

III. COCONUT TECHNOLOGY

Project Title: CONVERSION OF COCONUT OIL INTO INDUSTRIAL SOLVENTS (LABORATORY STUDIES)

Name and Address of Principal Investigator: Teodorico F. Festin
UP College of Engineering, Diliman,
Quezon City

Description of the Project: The project has for its objective the development of a process that will convert coconut oil into hexane and/or heptane. This study involves the pyrolysis under pressure of coconut oil and its fatty acids in the presence of catalysts which are locally available. The products of pyrolysis will be analyzed to determine their chemical and physical properties. The amount of catalyst will be varied to determine its effect on yields.

Project Cost and Source Funding: ₱59,300.00
Philippine Coconut Research and Development
Foundation, Inc.

Cooperating Agencies: Philippine Coconut Authority

Date Started: April 1979

Duration or Expected Date of Completion: Oct. 1980

Present Status of Project: A literature survey report on Industrial Solvent from Coconut Oil and Fatty Acids has been prepared. Pyrolysis Experiments using varied quantities of the following catalyst have been made: $AlCl_3$, $FeCl_3$ and activated lava. A Para high pressure reactor was used in these experiments.

These types of catalysts and their concentrations effect the yields of pyrolysis.

Other Relevant Information: The literature survey revealed that there are not very many studies undertaken which are related to the conversion of vegetable oils, specially coconut oil, into industrial solvents. Most of the studies were in the thirties and these were aimed at producing hydrocarbonic fuels from vegetable oils.

Solvents that may be derived from coconut oil are attractive because the source, the coconut, is renewable and widely available.

Project Title: PILOT COMMUNITY INTEGRATED COCOCENTRAL: PLANT DESIGN AND TECHNO-ECONOMIC STUDIES

Principal Investigators: MSU-IIT Research Task Force Group
Team Leader: Prof. Rosello Macansantos
MSU-IIT, Iligan City

Description of the Project: The project is a techno-economic study of MSU-IIT's model of the Pilot Community Integrated Cococentral. Detailed plant design and project feasibility studies are discussed. The manuscript established guidelines for planning and developing the pilot cococentral project at the Institute's Coconut Industrial Research and Development Center.

Project Cost: ₱25,000.00

Source of Funding: MSU-Iligan Institute of Technology

Date Started: September 11, 1979

Present Status of the Project: A work-in-progress report of the project was compiled last April 24, 1980 and is being refined for publication. Various researches are in progress based on its objectives.

Other Relevant Information: The Community Integrated Coconut Central concept is an ideal project under the Bagong Lipunan Sites and Services (BLISS) Level II program of the Ministry of Education and Culture. Specifically, the project consists of the following components: Livelihood projects; "JSR" Integrated Copra-Charcoal Plant; Cocowater Food Products Plant; Coir Plant; Bricks Plant; Shelter Projects; Edible Oil Refining Plant.

Project Title: ANALYSIS OF COCO TAR AS BY-PRODUCT FROM THE "JSR" INTEGRATED COPRA-CHARCOAL PLANT

Principal Investigator: Prof. Jovenal San Agustin
MSU-IIT, Iligan City

Description of the Project: The research project will seek to establish the composition of the coco tar from the "JSR" Integrated Copra-Charcoal Plant (R.P. Patent 6087 S. 1971) as well as relative amount of this components.

Project Cost: ₱40,000.00

Source of Funding: MSU-Iligan Institute of Technology

Date Started: August 1, 1980

Expected Date of Completion: December 30, 1980

Present Status of the Project: Initial data have been taken. Equipment needed for the experiment are being ordered.

Project Title: PERFORMANCE EVALUATION OF THE "JSR" INTEGRATED COPRA-CHARCOAL PLANT

Principal Investigator: Prof. Jose D. Clar
MSU-IIT, Iligan City
Prof. Ciriaco A. Darunday, Jr.
MSU-ITT, Iligan City

Description of the Project: The research is an evaluation on the Performance of the Copra-Charcoal Plant of Jacinto S. Roque (R.P. Patent No. 6087, June 1971)

Project Cost: ₱466,221.00

Source of Funding: MSU-Iligan Institute of Technology

Date Started: May 1, 1980

Expected Date of Completion: June 30, 1981

Present Status of the Project: Initial data of the Plant have been taken. Other apparatus needed for documentation are still being procured.

