their drinking water from improved sources in less than 30 minutes for a round trip. About 28% of the households in Buenavista, Quezon have limited water services as indicated by excessing queuing time for the delivery of drinking water by the limited number of refilling stations. Further, 1 out of every 10 families in Buenavista, Quezon still uses surface and unimproved water as drinking sources. With regards to water availability, it was recorded that six out of 10 households in Buenavista, Quezon have high availability of drinking water.

Overall, the accessibility and availability of drinking water in Buenavista, Quezon is influenced by the heavy reliance on a limited number of water refilling stations by the majority of the residents. The result of this study can serve as a basis in the development of an enabling mechanism for the conversion of unimproved water sources to improved water sources and for site prioritization of Water, Sanitation and Hygiene (WaSH) program implementation by the local government unit of Buenavista in order to have better access and availability of safe drinking water for all.

Keywords: drinking water, water accessibility, water availability, SDG, WaSH program

SSD – 02

BREAKING THE SILENCE OF ISLAND-BASED TEACHERS: SOCIAL REPRESENTATIONS OF HUMAN RIGHTS ON TEACHERS' MISTREATMENT AND SUPPORT

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Experiences of island-based teachers during the K-12 transition and Covid-19 pandemic were examined as to mistreatment and support from their principals within the public school system settings. As a multi-method inquiry, the (i) descriptive approach on a cross-sectional survey of 205 teachers as subjects using the questionnaire on Principal Mistreatment/Abuse Inventory (PMAI); and the (ii) use of Social Representation (SR) theory of Serge Moscovici in examining teacher-principal relationship within mistreatment, trust and support. On the SR inquiry, analysis used the associative network approach to elicit the SR perspectives of the teacher-principal relationships in the school setting, but also extended to the neighborhood living within the 50-meter radius where the schools are located that involved interviews among parents and the local leaders. Firstly, it was discovered that mistreatment and frequency of teacher-principal conflicts in the schools surveyed reveal very low incidence at 6% to 12%. Secondly, mistreatment that caused harm to the teachers are on health and well-being (i.e. insomnia or sleeplessness, hypertension) and other respiratory diseases were common among those who experienced mistreatment; and the principals seriously address student-to-student (STS) bullying within a cooperative stance among of the teachers with their principals. On the associative network approach, index of polarity was computed as 0.25, which means that most words expressed by the teacher respondents were connoted positively. Positive association implies that the words expressed by the teacher-respondents are overtones of their claims of being victimized. As to the neutrality index, it was computed as - 0.697, meaning that the neutral words tend to be equal to the sum of the positive and negative words, indicating that the teacher representations appear to be balanced considering that there are factors that these teachers expressed are also considered by their principals. Using SR several tools of analyses were found to be appropriate. On trust, this is embedded in the social context to which these teacher-subjects are exposed to changeover stage during K-12 implementation and continued during Covid-19 pandemic that wrapped a more trusting relationship within the reciprocal relations evolved around “empathy” and “malasakit”). Included in this inquiry are two policy briefs for CHR, counseling initiatives and inputs to a Learning Module in Educational Justice and School Governance for pre-service teachers.

Keywords: school conflicts, mistreatment, support, trust, social representations

SSD – 03

**CASH TRANSFERS AND TEMPTATION GOODS:
AN ANALYSIS ON THE IMPACT OF CASH TRANSFERS ON POOR
HOUSEHOLDS' CONSUMPTION OF SUGAR-SWEETENED BEVERAGES IN
THE PHILIPPINES**

