multiply connected superconducting grains as a superconducting circular disk with a concentric hole. In the presence of an external applied dc magnetic field, the disk generates current flow along its perimeter due to the diamagnetic nature of the superconductor. Current along the boundaries is constant since it is equal to the intragranular shielding current. The magnitude of the current must be such that no magnetic flux penetrates the material.

In the presence of an applied sinusoidal ac magnetic field, current along the boundaries must screen magnetic flux from the sample. At the same time, due to the varying magnetic field, current out-of-phase with the applied magnetic field resulting from Faraday's law is generated. Moreover, the Faraday current keeps magnetic flux through the hole constant.

Energy loss is associated with this type of response by the sample. It is manifested by a magnetization out-ofp-phase with the applied field. Experimentally, magnetization is observed via ac susceptibility measurements. Out-of-phase ac susceptibility versus temperature shows a peak associated with sample granularity. This phenomenon is a result of the temperature dependent shielding current and Faraday current.

Keywords: magnetization, ac susceptibility

ENGINEERING SCIENCES AND TECHNOLOGY

ESTD No. 1   STUDY AND IMPLEMENTATION OF AN ASYNCHRONOUS TRANSFER MODE SWITCH SIMULATOR FOR THE DYNAMICALLY RECONFIGURABLE COMPUTING PLATFORM

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Reconfigurable computing systems are those computing platforms whose architecture can be modified by the software to suit the application at hand. The idea behind the Reconfigurable Processing Unit (RPU) is that, the fastest version of any program calculation is one in which a computer chip has been designed to perform that specific calculation only. With the advent of the flexible hardware, as new ways of solving problems arise, the RPU optimizes the computation power by implementing the calculation directly into a custom computer chip.

The study aimed to simulate an asynchronous transfer mode (ATM) switch based on the queuing system implemented on the reconfigurable processor.

The ATM switch was studied by creating a model of the switching element based on the queuing system. The components of the model were described using LOLA, an object-oriented logic description language. The approach in making the simulator was based on the mapping of the model of a physical system onto a reconfigurable computing system. A 16x16 ATM switch was made by forming two stages where each of the stage contain four (4) basic switching elements and interconnecting the stages by a Banyan Network. Routing of the connections was done using the XACT 6000 series software. A dynamically reconfigurable Field Programmable Gate Array (FPGA) like the 6200 RPU of XILINX was used to implement the simulator.

The study showed that dynamically reconfigurable RPU could be efficiently used for the simulation of the ATM switch that is based on the queuing system.

ESTD No. 2 A CELLULAR AUTOMATA-BASED STUDY OF VEHICULAR TRAFFIC DYNAMICS

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Cellular automata (CA) belong to a class of mathematical systems characterized by discreteness, determinism, local interaction and an inherently parallel form of evolution. This in study, we present a CA model of vehicular traffic dynamics based on the work of Nagel and Schreckenberg. We also review fundamental mathematical and computational aspects of one-dimensional and two-dimensional CA. Using Mathematica, a computer algebra system, we produce simulation results that are in agreement with data obtained from classical models of vehicular traffic.

We note the following results: (a) Simulations using the CA model produces speed versus density and flux versus density relationships that are similar to those obtained using the classical theory of vehicular traffic dynamics; (b) At a certain density level, increasing the maximum velocity have little effect in improving the flux or average speed of the system; (c) Increasing the randomization parameter decreases the flux and average speed of the system; (d) Introducing vehicles with lower maximum velocity also reduces the average speed but has little effect on the flux of the system.