Other Relevant Information: The study involves fabrication, calibration and installation of test instruments and equipment; field testing;

sampling; lab testing; and data analysis needed for efficient functioning of the copra-charcoal plant.

Project Title: PRELIMINARY STUDY OF THE TECHNO-ECONOMIC FEATURES OF THE "JSR" INTEGRATED COPRA-CHARCOAL PROCESS

Principal Investigators: Prof. Rosello C. Macansantos
MSU-IIT, Iligan City
Mr. Jacinto S. Roque
Mahayahay, Iligan City

Description of the Project: The study discusses the important features of the JSR Integrated Copra-Charcoal Process (Phil. Pat. No. 6087, June 1971) and its techno-economic feasibilities.

Project Cost: ₱ 10,000.00

Source of Funding: MSU-Iligan Institute of Technology

Date Started: May 1, 1978

Date of Completion: August 30, 1978

Other Relevant Information: The study includes the basic techno-economic features of "JSR" process such as: plant lay-out and production aspect; production capacity; work organization and manpower requirements; land area and other equity requirements; management and community linkages, socio-economic implications, manpower requirements and cost; fixed capital requirements; production cost factors; raw material pricing alternatives and current farmers' net income.

Project Title: BRIQUETTING OF COIR WASTES AND COCONUT SHELL CHARCOAL

Name and Address of Principal Investigator: Emilio B. Asiddao
National Institute of Science and
Technology, Pedro Gil, Manila

Description of the Project: The primary purpose of the project is to develop suitable conditions in briquetting coir wastes and coconut shell charcoal using the ERD Pilot Plant pelletizer. The pelletizer was modified by attaching a die to serve the purpose.

Project Cost and Source Funding: (this is a general fund project, therefore the project cost is not available)

Cooperating Agencies: None

Date Started: July 1973

Present Status of Project: Suspended as of July, 1974

Project Title: SOLVENT EXTRACTION OF OIL FROM COCONUT MEAL

Name and Address of Principal Investigator: Eduardo Serra
National Institute of Science and
Technology, Pedro Gil, Manila

Description of the Project: This project aims to find suitable conditions in the extraction of oil from coconut meal using hexane.

Project Cost and Source Funding: (This is a general fund project, therefore the cost is not available)

Cooperating Agencies: None

Duration or Expected Date of Completion: 1 year

Date of Completion (for completed projects): 1975

Present Status of Projects: Completed

Project Title: DESIGN AND DEVELOPMENT OF COCONUT PROCESSING MACHINERIES AND EQUIPMENT

Name and Address of Principal Investigators: Nelson D. Develos
National Institute of Science and
Technology
Pedro Gil, Manila

Description of the Project: This project will develop efficient machines and equipment for extracting "gata" from fresh coconut meat, drying the sapal, conversion of coconut by-product to fuel.

Project Cost and Source of Funding: (This is a General Fund Project, therefore the project cost is not available)

Cooperating Agencies: None

Date Started: July 1976

Duration or Expected Date of Completion: 4 years

Date of Completion (for completed projects): December 1980

Present Status of Project: On-going

Project Title: UTILIZATION OF COCONUT WATER FOR THE PRODUCTION OF FOOD YEASTS AND OTHER MYCELIAL PRODUCTS.

Name and Address of Principal Investigator: Luz G. Paca
National Institute of Science and
Technology
Pedro Gil, Manila

Description of the Project: This project investigates the economic feasibility of culturing in coconut water, yeast and other edible microbial flora or metabolic products of sufficiently high quality for human consumption. The project also aims to produce sufficient samples for products and market evaluation.

Project Cost and Source of Funding: ₱219,635 — NIST

Cooperating Agencies: None

Duration or Expected Date of Completion: 7 years

Present Status of Project: Suspended as of July, 1976

Project Title: A STUDY AND EVALUATION OF THE PERFORMANCE OF A SMALL-CAPACITY COCONUT OIL EXPELLER

Name and Address of Principal Investigator: Dr. Ibarra E. Cruz (Professor)

Department of Mechanical Engineering, University of the Philippines, Diliman, Q.C.