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Sugar intake has been increasing globally and locally for individuals. Meanwhile, Philippine institutions continue to provide cash transfers (CTs) to poor households. Past literature found varying results of the impact of transfers on expenditure, consumption, and temptation goods; however, most studies focused on alcohol and tobacco consumption and neglected the impact of cash transfers on the consumption of sugar-sweetened beverages (SSBs). Thus, this paper analyzed the impact of CTs on sugar-sweetened beverage consumption of poor households in the Philippines. The study used propensity score matching and average treatment effects on the treated (ATET) evaluation method to compare the consumption of poor households with transfers to their consumption if they had not received cash transfers and determine the characteristics of households who were likely to receive transfers. The likelihood of poor households receiving CTs was significantly affected by some of the household head's characteristics (age, educational attainment, and class of worker), household characteristics (household type, number of children below 18 years old, salaries and wages, and region of residence), and household facilities (water source, type of toilet facility, and type of roof). CTs were found to significantly decrease soft drinks consumption but did not significantly affect consumption of other SSBs. Policy responses related to increasing awareness of the health effects of these drinks such as requiring warning labels, monitoring advertisements, and imposing restrictions on the amount of sugar added are highly recommended to decrease consumption of the said beverages.

Keywords: cash transfers, sugar-sweetened beverage consumption, propensity score matching, average treatment effects on the treated evaluation

SSD – 04

FOOD SAFETY KNOWLEDGE AND PRACTICES OF READY-TO-EAT FOOD VENDORS AMIDST THIS NEW NORMAL SITUATION IN GUINAYANGAN AND SARIAYA, QUEZON, PHILIPPINES

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The growing industry of ready-to-eat food (RTEF) and the onset of the COVID-19 pandemic imposed an urgent need for food vendors to adhere to both food safety and COVID-19 safety measures to avoid foodborne illnesses and the spread of SARS-CoV-2. This study determined the food safety knowledge and practices of the RTEF vendors and their compliance with the COVID-19 safety health protocols. A survey through an interview with 88 food vendors from restaurants, food stands, food stalls, and bakeries and physical observation was conducted in Guinayangan (n=36) and Sariaya (n=52) Quezon in May-September 2021. Using a pointing system, it was revealed that 64-88% of the RTEF vendors in both municipalities have good knowledge of personal hygiene, sanitation, storage, and food handling and processing, but they lack knowledge of foodborne diseases. The observation of their practices revealed that less than 50% of RTEF vendors in both municipalities have proper personal hygiene practices. The sanitation measures were being practiced by 7-61% of the RTEF vendors. Less than 50% showed proper food handling and processing in terms of handwashing, not wearing jewelry while working, and touching the RTEF barehanded. Fifty-four to one hundred percent of the RTEF vendors have proper food storage practices. It was also determined that they have poor compliance with the DOH COVID-19 safety health protocols. In terms of administrative control, only 3% of RTEF vendors in Guinayangan while 60% in Sariaya do self-monitoring. Not more than 10% of the RTEF vendors in both municipalities checked the customers' temperature, but around 50-65% in Guinayangan and Sariaya limit the number of employees or customers within their establishment. Also, only 6-37% adhere to the engineering control protocol of having available alcohol-based sanitizer, marked areas to promote social distancing, and posted signages about the use of Personal Protective Equipment (PPE) and other COVID-19 safety measures. Lastly, less than 50% have proper disposal of used PPEs. Ready-to-eat food vendors in both municipalities have good knowledge on many aspects of food safety. However, these are not reflected in their food safety practices and compliance with COVID-19 safety health protocols. Their poor food safety practices and compliance with the COVID-19 safety health protocols indicates that the RTEF vendors in Guinayangan and Sariaya can become a source of foodborne microorganisms and COVID-19 virus.