ESTD No. 3   NOVEL PPEI-Ca²⁺ FLOCCULANT SYSTEM FOR SCAVENGING MERCURIC IONS FROM AQUEOUS SOLUTIONS

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Removal of toxic mercuric (Hg^{2+}) ions from aqueous solutions by a novel heavy metal flocculant was conducted. Treatment of Hg^{2+}-containing wastewaters is one application specifically targeted by this technique. The heart of the process is a hybrid soluble heavy metal chelating phosphonomethylated-polyethyleneimine (PPEI) polymer, which precipitates in the presence of Ca^{2+} ions. The branched structure of the PPEI, with its numerous amine ligands, contributes to the formation of strong coordinate bonds with Hg^{2+}. The phosphonate section provides the polymer with the required flocculation property in the presence of Ca^{2+} ions. Synthesis of fully functionalized PPEI was initially conducted following the Mannich reaction where phosphonate groups from phosphorous acid is introduced into a PEI polymer. The flocculation ability of purified PPEI in combination with Ca^{2+} ion for Hg^{2+} was then evaluated. The optimum pH and scavenging ability of the PPEI-Ca^{2+} flocculant system were the parameters primarily evaluated. The degree of phosphonate substitution in PEI was analyzed using a Perkin-Elmer Elemental Analyzer (Model 2044 CHN). Phosphorus content of PPEI as well as the heavy metal concentrations of solutions were determined by a Seiko Inductively Coupled Argon Plasma Spectrophotometer (Model SII SPS 3000S). Synthesis results indicated a close to 100% functionalization of PEI with phosphonate groups. This indicates the high efficiency of the modification process. Flocculation experiments showed that considerable floc formation accompanying Hg^{2+} sequestration occurs even at low initial Hg^{2+} concentration. Optimum Hg^{2+} removal occurs at basic pH where maximum precipitation of the PPEI-Ca^{2+}-Hg^{2+} complex occurs. Under this condition, the process is capable of scavenging Hg^{2+} ions to less than 3 ppb, which is below the disposal standard limit for Hg^{2+}-containing wastewaters of 5 ppb. To summarize, a simple, rapid and effective method for Hg^{2+} scavenging from aqueous solutions by a novel PPEI-Ca^{2+} flocculant system was established in this work.

Keywords: calcium; chelation; flocculation; mercuric ion; phosphonomethylated-PEI; wastewater treatment; phosphonate

ESTD No. 4   OPTIMIZATION OF SUPERCRITICAL CARBON DIOXIDE EXTRACTION OF THE ESSENTIAL OIL PF PHILIPPINE *Cananga odorata* Hook Fil et. Thomson FLOWERS BY RESPONSE SURFACE METHODOLOGY

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Essential oil was extracted from the flowers of Philippine Cananga odorata var. genuine grown in Pala-o, Iligan City hy supercritical carbon dioxide (SC-CO$_2$).

A statistical experimental design, first order 2^1 factorial, was used to investigate the effects of three independent variables (pressure, temperature, and flow rate of CO$_2$ on % oil yield (w/w), % linalool (v/v) and % benzyl benzoate (v/v) on the extracted oil. Three corresponding response equations were generated for values of pressure (80-100 bar), temperature (35-50°C) and flow rate of CO$_2$ (1-4 mL/min). Optimum oil yield (8.479%) was obtained under the following SC- CO$_2$ extraction operating conditions (98.61 bar, 39.58°C, 2.99 mL/min). This oil yield is much higher compared to the oil yield from hydrosteam distillation which is 2-2.25% (v/v). The extracted oil passed the 2nd grade quality except for its acid value (26.2794) which is too high for the given standard specification of less than three.

Gas chromatography was performed on the ilang-ilang oil extracted by SC-CO$_2$ extraction, laboratory, and commercial scale hydrosteam distillation. Degradation products were observed in the hydrosteam distillation. The linalool to benzyl benzoate ratio showed that the oil quality of the sample from Anao, Tarlac (0.658) is superior to that from Pala-o, Iligan City (0.583) perhaps due to the agroclimatic origin of the plant trees.

Keywords: Cananga odorata, carbon dioxide extraction, essential oil gas chromatography

ESTD No. 5   FED-BATCH PRODUCTION OF METHYL ESTERS FROM COCONUT OIL

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The Philippines is a major producer of coconut oil with exports of 1,080,913 metric tons and a domestic consumption of 464,000 metric tons in 1997. However, since

the oil is an agricultural product it usually has a low price in the international market. Greater revenues can be obtained if most of our coconut oil is transformed into higher value oleochemicals locally before being exported.   Among these oleochemicals, the methyl esters are the most promising.

