PROCESS SECTOR: Textiles Program

Updated as of 15 February 2024

New/ Ongoing | Done | Target

Overall Strategies:

Human Resource
- Training for nonwoven technologies (needle-punch, wet-laid, spunbond and melt-blown)
- Training on upcycling technologies

R&D Technologies
- Development of eco-friendly solutions for the filtration, automotive, packaging, geotextile industries
- Improvement of technologies for producing alternative sustainable materials for wearables
- Development of eco-friendly finishing technology for nonwovens
- Development of recycling technologies for old clothes/fabrics
- Expansion of testing capabilities to cover medical protective textiles
- Establishment of National Sizing System
- Development of technologies for the textile-based needs of defense sector

Facilities/Services
- Establishment of Core facility for Nonwoven R&D for needle-punched, wet-laid, spunbond and melt-blown technologies
- Establishment Testing facility for Medical Textiles

S&T Policies
- Policy Recommendation to use MedTex Testing Facilities
- Policy Recommendation resulting from Data generation and Ex-ante

2021

127.4 M
- Establishment of PTRI Medical Textile Testing Lab
- Technical Nonwoven Lignocellulosic Fibers for the Automotive and Air Filtration Nonwoven
- Development of Nonwoven Finishing Technologies Toward Alternative Leather
- Community-level Functionalization of Handwoven Cordillera and Mindoro Textiles for Creative Protective Clothing
- Establishment of Regional Yarn Production and Innovation Center – Northern Luzon
- Integrated Community-scale Textile Fiber Innovation Hubs in Northern Luzon

- Capability building for wet-laid and needle-punching nonwoven technologies
- Capability building for testing of medical protective textiles
- Established processing performance and quality standards of NTFs from different provinces in the production of RYPIC yarns and conduct of Technology Roll-out

2022

71.1 M
- Establishment of PTRI Medical Textile Testing Lab
- Technical Nonwoven Lignocellulosic Fibers for the Automotive and Air Filtration Nonwoven
- Development of Nonwoven Finishing Technologies Toward Alternative Leather
- Community-level Functionalization of Handwoven Cordillera and Mindoro Textiles for Creative Protective Clothing
- Sustainable Spunbonded and Meltblown Nonwoven Textiles for Personal Protective Clothing
- Functional Spunbonded Nonwovens for Agro-Industrial and Geo-Textile Applications
- Establishment of Regional Yarn Production and Innovation Center – Northern Luzon
- Integrated Community-scale Textile Fiber Innovation Hubs in Northern Luzon

- Capability building for melt-blown and spunbonded nonwoven technology
- Prototype weltaid and needle-punched nonwoven fabrics
- Capability building for bamboo yarn processing
- Textile fiber hubs establishment
- Functionalized handwoven-based facemasks

2023

158.8 M
- Establishment of Regional Yarn Production and Innovation Center – Northern Luzon
- Functional Spunbonded Nonwovens for Agro-Industrial and Geo-Textile Applications
- Sustainable Spunbonded and Meltblown Nonwoven Textiles for Personal Protective Clothing
- Establishment of upcycling facility
- Banana and Bamboo Textile-based Battle Dress Uniform
- Banana and Bamboo Fiber-based Functional Philippine Camouflage

- Prototype meltblown and spunlaid nonwoven fabrics for spunlaid filter/mask, packaging and agrotextile
- Recycled thermoplastic polymer for spunlaid textile
- Blended biopolymer for spunlaid textile
- Operational Spunlaid Nonwoven facility
- Capability building for upcycling technology for textiles
- Established 2nd RYPIC
- Prototypes for battle uniforms, camouflage and Nonwoven textiles for anti-ballistic wear
- Finishing Technologies for Nonwoven Assemblies