Keywords: COVID-19 pandemic, food handlers, safe foods, safety health protocol, sanitation

SSD – 05

FOSTERING STUDENT ENGAGEMENT IN THE ONLINE CLASSROOM: AN APPRECIATIVE INQUIRY

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Engagement is an important facet of learning and motivation. When the COVID-19 pandemic forced schools to transition to virtual classrooms, one of the challenges teachers experienced was on instigating and sustaining student engagement. How can a teacher encourage students to be virtually present and participative when they are in a place and situation that is not conditioned for focused learning? Using an appreciative inquiry approach, this study examined the qualities of the teacher and the nature of the virtual classroom that motivates students to learn and participate in those classes. Eighty-eight (88) college students responded to an online survey form composed of open-ended questions that pertain to what makes them engage in their online classes. To strengthen the findings in the online survey, a follow-up one-on-one virtual interview was conducted with 6 students to elicit detailed information on the themes. This study finds that teachers' personal and professional qualities play a major and important role in student engagement. Students become engaged in virtual classrooms when teachers are understanding, considerate, encouraging, and accepting. Moreover, students are motivated to pursue their learning tasks when teachers give a few, essential requirements, facilitate well-planned and organized lessons and activities, and make use of varied and interactive applications and strategies that allow for maximum participation. These are valuable information that will help teachers redesign their teaching strategies that foster engagement and responsiveness to the needs of students in the current context and beyond.

Keywords: student engagement, online learning, virtual classroom, teacher quality

SSD – 06

HALALAN 2022 ON FACEBOOK: A CONTENT ANALYSIS ON SELECTED POSTS DURING THE FILING OF THE CERTIFICATE OF CANDIDACY

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Facebook is primarily used for communicating and building relationships. Further, it is being used as a source of mainstream news coverage, especially for the upcoming Philippine 2022 Election. During the filing of the certificate of candidacy period, there were several posts published from various Facebook accounts. With this, the researcher aimed to characterize the various public information posts about Elections 2022 on Facebook. This study employed qualitative content analysis on the posts published from October 1 to 8, 2021. There were 101 posts retrieved using the terms #Halalan2022, #Election2022, #pHVote2022 and #Pilipinas2022. Thematic analysis was used to analyze the retrieved posts. A total of 6 themes emerged from the analysis of the retrieved posts. These themes are (i) National Position Aspirants for 2022 Election, (ii) Local Position Aspirants for 2022, (iii) Personalities turned into Politicians, (iv) Statistics and Profiles of 2022 Presidential Candidates, (v) Social and Emotional Disconnections, and (vi) Issues and Promises of 2022 Presidential Candidates. The content analysis on various Facebook posts during the filing of the certificate of candidacy provides information to the public about the possible candidates for the Philippine 2022 election, their political background or career, and their stand towards different social issues and concerns. Thus, it will assist every Filipino in determining the next set of leaders that can make the Philippines a better and prosperous nation in the future.

Keywords: content analysis, election 2022, Facebook posts, Philippines

SSD – 07

LEARNING AMID COVID-19 PANDEMIC: SCIENCE STUDENTS' LEVEL OF PERCEPTION, CONSTRAINTS, AND PREFERENCES TOWARDS ONLINE EDUCATION

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The study aimed to determine students' perception, constraints and preferences towards online education in terms of technical requirements, structure, frequency and duration, addressing of queries and plan and criteria of evaluation. It utilized an adapted survey questionnaire from Muthuprasad et al. (2020) in gathering data among eighty seven (87) first year Sciences students enrolled in Central Mindanao University. Descriptive statistics and percentage and frequency distribution were employed in analysing the data. The study revealed that first year Sciences students perceived online education as equally effective. Moreover, most students have encountered technological constraints with online learning, notably data limits and internet speed. In terms of online learning preferences, students choose Google Classroom for class updates, and use both smartphones and laptops linked to the internet via data packs. In terms of online class structure, students choose live sessions that are recorded. Students also prefer 4-6 hours of class time each day, with an hour session length and a 15 minute break between classes. Furthermore, students prefer using messenger, email, and live chat to communicate with their instructors. Lastly, students favor the idea of having homework at the end of every lesson and attend online examinations that are both subjective and objective in nature. To provide the best alternative teaching strategies and make online learning easy, efficient and productive to students, researchers recommend that the school should intensively assess students' geographical location, parental financial resources, and their preferred learning methods at the start of each school year, especially the incoming first year students.