The study was part of research on improving the traditional batch process of producing methyl esters from coconut oil. The process tested was fed-batch and the parameters investigated were (1) coconut oil temperature, (2) oil flowrate, (3) percent of catalyst (NaOH), and (4) ratio of methanol to coconut oil.

The fed-batch process involved the gradual addition of coconut oil into a reactor vessel containing a boiling solution of methanol and NaOH. The highest yield of 96.663 % was obtained at 2:1 methanol to oil ratio, 0.50% NaOH, one hour reaction time, 200 g/ L oil flowrate, and oil temperature of 27.5°C.

Statistical analysis of yields showed that the oil temperature and flowrate have no significant effect. Comparison between fed-batch, batch with reflux, and batch with stirring for 30 minutes reaction time and similar reaction conditions of 2:1 methanol to oil ratio, and 0.5% NaOH were performed. Statistical analysis (a = 5%) showed that the yield of methyl esters using the two types of batch processes gave no significant difference However, the yield from the fed-batch process was found out to be significantly higher The fed-batch process is therefore more efficient than batch process since greater yield is produced for the same conditions. This result could be due to the faster rate of reaction of the fed-batch process. This result shows that simply switching to a fed-batch process instead of a batch process in the production of methyl esters would make the reaction go to completion faster.

Keywords: coconut oil, methyl esters, batch process, fed-batch process

ESTD No. 6   CORRELATION STUDIES ON PERCENTAGE UTILIZATION OF SELECTED SUGARCANE VARIETIES AND SUGAR RECOVERY AT DIFFERENT MILLING DISTRICTS FOR FIVE CROP YEARS

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Yield parameters like 50-kg sugar per tone cane $\left[\dfrac{Lkg}{tc}\right]$ and 50-kg sugar per hectare $\left[\dfrac{Lkg}{Ha}\right]$ are determined by several factors including efficiencies of both farm and factory operations. The facto ry performance, measured in terms of pol extraction (E), actual boiling house recovery (BHR_{actual}) and over-all recovery (OR), may be affected by the cane varieties being processed.

This study generally aimed to correlate percentage utilization of cane varieties in different sugar factories in the Philippines with respect to sugar recovery expressed in E, BHR_{actual} and OR.

Major varieties with high percentage utilization like Phil 56226, Phil 58260, Phil 6553, Phil 6607, Phil 6723, Phil 7495, Phil 7779, Phil 8013, Phil 8093, Phil 8477, Phil 8361, Phil 8585, Phil 7544 and VMC varieties were correlated with sugar recovery (E, BHR_{actual}, OR) of ten (10) sugar factories using statistical mean-linear regression. The same procedure was applied in the factory performance in the regional level (Luzon, Visayas and Mindanao).

In one factory, there was a strong and positive correlation between factory performance and % utilization of Phil 6607. In another sugar factory using VMC varieties, there was a strong positive linear relationship between E and OR, and a very strong positive linear relationship with BHR_{actual}. In other factories studied, a strong correlation was also shown. However, % utilization of Phil 56-226 is moderately correlated with OR, moderately, inversely related with E and weakly related with BHR_{actual}.

In the analysis of regional performance, the Phil varieties gave the highest performance, in Luzon. For Eastern Visayas, Panay, Negros and Mindanao, the varieties Phil 6607, VMC and a mixture of other varieties showed a direct correlation between % utilization and OR. One factory in the Eastern Visayas region had the best performance in terms of parameters investigated.

Results showed conclusive trends for specific varieties and region, especially in the Eastern Visayas. For other regions, the poorly correlated parameters tend to confirm some on-site observations in some milling districts with respect to actual use of identifiable cane varieties.