2024

58.2.0M
- Sustainable Material Solution from Post-Industrial Textile Wastes
- High-Performance Finishings for Smart Nonwoven Assemblies
- Banana and Bamboo Textile-based Battle Dress Uniform
- Banana and Bamboo Fiber-based Functional Philippine Camouflage
- Functional Spunbonded Nonwovens for Agro-Industrial and Geo-Textile Applications
- Sustainable Spunbonded and Meltblown Nonwoven Textiles for Personal Protective Clothing
- Development of Lignocellulosic Nonwoven Textiles for Anti Ballistic Wear and Protection

- Prototype upcycled yarns and fabrics
- Established Upcycling facility
- Technology for battle uniforms and Nonwoven textiles for anti-ballistic wear production
- Finishing Technologies for Nonwoven Assemblies

2025

88M
- Enhancement of ICYT for Mainstream Fashion
- Pilot scale verification of functional spunlaid nonwoven textile
- High-Performance Finishings for Smart Nonwoven Assemblies
- Development of localized synthetic polymers such as lyocell for textile applications

- Spunlaid nonwoven textile technology verified
- Development of localized synthetic polymers such as lyocell for textile applications
- Singeing as new finishing technology

Vision

A Competitive, Integrated and Sustainable Philippine textile-garment industry that generates Inclusive economic Growth (CISIG)

Overall Outcomes

Human Resource
- Competent and trained S&T personnel on new technologies identified
- Production & R&D staff from the Textile Industry and related industries equipped with training and new knowledge on latest technologies

R&D Technologies
- Needle-punching, Wet-laid, Spunbond and melt-blown technologies for nonwoven production using different feedstock
- Upcycling and recycling technologies for textiles
- Measurement technology for body sizing and related applications
- Technologies for production of battle uniform, camouflage and nonwoven textiles for anti-ballistic wear

Facilities / Services
- Core facility for Nonwoven R&D for needle-punched, wet-laid, spunbond and melt-blown technologies
- Testing facility for Medical Protective Textiles
- Upcycling facility for textiles
- Improved operation of RYPIC for processing of NTFs

S&T Policies
- Policy to Promote Testing facilities for Medical Protective Textiles and use of data generated for input to legislations that will uplift textile industry

New/ Ongoing | Done | Target

PROCESS SECTOR: Textiles Program

Updated as of 15 February 2024

Overall Strategies:
Human Resource
- Training for high performance medical textiles and hygiene materials
- Training for foam finishing technology, wearable technologies and modernized dyeing and printing technologies

R&D Technologies
- Development of textiles from red spanish pineapple fibers
- Development of wearable technologies for various textiles
- New technologies for improved dyeing and printing using synthetic dyes

Facilities/Services
- Establishment of Material Resource Center from fibers to textiles
- Expansion of services for Medical Textiles laboratory

125 M
- Enhancement of ICYT finishing technologies for Mainstream Fashion
- Development of localized man-made polymers such as lyocell for textile applications
- Mechanization of knotting of natural fibers (e.g., Pineapple, abaca, ramie, etc.)
- Development of tropical fabrics from novel fiber sources
- Recycling of post-industrial polymers to produce filaments
- High-Performance Medical Textiles and Health and Hygiene Materials Testing
- Establishment of material resource center/library from fibers to textile

2026

- Upgraded ICYT Finishing technologies
- Tropical fabrics from novel fiber sources
- Recycled filaments from post-industrial polymers
- Capability building for testing high performance medical textiles and hygiene materials
- Established Material Resource Center from fibers to textile

75.3 M
- Establishment of Philippine National Sizing System
- Enhancement of ICYT finishing technologies for Mainstream Fashion
- Aerocomp 2.0: Level 4 Ballistic Technologies Fabrication using Fiber-reinforced Composites
- Establishment of material resource center/library from fibers to textile
- Applicability of Foam finishing to Natural fiber-based textiles
- High-Performance Medical Textiles and Health and Hygiene Materials Testing
- Development of tropical fabrics from novel fiber sources
- Development of textiles using Piña fiber from red spanish pineapple

2027

- Established Material Resource Center from fibers to textile
- Testing services for high performance medical textiles and hygiene materials
- Textiles prototypes using fiber from novel fibers
- Data gathered to develop Philippine National Sizing System
- Mechanized knotting of natural fibers