Keywords: perception, constraints, preferences, technical requirements, structure, frequency and duration, addressing of queries, plan and criteria of evaluation

SSD – 08

“LUMINDOL BA?!” EARTHQUAKE INFORMATION ON DOST-PHIVOLCS FACEBOOK DURING THE 2017 BATANGAS EARTHQUAKE EVENTS

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During felt earthquake events, Facebook users visit the Department of Science and Technology – Philippine Institute of Volcanology and Seismology’s (DOST-PHIVOLCS) Facebook page to gather information. They use the comments section to react, discuss, and inquire for additional information about the situation. Previous research utilized this user-generated content to gain insight into the audience's perspective during a disaster. In this study, a total of 9,057 comments under the earthquake information posted on the Facebook of DOST-PHIVOLCS for the series of felt earthquakes in Batangas in 2017 (04 April 8:58 PM, 08 April at 3:07 PM, and 3:09 PM) were thematically analyzed. Based on the categorized themes and analysis, we identify the information needs and challenges in disseminating earthquake information. Results suggest the importance of a strong social media presence to augment our Facebook posts and to address immediate concerns and reiterate the position of the organization as the information source. Continuous earthquake awareness and preparedness information campaigns will increase the public’s ability to respond appropriately during an earthquake. And, there is a need to increase social media literacy to discern factual and useful information online.

Keywords: Social Media, 2017 Batangas Earthquake, Disaster Risk Reduction (DRR), Social-Mediated Crisis Communication (SMCC)

SSD – 09

RE-EQUIPPING SCIENCE AND MATH EDUCATION: CURRICULUM, ASSESSMENT AND MISSION-VISION STATEMENT GEARED TOWARDS ADHERENCE TO THE 21ST CENTURY STANDARDS AMIDST ONLINE LEARNING

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The abrupt shift of traditional learning (face-to-face) into online learning (remote or blended) need the educational system to level up in terms of digital resources. Teachers should adapt the recent trends in education by retooling and upskilling the learning and teaching strategies. The 4 Cs: communication, collaboration, critical thinking and creativity of 21st century skills should be embedded and integrated in the educational system even in the online environment.

Curriculum and Assessment Review focus on the learners aged 13-16 (Grade 7 to Grade 10) that identify the state of science and mathematics curriculum in terms of significant processes, obstacles and innovative possibilities. The research employed the Descriptive – Survey Research design where the Science, Math, and Computer Science and Technology (SMCT) teachers identified the teaching practices and classroom activities that develop the 21st century skills among the students. Furthermore, this research also focused on how was the Mission-Vision translated in the curriculum and activities of the learners through curriculum feedback and assessments like National Readiness Test (PSHS System).

The findings of the research are as follows: The teacher-respondents are capable Science and Math teachers; matured in terms of age, teaching experience and educational attainment. Majority of the teachers practiced critical thinking skills, collaboration skills, and creativity skills with students 1-3 times a week. While majority of the teachers practiced communication skills with students 1-3 times a month. Collaboration/group work strategy is the most common strategy used by the teachers.

In conclusion, with the technological advancement, the digital resources make online instruction and learning activities more effective that develop and enhance 21st century skills when used appropriately by the teachers. In this way, students may become communicators, collaborators, critical thinkers and creative for the benefit of the society in the 22nd century.