Keywords: sugarcane, yield parameters, sugar recovery

ESTD No. 7   ENZYMATIC EXTRACTION OF RICE BRAN OIL

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The Philippines harvested 11, 923, 000 metric tons of rough rice in 1999. Milling of this rice produced large quantities of rice bran which is mostly used as animal feed. However, studies have shown that rice bran has an oil content ranging from 15-22%. This oil is composed mostly of unsaturated fatty acids and is different from coconut oil which is saturated. The availability and continued supply of rice bran in our country should make it an ideal alternative local source of oil.

The study determined the effect of using enzymes on the aqueous extraction of rice bran oil. The factors investigated were type of enzyme (cellulase, pectinase, cellulase-pectinase combination), enzyme concentration (0%, 2%, 4%), temperature (30°C and 45°C), solvent (hexane) addition before recovery, and dry heat pretreatment.

The rice bran was sieved and heat treated at 100°C for 5 minutes. Sets of 50 g of bran were then mixed with 150 ml enzyme solution in conical flasks. These were incubated in a shaker for 6 hours at the temperature being tested. Control set-ups were done using distilled water.

Results showed that higher temperature and enzyme concentration produced an increase in oil recovery (a = 5%) when solvent was used to recover the oil. At 30°C, the highest yield was observed with the cellulase-pectinase combination at 77.5% recovery, followed by pectinase with 60% and then cellulase with 50.1%, all at 4% enzyme concentration. For the effect of temperature, both cellulase and pectinase gave higher yields of 79.24% and 61.96%, respectively, at 45° than at 30°C. The data obtained when no hexane was used after enzymatic extraction shows that the use of enzymes was not significantly different with that of the control.

The use of thermal pretreatment appears to have no significant effect on the enhancement of oil recovery when solvent was not used.

The study indicates that cellulase and pectinase increases the extractability of rice bran oil by hexane. However, simple aqueous enzymatic extraction gives low recovery and this may be because the oil dissolves poorly in water.

Keywords: rice bran, rice bran oil, enzymatic extraction, pectinase, cellulase

ESTD No. B   **PARAMETRIC AND KINETIC ANALYSIS OF THE ACID HYDROLYSIS OF COPRA MEAL**

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The typical mass composition of copra meal is 43 - 45% carbohydrates, 19-20% protein, 10-11% oil and 12% crude fiber. Its high carbohydrate and protein content merits its consideration as a major source of food, feed or industrial material. In the Philippines, copra meal is mainly used as livestock feed but this is not

efficient since the high fiber content of copra meal decreases its digestibility.

The breakdown of copra meal has been generally achieved by acid hydrolysis but the effect of various parameters on the yield of sugars has not been completely determined. This study investigated the effect of (1) copra meal pretreatment (no pretreatment, defatted, delignified), (2) concentration of aqueous HCl (5%, 20%, 36% HCl by mass), and (3) reaction temperature (room temperature, 45°C, 60°).

Five grams of copra meal (no pretreatment, defatted, delignified) were placed in a 250-ml erlenmeyer flask. The acid was added and the contents of the flask were mechanically stirred. Samples were taken at 1-hr intervals and their acidity and reducing sugar content were analyzed.

The results showed that pretreating the meal had no significant effect on the overall production of the sugars. The acid concentration significantly affected the production of reducing sugars. The yield of reducing sugars for the 36%, 20%, and 5% acid concentrations were 0.17 (g sugar/g copra meal), 0.15, and 0.093, respectively. This corresponds to fractional conversions of 0.64 for the 36% acid, 0.58 for the 20%, and 0.35 for the 5%.

A kinetic study was done based on the proposed mechanism which treats the hydrolysis as a pseudo homogeneous catalyzed reaction that is first order with respect to both the polysaccharide and the acid catalyst. The equation used for the rate of reaction was $-\ln(1 - X_a) = k_{observed} t$, where X_a is the fractional conversion, $k_{observed}$ is the observed specific reaction rate, and t is the reaction time.