Description of the Project: To study the performance of a locally-fabricated, small-capacity coconut oil expeller with the view of incorporating improvements in the design of the expeller and in the process of preparing the feed material so that a better quality of oil product can be obtained

Project Cost and Source of Funding: Budget: ₱50,000.00
Amount released as of Dec. 15, 1979:
₱42,500.00

Cooperating Agencies: Philippine Coconut Research and Development, Inc.

Date Started: March 1, 1979

Duration or Expected Date of Completion: 1 year

Other Relevant Information: 3 runs have so far been made. The oil extraction efficiency was about 55% for single passes. When the meat passed thru the expeller for a second time, the extraction efficiency increased to 59%.

Project Title: SYNTHESIS OF CERTAIN DERIVATIVES OF COCONUT FATTY ACIDS PART I: SOLVENTLESS METHODS FOR METHYL GLUCOSIDE AND SORBITOL ESTERS OF COCONUT FATTY ACIDS

Name and Address of Principal Investigators: Ester A. Garcia (Chairman)
Department of Chemistry
University of the Philippines,
Diliman, Quezon City

Description of the Project:

Part I: Prepare carbohydrate and alditol esters of coconut fatty acids under different conditions

Part II: Prepare esters of coconut oil fatty acids with the hydrolysis products of cellulose under different reaction conditions

Part III: Prepare derivatives of coconut fatty acids

Project Cost and Source of Funding: Budget: ₱87,450.00

Cooperating Agencies: Philippine Coconut Research and Development Foundation, Inc.

Date Started: August 1978

Duration or Expected Date of Completion: 2 years

Other Relevant Information: Terminal report for part I has been submitted

Project Title: DESIGN AND DEVELOPMENT OF AN EDIBLE COCONUT OIL PROCESSING PLANT USING NATURAL STEAM AS ENERGY SOURCE

Name and Address of Principal Investigator: Ernesto Lozada

Description of the Project: Post-harvest processing of coconut and rice results in too many losses due to outmoded processing techniques. The project aims to improve the processing capabilities of areas where geothermal energy is available

Objectives:

1. To design and develop drier using natural steam for hygienic processing of coconut meat.
2. To design and develop a small scale edible oil extraction plant using steam as energy source.
3. To design and develop a rice drier using natural steam as energy source.

Project Cost and Source of Funding: ₱10,000.00

Cooperating Agencies: Philippine Coconut Research and Development Foundation, Inc.

Date Started: May 1978

Duration or Expected Date of Completion: 6 months

Present Status of Project: Completed

Other Relevant Information: Accomplishment/Findings

1. Representations were made with relevant government agencies, concerning the use of steam from drill holes at Tiwi, Albay. Results of this representation shows that the steam tapped was just enough for the project being undertaken on the site.
2. In anticipation of unproductive arrangements with the relevant government agencies, two designs were made: one using natural steam and another using processed steam from boilers.
3. The plant designed will use a continuous conveyor drier similar to those currently being used by desiccated coconut plants. The idea here is to shorten drying time to less than 30 minutes under hygiene conditions. Drying is from 50% M.C. to 2% M.C. Drier capacity designed was 145 kgs/hr desiccated coconut.
4. Based on the terminal report, at small scale capacities, the conveyor drier barely outperform the tray drier in terms of economics.

Project Title: A. DRYING OF EDIBLE COCONUT CHIPS USING THE UPLB COPRA DRYER AND THE KUKUM DRYER. B. DRYING OF COCONUT INTERCROPS USING THE UPLB COPRA DRYER.

Name and Address of Principal Investigator: Dr. Ernesto P. Lozada (Chairman)
Department of Agricultural Processing, Institute of Agricultural Engineering and Technology, UPLB

Description of the Project: The objectives of the project are as follows: A. To design, develop and adopt dryers suitable as component of a village level edible oil processing system; B. To develop a procedure for hygienic processing and packaging of edible coconut chips; C. To study the adoptability of the UPLB Copra Dryer for drying coconut intercrops; D. To increase the percentage utilization of the UPLB Copra Dryer in the farm.