Keywords: curriculum, assessment, science, math, 21st Century, learning

SSD – 10

SOCIO IMPACT ASSESSMENT UNDER THE COMMUNITY BASED FOREST MANAGEMENT-COMPREHENSIVE AGRARIAN REFORM PROGRAM (CBFM-CARP) APPROVED PROJECTS IN CARAGA REGION

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This study assessed the nine (9) people's organizations (POs) beneficiaries of Community-Based Forest Management-Comprehensive Agrarian Reform Program (CBFM-CARP) using FMB Technical Bulletin No. 9. Results were analyzed using descriptive statistics to establish quantitative data characteristics and Wilcoxon Signed Rank Test to determine whether there is a significant difference in household monthly income status before and after the project implementation. The estimated percentage of total income from the CBFM project ranged from 24% to 62%. Eight (8) PO's household beneficiary monthly income before and after the project implementation has a significant difference (at $\alpha=0.05$), while only one (1) PO show was non-significant. Generally, CBFM-CARP helped alleviate the socio-economic status of its beneficiary and manage forestry resources through forest cover rehabilitation and agroforestry.

Keywords: CBFM-CARP, income, forest, agroforestry

SSD – 11

STUDENTS' ATTITUDE AND THEIR LEARNING ENVIRONMENT IN VIRTUAL LABORATORY CLASS

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The purpose of the study is to determine the students' attitudes, assess their learning environment, and find out the relationship between students' attitudes and learning environment in virtual laboratory class among 173 science education students from the College of Education, Central Mindanao University.

This quantitative study used descriptive correlation research as research design and data analysis.

The results of the study revealed that the students' attitude in virtual laboratory classes in terms of inquiry was acceptable, and the enjoyment was highly acceptable among the respondents. For the learning environment in virtual laboratory classes, five dimensions were moderately practiced, namely: integration, material environment, teacher support, task orientation, and investigation. Only the dimension of differentiation was fairly practiced among the science education students. The result of the Pearson (r) correlation shows the significant relationship between the learning environment and students' attitudes in virtual laboratory classes.

The study recommends that enhancing the setup for virtual laboratory is one of the keys to promoting a positive attitude and in performance of the students in the activities and experimentations.

Keywords: attitude, learning environment, virtual laboratory, science education

SSD – 12

TECHNOLOGICAL PEDAGOGICAL AND CONTENT KNOWLEDGE (TPACK) SELF-EFFICACY, 21ST CENTURY INSTRUCTIONAL SKILLS AND PERFORMANCE OF SCIENCE TEACHERS IN THE NEW NORMAL

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This study investigated the TPACK self-efficacy, 21st century instructional skills and performance of Science teachers in the new normal. Descriptive-correlational research design was used. TPACK self-efficacy and 21st century instructional skills were assessed using adapted questionnaires while teachers' performance was assessed using the Philippine Professional Standards for Teachers (PPST) criteria.

Three hundred and eighty six (386) Science teachers participated and their responses were analyzed using descriptive-correlational and causal comparative designs. Path analysis was employed to test the parsimonious relationship of the causal models and the other variables.

Results of the study revealed that Science teachers had a high level of TPACK self-efficacy and were highly skilled in 21st century instructional skills which resulted to a very satisfactory teaching performance.

Science teachers' performance was significantly correlated with technological knowledge (TK) which was also the lone predictor of their performance.

The best-fitting model, Causal Model 3 of Science teachers' performance was directly anchored to technological knowledge supported by pedagogical content knowledge, content knowledge, communicative and collaborative skills and innovative and ICT skills. Therefore, teachers must be given opportunities to enhance their Technological Knowledge together with their 21st century instructional skills to improve their performance in the academe.

keywords: teachers' performance, TPACK self-efficacy, 21st century instructional skills

SSD – 13

THE FUTURE OF ROBOTICS AND AUTOMATION IN THE PHILIPPINE FOODSERVICE INDUSTRY: A TECHNOLOGY FORESIGHT THROUGH SCENARIO-BUILDING

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Foodservice professionals and futurists identify robotics and automation as industry disruptors in 2030. Its exponential advancement and the COVID-19 pandemic accelerated its adoption among early adopters due to its perceived benefits of alleviating labor pains, enhancing efficiency, cost savings, improving food quality, and creating a competitive advantage. This foresight study explores the readiness of the Philippine foodservice industry through scenario development with local experts. The environmental analysis presented optimistic buy-in scenarios toward enabling food robots and automation to address the demographic shift, augment the workforce, establish startups, and define the vulnerabilities of a business-as-usual case. Several strategies emerge to prepare the local industry, such as strategic technology planning, direct policy development, educational reforms, and recovery strategies. These results advise the public agencies, private stakeholders, and academic professionals with the industry's technological opportunity to transcend towards a new foodservice ecosystem.