The $k_{observed}$ for 36%, 20%, and 5% were 0.1191 h^{-1}, 0.0954, and 0.0410, respectively. Results showed that the uncatalyzed reaction was insignificant so the $k_{observed} = k_2 Cc$, where k_2 is the specific rate constant of the catalyzed reaction, and Cc is the concentration of the HCl. Linear regression of the $k_{observed}$ for the different acid concentrations gave a k_2 of 0.0078 (Li/mol-h). The effect of temperature on the $k_{observed}$ for 5% acid concentration was determined. For 30°C, 45°C, and 60°C, the were 0.041, 0.0518, and 0.3614, respectively.

The results showed that copra meal can be significantly converted into simple sugars by acid hydrolysis using 5 % HCl (aq) and 60°C.

Copra meal is the ground residue obtained after the extraction of oil from dried coconut meat. In 1997, Philippine copra meal production reached 508, 565 tons.

Keywords: copra meal, mannan, reducing sugars, acid hydrolysis, kinetics

ESTD No. 9   ADSORPTION OF REACTIVE PROCION RED AND BASIC MALACHITE GREEN DYES FROM SIMULATED TEXTILE MILL EFFLUENT USING ACTIVATED CARBON FROM COCONUT SHELL

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It is estimated that of the 450,000 tons of dye produced worldwide, 9,000 tons (2%) are discharged in effluent from manufacturing operations while about 40,000 tons (9%) are discharged in effluent from the coloration industries.

Dyed wastewater in the textile industry is characteristically high in both organic contents and color. Moreover, these textile wastewaters are generally high in biochemical oxygen demand (BOD), chemical oxygen demand (COD), and total solids that could alter the condition of receiving streams causing pollution.

This study aims to investigate the effectiveness of activated carbon from coconut shell as an adsorbent.

The general objective of this study was to determine the adsorption characteristics of two dyes namely, Basic Malachite Green and Reactive Procion Red dyes on activated carbon from coconut shell.

The order (n) and specific rate constant (k) of adsorption of Basic Malachite Green (BMG) and Reactive Procion Red (RPR) dyes on activated carbon (AC) from coconut shell of mesh 78 and 30 were investigated. The maximum adsorptive capacity of AC for each dye was determined.

The adsorption rates of both dyes followed first order of reaction with adsorption rate constants of 0.142 min^{-1} (mesh 30) and 0.222 min^{-1} (mesh 78) for BMG dye and 0.0441 min^{-1} (mesh 30) and 0.0223 min^{-1} (mesh 78) for RPR dye. The adsorption isotherm for BMG dye fitted to Langmuir isotherm with maximum adsorptive capacities of 243.902 mg/g (mesh 30) and 250.273 mg/g (mesh 78). The adsorption isotherm for RPR dye did not fit in Langmuir and Freundlich isotherm.

Keywords: textile wastewater, dyes, activated charcoal, coconut

ESTD No. 10 EEFECT OF MIXED CULTURE ACTIVATOR ON THE DECOLORIZATION AND COD REDUCTION OR DISTILLERY SLOPS

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Distillery slops is a voluminous and highly pollutive residue produced by an ethyl alcohol plant. Its deep dark brown color and high BOD (20,000 to 120,000 mg/liter) necessitate proper treatment prior to its discharge to a receiving stream. In this study, a mixed culture activator composed of different species of bacteria and fungi and different types of enzymes was utilized.

The decolorization and COD removal capacity of a mixed culture activator on distillery slops was studied via aerobic process. Dilution alone resulted to 30. 84%, 76.80%, 90.81%, 92.17% and 94.80% color reductions for 1:1, 1:5, 1:10, 1:15, and 1:20 dilutions respectively. One-liter samples were treated with 5,10, and 20 grams of the activator for seven days. Results have shown that the maximum decolorization and COD reduction were obtained at 1:15 dilution with 15 grams of the activator. Decolorization was maximum at 99.34% color reduction with corresponding COD reduction at 85.5%. This optimum condition was achieved in five days. After the fifth day the color and other parameters (i.e. turbidity and TDS) intensified probably due to the death of microbial population.