Drying time for coconut meat can be reduced from several hours to just 15 minutes if the meat is sliced to small pieces before drying. Such a process usually requires sophisticated drying and ancillary equipment. The UPLB Copra Dryer and the Kukum Dryer, two dryers that can produce clear, sanitary and low-moisture content copra, can be modified to dry coconut chips or sliced meat. What only needs to be done is to develop the processing procedures using these dryers on the farm level.

Preliminary tests on the use of the UPLB Copra Dryer indicated that it is suitable for drying crops as corn, peanuts, cassava, and coffee. This added flexibility can provide incentives to farmers to plant coconut intercrops, thereby increasing their income. Only additional information on the efficient procedure for drying intercrops using the UPLB Copra Dryer are needed. This is what this project seeks to obtain.

Project Cost and Source of Funding: ₱ 10,000.00

Cooperating Agencies: Philippine Coconut Research and Development Foundation, Inc.

Date Started: March 1, 1979

Duration or Expected Date of Completion: End of 1980

Project Title: COCONUT DRYING AND MILLING INTO EDIBLE OIL AND FLOUR (SAGINCO)

Name and Address of Principal Investigator: Manolo Santos Saginco
Sarangaya St. While Plains, Q.C.

Description of the Project: The project hopes to establish a dryer in every barrio and a mill in every town. Small scale industrial activity will thus be brought to the rural areas where the concomitant increase in employment and income is most needed. By selling coconuts directly to the enterprise than to middleman, farmers can command a higher price for nuts and at the same time, he can share the profit derived from the processing of coconuts into end products. Also, all equipment needed in this venture can be fabricated locally. The products obtained like coconut flour can be a good substitute for imported wheat flour and the edible oil that comes out require only minimum refining.

The objectives of the project are as follows:

1. Develop village-type system for processing fresh coconuts into flour and edible oil for commercial utilization.
2. Demonstrate a model that is implementable in rural areas, in line with countryside development involving the participation of coco farmers.
3. Produce coco flour which can be substituted for wheat flour in the preparation of breads and biscuits, and edible oil that can be sold for human consumption.
4. Develop a market for coco flour and oil produced from this plant.

Project Cost and Source of Funding: P 150,000.00

(PCRDF Counterpart only)

Cooperating Agencies: Philippine Coconut Research and Development Foundation, Inc.

Date Started: Dec. 1976

Duration or Expected Date of Completion: 6 months only but extended indefinitely

Other Relevant Information: Some modifications have been made on dryer design. Originally, the drier was so designed such that hot air and coconut granules are moving currently within the dryer. Several tests conducted using this mode of flow did not give satisfactory results although the operating temperatures which are in the range of 180-250°C are already considered high. A counter current mode of flow is being tried. However, the result of the test is not so reliable because of the continual heavy downpour in the area.

Dried fuels are hard to produce forcing them to use wet fuels which make combustion inefficient and sooty. As a result, the stack (chimney) corroded and this has to be replaced.

Another important feature of the dryer that has to be modified is the feeding system. Feed density in the conveyor system is too thick, making drying inefficient.

Project Title: DETERMINATION OF THE CHEMICAL PROPERTIES OF MACAPUNO

Name and Address of Principal Investigator: Dr. Julian A. Banzon

Description of the Project: Presently, the only use of the "meat" is as preserves and in ice cream. However, before we can look for other applications, it is necessary that physical and chemical characteristics, behaviour in different systems under varying conditions and its chemical make up be fully known. The objectives of the project are as follows: To determine the chemical/physico-chemical properties of the "meat" of the macapuno like:

- 1) The colloidal properties;
- 2) Solubility and dispersability in water and aqueous systems;
- 3) Behaviour towards change in pH; in osmotic pressure; in increased temperatures, upon dessication etc.
- 4) The natural state of the oil globules; nature of the oil.
- 5) Information on chemical make-up.

Project Cost and Source of Funding: Total budget: first phase — P9,600.00
second phase — P17,250

Cooperating Agencies: Philippine Coconut Research and Development Foundation, Inc.