60 M
- Establishment of Philippine National Sizing System
- Applicability of Foam finishing to Natural fiber-based textiles
- Modernization in dyeing and printing technologies using synthetic dyes
- Wearable Technologies for Various Textile types

2028

- Service offering for foam finishing
- Capability building for new dyeing and printing technologies and wearable technologies
- Philippine National Sizing System established

Vision

A Competitive, Integrated and Sustainable Philippine textile-garment industry that generates Inclusive economic Growth (CISIG)

Overall Outcomes

Human Resource
- Competent and trained S&T personnel on new technologies identified
- Production & R&D staff from the Textile Industry and related industries equipped with training and new knowledge on latest technologies

R&D Technologies
- Production of yarns from red Spanish pineapple
- Modernized dyeing and printing technologies
- Wearable technologies

Facilities / Services
- Material Resource Center from fibers to textiles
- New testing services for high performance medical textiles and hygience materials

List of Projects under Textile Roadmap

R&D Technologies	Project Title	Budget Allocation ('000)							Status
		2022	2023	2024	2025	2026	2027	2028	
Establishment of the PTRI Medical Textile Testing Laboratory	Establishment of the PTRI Medical Textile Testing Laboratory	867,045.20							completed
Technical Nonwoven Lignocellulosic Fibers for the Automotive and Air	Technical Nonwoven Lignocellulosic Fibers for the Automotive and Air	5,261,116.80							completed
Technical Lignocellulosic Nonwoven Textiles for the Automotive and Air Filtration Application	Technical Lignocellulosic Nonwoven Textiles for the Automotive and Air Filtration Application	4,631,392.00							completed
Sustainable Meltblown Nonwoven Textiles for Mask Filters and Packaging Application	Sustainable Meltblown Nonwoven Textiles for Mask Filters and Packaging Application	21,994,721.60	5,854,804.80						on-going
Functional Spunbonded Nonwovens for Agro-Industrial and Geo-Textile Applications	Functional Spunbonded Nonwovens for Agro-Industrial and Geo-Textile Applications	31,126,352.80		5,396,488.80					on-going
Establishment of Regional Yarn Production and Innovation Center – Northern Luzon	Establishment of Regional Yarn Production and Innovation Center – Northern Luzon	8,286,254.40							on-going
Establishment of upcycling facility	Sustainable Material Solution from Post-Industrial Textile Wastes			5,000,000.00					new
Banana and Bamboo Fiber-based Functional Philippine Camouflage	Functional Philippine Camouflage Field Service Uniform (FSU) / Battle Dress Uniform (BDU)		8,715,036.00	4,851,436.00					on-going
High-Performance Finishings for Smart Nonwoven Assemblies	High-Performance Finishings for Smart Nonwoven Assemblies			23,555,840.00	5,505,840.00				new

PROCESS SECTOR: Natural Products Program

Updated as of 15 February 2024

New/ Ongoing | Done | Target

Overall Strategies:

Human Resource
- Training for technologies on extraction, grading, purification, stabilization and application studies for naturally derived products such as colorants, oils, ingredients, etc.

R&D Technologies
- Development and improvement of eco-friendly and cost-effective technologies for extraction, production and stabilization of naturally derived products such as colorants, oils, ingredients, etc.
- Application studies for naturally derived products
- Development of standardized protocol in the collection, processing and evaluation of dyestuff and dyed products.

Facilities/Services
- Establishment of R&D Lab for plant oils' extraction and characterization in the regions

S&T Policies
- Policy Recommendation to promote use of naturally derived products

2021

55.4M
- Colorimetric and Performance Standardization of NatDyes Produced in Various NatDyes Hubs in the Philippines
- Scale-up Production, Stability and Other Applications of Natural Colorants for Cosmetics
- Valorization of Agri-food Waste: Ultrasound-assisted Extraction of Oil and Polyphenols from Green Cherry Rejects of Cordillera Grown Arabica Coffee
- Technology Intervention to Provide an Alternative Market for Sampaguita (Jasminum sambac) as Raw Material for Jasmine Oil Production
- Green Oil and Phytochemicals from Cashew