The optimum dosage of the activator at the optimum dilution was further investigated by varying the pH and temperature. The pH was adjusted to 6, 7, 8, 9 and 10 with addition of H_2SO_4 or NAOH solutions. Decolorization was achieved at pH 8 with a reduction of 6.61% compared to 1070 PCU which was obtained upon treatment with the MCA alone. For the other pH settings, color further intensified. Thus, it could be surmised that the microorganisms and enzymes present in the activator have their maximum decolorization activities at pH 8. The COD of the wastewater decreased at all pHs and the maximum removal of 14.29% was obtained at pH 8 compared to 31,710 mg/l obtained upon treatment with MCA alone.

The optimum effect of temperature on the decolorization and COD reduction was observed at 30ºC. The result can probably be explained by the performance of the mixed culture activator at this temperature setting.

Keywords: distillery slops, decolorization, dilution, culture activator

ESTD No. 11 LEADLESS GLAZE FORMULATION (LOW FIRING) ULTILIZING LOCAL RAW MATERIAL FOR RED CLAY BODY

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Despite the abundance of local materials for glaze purposes, the ceramic industry still relies on imported raw materials. Lead oxide (litharge and red lead) is one component in making low fired glaze batch for ceramic body, which is costly and presents the risk of lead poisoning.

The study was focused on the leadless low fired glaze slip utilizing local raw materials such as rice hull ash and calcined "tumedted" limestone with the addition of commercial oxide soda ash, to determine the suitability of these materials as alternative replacement and supplement for imported raw glaze materials.

Three local clays were used as test samples in the experiment: Nanguyudan red clay in Paoay, Macayepyep red clay in Banna and Tapao red clay in Sinait. The glaze batch was based on the empirical formula $0.85\ Na_2O\ 0.15\ CaO\ 1.1\ SiO_2$. The prepared glaze batch formulation (three glaze slip formulation) was fired at 1050°C.

Results show that the formulated glaze exhibit a glassy phase appearance in the test bodies of the sample local red clay bodies. Some defects were evident in the test samples but these gave a unique artistic surface appearance.

Keywords: slip glaze, local red clays, solid casting, leadless glaze formulation

ESTD No. 12 ENERGY AUDITING OF THE BRICK AND POTTERY INDUSTRY IN ILOCOS NORTE

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The ceramic industry of Ilocos Norte revolves primarily on the manufacture of bricks for the construction industry and pottery (i.e. earthen cooking pots, stoves and flowerpots). All of these are fired and vitrified with the use of fuelwood and similar fuel materials like bamboo.

The study determined the sources, quantity and cost of fuels used in the firing of the ceramic products.

The use of bamboo and straw as a fuel is very common in the firing of bricks. The cost varies depending on the source. A limited use of fuelwood was also observed. The source of the fuel is from the province. Bamboo stumps were usually used in the firing process. The consumption varies depending upon the firing system; however, the open firing consumes the most fuel per fired product.

For the pottery industry, open firing is also practiced despite the presence of a kiln designed by the Industrial Technology and Development Institute. All systems use fuelwood and limited quantities of bamboo which does not exceed 10%. In terms of efficiency, the ITDI kiln is the most efficient which reduces the fuelwood use by as much as 50%.

The ceramic industry in Ilocos Norte is largely dependent on the fuelwood source in the province. However, there is no evidence of the cutting of big trees for fuel, but rather the harvesting of branches for fuelwood is practiced.

Keywords: bricks, ceramic, energy, fuelwood, kiln, pottery

ESTD No. 13   DESIGN AND DEVELOPMENT OF A MECHANIZED PRECISION SEEDER FOR HYBRID RICE PRODUCTION

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To date, the country's food security depends primarily on its ability to achieve rice self-sufficiency to cope with its increasing population. The utilization of hybrid rice technology has been eyed as the major agricultural program of the government towards rice self-sufficiency.