Keywords: robotics, automation, foodservice industry, technology foresight, scenario building

SSD – 14

THE MEDIATING ROLE OF MENTAL TOUGHNESS TO COVID-19 RELATED ANXIETY AND THRIVING QUOTIENT OF COLLEGE STUDENTS**Rhalf Jayson F. Guanco and Sheryll Ann M. Castillo**

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Thriving is vital in students' success for it provides a path towards meaningful student life and productive living. There is no doubt, however, that the global COVID-19 pandemic has massively impacted students' academic life. There is a need to understand how students can continue to thrive despite unprecedented challenges. Hence, this study aimed to determine the relationship of COVID-19 related anxiety to thriving quotient and examine whether mental toughness can buffer its effect. Through non-probability sampling technique using volunteer (opt-in) panel for online research methods, eight hundred thirty (n=830) college students from public and private higher educational institutions in the Philippines were selected as sample. Researcher-made COVID-19 Related Anxiety Scale (CRAS-30) and modified standardized questionnaires such as The Mental Toughness Questionnaire (MTQ-18) and Thriving Quotient (TQ-30) were used to measure the variables of the study. Results indicated a high level of COVID-19 related anxiety, and moderate levels of mental toughness and thriving quotient among students. Further, partial least square-structural equation modeling (PLS-SEM) generated a full mediation effect of mental toughness to the relationship of COVID-19 related anxiety and thriving quotient. This result implies that to curb the negative effects of COVID-19 related anxiety on students' thriving, it is imperative that mental toughness be developed in them. Recommendations to the academic community and for further studies are discussed.

Keywords: COVID-19 anxiety, mental toughness, thriving quotient

SSD – 15

THREE-FACTOR STRUCTURE FOR YOUTH ENGAGEMENT IN COMMUNITY POLICING DURING THE NEW NORMAL: A CONFIRMATORY STUDY

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The Filipino youth is vital in leadership, nation-building, and public safety; nevertheless, works of literature point out that they are at higher risk of exploitation, cyberbullying, domestic violence, and recruitment by terrorists and other criminal networks. The youth need to be protected by the COVID-19 virus and the many crimes associated with quarantines and lockdowns. With all these, law enforcement agencies need to have more efforts to ensure that the youth are protected from crimes and become partners of the police in crime prevention. One of the strategies identified is involving them in community policing. Thus, this research aimed to identify, describe, and validate how to engage the youth in community policing in the new normal. In doing so, this research used confirmatory factor analysis (CFA) to examine the Three-Factor Structure for Youth Engagement in Community Policing During the New Normal (TFSYECINN) developed by Triste et al. in 2021. A total of 1,354 Filipino youth coming from all regions in the Philippines participated in this research. CFA results indicated that the hypothesized three-factor structure fit the data. However, the order of the first and second factors from the hypothesized and outcome model differed. The findings on the outcome model revealed that the first factor is knowledge-building about community policing. This factor highlighted the importance of providing activities that will benefit the youth. Moreover, the second factor is trust-building between the youth and the police through strengthened community partnership and information dissemination. Lastly, the third factor is utilizing technology such as mobile applications to motivate the youth to be more aware of criminal penalties. The overall findings of the study led to many implications. The fundamental contribution of the study was the development of the program "Kabataang Pulis". The program will help encourage and sustain the active participation of the Filipino youth in community policing. Notably, this research served as a baseline and provided insights for further studies considering the limited literature about the Filipino youth in community policing.

Keywords: youth engagement, community policing, new normal

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