- Upscale production of natural dyes
- Lab-scale production of jasmine oil
- Lab-scale production of oils from cashew nut and nut shell

2022

47.1M
- Colorimetric and Performance Standardization of NatDyes Produced in Various NatDyes Hubs in the Philippines
- Scale-up Production, Stability and Other Applications of Natural Colorants for Cosmetics
- Valorization of Agri-food Waste: Ultrasound-assisted Extraction of Oil and Polyphenols from Green Cherry Rejects of Cordillera Grown Arabica Coffee
- Technology Intervention to Provide an Alternative Market for Sampaguita (Jasminum sambac) as Raw Material for Jasmine Oil Production
- Green Oil and Phytochemicals from Cashew
- Comparative GC-MS Profiling of wild and propagated seed-bearing plants and essential oil products

- Grading and Evaluation/ Certification protocol for indigo
- Nat Dyes powder testing protocol
- Characterized lab-scale extracted coffee cherry extracts
- Lab-scale production of components and application studies using oils and components for food, cosmetic and personal care products

2023

85M
- Colorimetric and Performance Standardization of NatDyes Produced in Various NatDyes Hubs in the Philippines
- Comparison of Ultrasound and Conventional Extraction Methods on the Yield of Anthocyanin Pigments from Roselle and Cooked Ubi Peels
- Comparative GC-MS Profiling of wild and propagated seed-bearing plants and essential oil products
- Green Oil and Phytochemicals from Cashew
- Development of Natural Dyes from Novel sources

- Application studies using natural dyes for personal care and cosmetics
- Technology for oil extraction from cashew nut, shell and purification of components
- Conventional technology for extraction of natural dyes for food applications
- Green Extraction of Philippine Agricultural Wastes for the Development of Cosmetic Lyophilized Active Ingredients in Microcapsules (CLAIM) against Skin Oxidative Stress

2024

70M
- Comparison of Ultrasound and Conventional Extraction Methods on the Yield of Anthocyanin Pigments from Roselle and Cooked Ubi Peels
- Comparative GC-MS Profiling of wild and propagated seed-bearing plants and essential oil products
- Development of Natural Dyes from Novel source
- Valorization of Various Wastes for extraction of natural compounds for various industry applications

- Ultrasound technology for extraction of natural dyes for food applications
- Preliminary process for extraction of natural dyes from novel sources and natural compounds from wastes

2025

40M
- Comparison of Ultrasound and Conventional Extraction Methods on the Yield of Anthocyanin Pigments from Roselle and Cooked Ubi Peels
- Development of Natural Dyes from Novel sources
- Valorization of Various Wastes for extraction of natural compounds for various industry applications

- Advanced extraction techniques or methods for extraction of natural dyes for food applications
- Technology for natural dyes extraction from novel sources
- Technology for natural compounds extraction from wastes

Vision

A competitive industry equipped with relevant technologies and innovative products

Overall Outcomes

Human Resource
- Competent and trained S&T personnel on new technologies identified
- Production and R&D staff equipped from the Natural Products Industry and related industries (Cosmetics, Food, Personal Care) equipped with training and new knowledge on latest technologies

R&D Technologies
- Technologies for extraction, production, grading and stabilization of naturally derived products such as colorants, oils, ingredients, etc.
- Technologies for use of naturally derived products in various applications

Facilities / Services
- R&D Center for plant oils' extraction and characterization in the regions near sources

S&T Policies
- Policy Recommendation to promote use of naturally derived products such as the standardized protocol in the collection, processing and evaluation of dyestuff and dyed products.

PROCESS SECTOR: Natural Products Program

Updated as of 15 February 2024

New/ Ongoing | Done | Target

Overall Strategies:

Human Resource
- Training for technologies on extraction, grading, purification, stabilization and application studies for naturally derived products such as colorants, oils, ingredients, etc.