Manually transplanted hybrid rice at 1 to 2 seedlings per hill increases the rice yield of farmers by at least 15%. However, crop establishment is labor-intensive and there is an acute shortage of labor during transplanting. Hence, a precision seeder (laboratory model) was developed and evaluated. The seeder has a singulated metering mechanism that could meter-out hybrid seeds ranging from 1 to 4 seeds per hill with a row and hill spacing of 20 cm and 20–30 cm, respectively. Further modification is being undertaken to improve the mechanism. Fabrication is simple and some parts are recycled materials that would substantially reduce the cost of manufacturing.

A mechanized precision seeder will accelerate and intensify the utilization of hybrid rice technology.

Keywords: hybrid rice technology, precision seeder, singulated metering mechanism

ESTD No. 14   ADAPTATION OF THE HAND TRACTOR-DRAWN PADDY SEEDER IN SELECTED AREAS IN THE PHILIPPINES

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A paddy seeder was designed and developed to mechanize direct seeding operations in medium and large farms, where hand tractors are commonly used for land preparation and other farm-related operations.

The paddy seeder is equipped with six (6) cylindrical hoppers and a furrower assembly that can seed 12 rows in every pass. It has a very simple drum-metering device to regulate the amount of seeds to be sown.

Adaptation trials were conducted in selected areas (Aliaga, Nueva Ecija; Valencia, Bukidnon and Pigcauayan, North Cotabato) in the Philippines for its acceptance and verify the performance at different soil condition.

Field-testing of the paddy seeder showed that field capacity range from 3-5 ha/ day and an average field efficiency of 69 percent. The dimension of the paddy field, characteristics of the soil and number of operators affected capacity. Field efficiency largely decreases as the area of the field increases.

Also, it was observed that seed and labor requirements are lesser than other crop establishment methods. The used of the hand tractor-drawn paddy seeder is moderately easy based on feedback from farmer-cooperators. However, the paddy seeder could perform well up to 20 cm depth of hardpan. Beyond this depth, operation is difficult or not possible. Moreover, it is not suitable in Bukidnon and North Cotabato because farmers used floating tillers for land preparation. Economic analysis revealed that the used of hand tractor-drawn paddy seeder is feasible for farmers having at least 4 hectares.

Keywords: paddy seeder, drum-metering, cylindrical hopper, furrower assembly

ESTD No. 15   ANTHROPOGENIC IMPACTS ON AQUATIC AND TERRES-TRIAL ENVIRONMENTS IN THE LA MESA WATERSHED

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The La Mesa Watershed, the remaining forest in Metro Manila has an area of 27 km.^{2} where one of the reservoirs of water for Metro Manila residents is located. The watershed experienced various management interventions coupled with the presence of illegal occupants that resulted in the decline of the forest cover and increased sedimentation rates and nutrients in the river system. This research aims to establish baseline data in the reforested area and streams of the watershed., This research will also assess the impacts of various land uses on the soil and water quality in the area including that of the biotic components.

The impact of reforestation and agricultural activities had no significant difference on the soil quality (soil pH, organic matter and phosphate) of the watershed. Potassium though was found to be significant which can be attributed to the presence of feldspar in the parent rock material. The streams in the area were shallow (0.03-0.28 m) with a relatively slow flow (0.89-3.73 m/s) and short-term variations in nutrient availability such as sulfate, nitrates and phosphate. Phosphate concentration was relatively higher in all sampling sites compared. The streams were poorly sorted and characteristic of a gravel bed type. There was a significant difference in the stream, sediment nutrient concentration across all streams having the highest concentration of total nitrogen, total organic carbon and sulfates. Twenty-three taxa of macroinvertibrates were identified and using the Belgian Biotic Index (BBI) in the stream sediments indicative of a good water quality including that of the phytoplankton consumption were all positive for fecal coliform contamination.

The data gathered from this research can help in watershed management and stream restoration plan to maximize the contribution of the streams to the reservoir.

Keywords: La Mesa Watershed, water quality, rivers, sediments, phytoplankton, benthic organisms, soil quality, nutrients