Date Started: 1st phase-April 15, 1978; 2nd phase-Jan. 3, 1980

Duration or Expected Date of Completion: 1st phase- 6 months
2nd phase- 1 year

Other Relevant Information:

The "meat" of the macapuno has been found to be largely a poly-

saccharide; its identification remains undetermined. This polysaccharide disperses well in water. There are many articles of commerce that need this kind of material. Examples are: 1) in pharmaceuticals; 2) in food items; 3) in water-based paints to produce stable mixtures; 4) in adhesives and glues; 5) in cosmetic preparations.

In this present research, a new product with potential in the food industry was developed. It consists of a dispersion of macapuno meat in specially prepared coconut cream. It is expected to find applications in bakery and confectionery. Improvements have been made in the process so that the product is preserved for longer time.

Dried macapuno has promise as an export item; the problem of browning during drying has been solved, but it is oily and studies are undertaken to remove part of the oil without changing flavor. However, this oiliness is being taken advantage of since this allows medicinals to be absorbed by the macapuno. The resulting product appears to be useful as "plaster" for treatment of burns, rheumatism, sore muscles, as beauty aids, etc. Dispersions of de-oiled macapuno in water at pH not lower than 5 are found amenable to admixing with a variety of substances resulting in very smooth cream-like product which is now being studied as a base for shaving cream, toothpaste, facial cream and hopefully a non-greasy hair pomade.

Project Title: STUDIES ON THE CONVERSION OF COCONUT OIL INTO INDUSTRIAL SOLVENT (LABORATORY STUDIES)

**Name and Address of Principal Investigator: Prof. Teodorico F. Festin
Department of Chemical Engineering, UP College of Engineering**

Description of the Project: The project aims for the diversification of uses of coconut to cope with an increasing coconut oil production. This will hopefully lessen dependence on petroleum-based solvents.

Project Cost and Source of Funding: ₱61,239.20

Cooperating Agencies: Philippine Coconut Research and Development Foundation, Inc.

Date Started: March 1, 1979

Duration or Expected Date of Completion: March 1, 1980

Present Status of Project: At present, runs are being conducted using $AlCl_3$ as catalyst. The most promising catalyst, from the point of view of hexane and heptane yield, will be used in pyrolyzing pure lauric acid. This last step will be used to determine the possible reaction mechanism and other pertinent reaction information.

Project Title: PREPARATION OF CERTAIN DERIVATIVES OF COCONUT FATTY ACIDS

Name and Address of Principal Investigator: Dr. Ester A. Garcia

Description of the Project: The study seeks to:

- 1) prepare carbohydrate and alditol ester of coconut fatty acids under different conditions (e.g. solvent. T catalyst, etc.)
- 2) prepare esters of coconut oil fatty acids with the hydrolysis products of cellulose under different reaction conditions
- 3) prepare amine derivatives of coconut oil fatty acids

Project Cost and Source of Funding: ₱90,800.00

Cooperating Agencies: Philippine Coconut Research and Development Foundation, Inc.

Date Started: Aug. 1976

Date of Completion (for completed projects): Aug. 1978

Project Title: NOVEL DERIVATIVES OF COCONUT FATTY ACIDS

Name and Address of Principal Investigator: Dr. William G. Padolina
Associate Professor, Department of
Chemistry, College of Arts and
Sciences, UPLB, College, Laguna

Description of the Project: The objective of the project is to conduct studies on the preparation and utilization of new derivatives of coconut fatty acids, such as: a) new ester derivatives of coconut fatty acids using other locally available alcohol, e.g. alcohols from fresel oil, b) halogenated derivatives of coconut fatty acids, c) derivatives of coconut fatty acids.

Project Cost and Source of Funding: ₱114,252.00

Cooperating Agencies: Philippine Coconut Research and Development Foundation, Inc.