R&D Technologies
- Development and improvement of eco-friendly and cost-effective technologies for extraction, production and stabilization of naturally derived products such as colorants, oils, ingredients, etc.
- Application studies for naturally derived products
- Development of standardized protocol in the collection, processing and evaluation of dyestuff and dyed products.

Facilities/Services
- Establishment of Testing services for active components and other testing needs of personal care, cosmetics and pharmaceutical industries

S&T Policies
- Policy Recommendation to promote use of naturally derived products

165M
- Establishment of Scale-up extraction facility for high value products (e.g. essential oil) with economic feasibility study (CGMP for cosmetics, pharmaceutical and personal care industry)
- Characterization and Standardization of Natural Products for application and formulation in cosmetics, hydrocolloids for personal care applications, Omega-3 oil purification from fish and algae, and for Natural polymers for modified drug release in vivo for personal care applications excluding cosmeceuticals and pharmaceutical applications
- Valorization of Various Wastes for extraction of natural compounds for various industry applications (eg. development of pharma excipient from agro-forestry, Seed nut and seed cake pongamia, bitaog, malunggay, pili pulp and resin, abundant raw material supply: banana, pineapple, coconut, and molasses, and calamansi)
- Establishment of Testing Services for Active components of Natural products (e. g. capability building of existing testing service centers)

2026
- Capacity building for extraction of high value products
- Capability building for extraction and downstream processing of hydrocolloids, omega-3 oil purification, modified drug release in vivo for personal care applications excluding cosmeceuticals and pharmaceutical applications
- Capability building for testing active components

135M
- Establishment of Scale-up extraction facility for high value products (e.g. essential oil) with economic feasibility study
- Characterization and Standardization of Natural Products for application and formulation in cosmetics, hydrocolloids for personal care applications, Omega-3 oil purification from fish and algae, and for Natural polymers for modified drug release in vivo for personal care applications excluding cosmeceuticals and pharmaceutical applications
- Valorization of Various Wastes for extraction of natural compounds for various industry applications
- Establishment of Testing Services for Active components of Natural products Development of Natural Dyes from Novel sources for industrial applications (microbial, pili pulp skin and other sources)
- Extraction, Characterization of natural products with the use of Emerging Technologies - pulsed electric field (PEF), high pressure processing (HPP)
- Physico-chemical Characterization and Product Development from Essential Oils of Mindanao Ferns and Seed-bearing Plants

2027
- Lab-scale production of hydrocolloids, natural polymers for modified drug release in vivo
- Preliminary extraction process for natural dyes,
- Preliminary extraction process and downstream processing of hydrocolloids, omega-3 oil purification, modified drug release in vivo for personal care applications excluding cosmeceuticals and pharmaceutical applications
- Preliminary service provision for 1st set of tests for active components
- Technology for waste valorization from country's abundant raw materials

115M
- Extraction, Characterization, and Standardization
- of Natural Dyes for Pharmaceutical applications
- Extraction, Characterization of Natural hydrocolloids for food applications
- Characterization and Standardization of Natural Products for Natural polymers for modified drug release in vivo for personal care applications excluding cosmeceuticals and pharmaceutical applications
- Extraction, Characterization of natural products with the use of Emerging Technologies - pulsed electric field (PEF), high pressure processing (HPP)
- Extraction, Characterization of Natural polymers as binders, bulking agents and disintegrants for tablets
- Establishment of Testing Services for Active components in Personal Care and Pharmaceutical products
- Upgrading of Testing Services to support Personal Care and Cosmetics Industry

2028
- Technology for production and application hydrocolloids, omega-3 oil purification, modified drug release in vivo for personal care applications excluding cosmeceuticals and pharmaceutical applications
- Service provision for 2nd set of tests for active components
- Capability building for new testing services for personal care and cosmetics industry
- Lab-scale production and safety tests conducted for binders
- Technology for waste valorization from country's abundant raw materials

Vision

A competitive industry equipped with relevant technologies and innovative products