Date Started: Feb. 15, 1978

Duration or Expected Date of Completion: Feb. 15, 1981

Present Status of Project: The project has accomplished the ff:

- a) Ester synthesis
- b) Hydrocarbon synthesis
- c) Oxidation of Coconut Acid

Project Title: SOME PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE EMULSIFIER OF COCONUT MILK

Name and Address of Principal Investigator: Aleli B. Yap
Department of Chemistry
College of Arts and Sciences, UPLB
College, Laguna

Description of the Project: The objectives of the study are:

- a) to determine the effects of successive washing and increasing duration of centrifugation on the protein to fat ratios of the cream, and on the physical properties of the oil globules.
- b) to develop an acceptable procedure for recovering the emulsifier of coconut milk, c) to analyze the lipid constituents of the emulsifier isolate.

To maximize the economic and food value of the coconut, a study of the coconut milk and cream as emulsions is relevant. An investigation of the nature of the substance(s) which prevent the coalescence of oil globules in coconut milk will improve our understanding of this natural emulsion and the phenomena associated with it, offer the basis for improving known techniques of stabilizing the coconut milk or cream, and possibly widen the utilization of coconut milk components.

Project Cost and Source of Funding: ₱9,470.00

Cooperating Agencies: Philippine Coconut Research and Development Foundation, Inc.

Date Started: March 1, 1979

Duration or Expected Date of Completion: June 30, 1980

Project Title: COCONUT CHEMISTRY AND TECHNOLOGY

Name and Address of Principal Investigator: Dr. Ricardodel Rosario; Department Food Science and Technology, UPLB, College, Laguna

Description of the Project: This bibliography is the first attempt of the author to compile literatures dealing with the food chemistry and technology of the coconut meat and its components. Many aspiring workers on coconut research have deplored the lack of accessible compilation of material regarding the status of one particular aspect in coconut research, to facilitate their work.

The contents of the bibliography are mostly studies conducted at UP Los Banos (UPLB), Philippine Coconut Authority (PCA), as well as those published in local and foreign journals available. Some are terminal and progress reports of the projects, and many unpublished theses from universities.

Project Cost and Source of Funding: ₱8,796.00

Cooperating Agencies: Philippine Coconut Research and Development Foundation, Inc.

Date Started: June 1979

Date of Completion (for completed projects): Feb. 1980

Other Relevant Information: Unpublished work from universities like PWU, UST, University of San Carlos and Adamson University as well as patents were compiled in separate section.

Project Title: PREPARATION OF NUTRITIOUS COCO SPREAD

Name and Address of Principal Investigator: Linda B. Mabesa
Assistant Professor
Department of Food Science and Technology, UPLB, College, Laguna

Project Cost and Source of Funding: ₱9,200.00

Cooperating Agencies: Philippine Coconut Research and Development Foundation, Inc.

Date Started: Feb. 1979

Duration or Expected Date of Completion: Aug, 31, 1979

Project Title: COCONUT DRYING CENTRAL PILOTS STUDIES (PHASE ONE)

Name and Address of Principal Investigator: Engr. Nonilon Bulilan
Department of Agricultural Engineering and Applied Mathematics,
VISCA, Baybay, Leyte

Description of the Project: The study was conducted to a) define the quality of copra that gives maximum return to coconut producers and b) determine technical conditions that yield the desired copra quality.

Project Cost and Source of Funding: P 54,574.00

Cooperating Agencies: Philippine Coconut Research and Development Foundation, Inc.

Date Started: Nov. 1976

Duration or Expected Date of Completion: April, 1980

Project Title: DESIGN AND FABRICATION OF SIMPLE TOOLS AND EQUIPMENT FOR THE PRIMARY PROCESSING OF COCONUTS

Name and Address of Principal Investigator: Dr. Jose R. Velasco

Description of the Project:

1. Develop simple tools and equipment for deshelling, chopping and comminution, pressing, breaking the emulsion and drying of various tractions.
2. Maximize mechanical advantage to enable employment of manual, animal, or other power energy; obviate use of petroleum products.
3. Obtain preliminary techno-economic data on their operation.

Project Cost and Source of Funding: Budget: Phase one — P 9,995.00
Phase two — P 16,600.00

Cooperating Agencies: Philippine Coconut Research and Development Foundation, Inc.

Date Started: Phase one — April 15, 1978

Phase two — January 3, 1980

Duration or Expected Date of Completion: Phase one- 6 months
Phase two- 1 year