Overall Outcomes

Human Resource
- Competent and trained S&T personnel on new technologies identified
- Production and R&D staff equipped from the Natural Products Industry and related industries (Cosmetics, Food, Personal Care) equipped with training and new knowledge on latest technologies

R&D Technologies
- Technologies for extraction, production, grading and stabilization of naturally derived products such as dyes, colorants, oils, hydrocolloids, bulking agents, binders, disintegrants, and other ingredients
- Technologies for use of naturally derived products in various applications

Facilities / Services
- Testing services for active components and other testing needs of personal care, cosmetics and pharmaceutical industries

S&T Policies
- Policy Recommendation to promote use of naturally derived products

List of Projects under the Natural Products Roadmap

R&D Technologies	Project Title	Budget Allocation ('000)							Status
		2022	2023	2024	2025	2026	2027	2028	
Colorimetric and Performance Standardization of NatDyes Produced in Various NatDyes Hubs in the Philippines	Colorimetric and Performance Standardization of NatDyes Produced in Various NatDyes Hubs in the Philippines								completed
Scale-up Production, Stability and Other Applications of Natural Colorants for Cosmetics	Scale-up Production, Stability and Other Applications of Natural Colorants for Cosmetics								completed
Valorization of Agri-food Waste: Ultrasound-assisted Extraction of Oil and Polyphenols from Green Cherry Rejects of Cordillera Grown Arabica Coffee	Valorization of Agri-food Waste: Ultrasound-assisted Extraction of Oil and Polyphenols from Green Cherry Rejects of Cordillera Grown Arabica Coffee								completed
Technology Intervention to Provide an Alternative Market for Sampaguita (Jasminum sambac) as Raw Material for Jasmine Oil Production	Technology Intervention to Provide an Alternative Market for Sampaguita (*Jasminum sambac*) as Raw Material for Jasmine Oil Production								ongoing
Green Oil and Phytochemicals from Cashew	Green Oil and Phytochemicals from Cashew	8,123,921.72							ongoing
Development of Natural Dyes from Novel sources	Sustainable and Alternative Coloration Technology for Abaca-based Textile Products Using Philippine Natural Dyesitled	4,831,276.00							ongoing
Comparative GC-MS Profiling of wild and propagated seed-bearing plants and essential oil products	Green Fragrance with Purpose: Extraction, Characterization, and Functionality of Selected Non-Wood Forest Products as Scent Product			17,930,049.17	4,818,183.19				new
Comparison of Ultrasound and Conventional Extraction Methods on the Yield of Anthocyanin Pigments from Roselle and Cooked Ubi Peels	Stability and Extraction Yield Enhancement of Anthocyanin Pigments from Roselle and Cooked Ube Peels through the Ultrasound Assisted Extraction (UAE) Method			14,871,762.00	3,661,852.00				new
Valorization of Various Wastes for extraction of natural compounds for various industry applications	Green Extraction of Philippine Agricultural Wastes for the Development of Cosmetic Lyophilized Active Ingredients in Microcapsules (CLAIM) against Skin Oxidative Stress			8,269,330.00	6,449,330.00				new
	Process Development for the Production of Unripe Mature Banana-Based Anticaking and Bulking Agent for Nutraceutical Applications			2,664,049.00	2,334,448.00				new
	Valorization of compounds from wastes of vetiver essential oil production			2,560,281.00	2,439,717.00				new

PROCESS SECTOR: Agro-Industrial Processing Program

New/ Ongoing | Done | Target

Updated as of 15 February 2024

Overall Strategies:

Human Resource
- Training for sensory analysis for cacao and cocoa products
- Training on technical services for product development and refining technologies

R&D Technologies
- Development of cost-effective technologies for shelf-stable beverages from tablea, cacao pod husk as food ingredient and biofertilizer, natural colorant from cocoa shell
- Technologies for use of sugarcane extract in as ingredient in food supplement and personal care products
- Development of fermentation technology for small scale producers of cacao
- Development of blockchain-based system for cacao
- Design of isotope-based methods to determine geographical origin of cacao
- Enhancement/improvement of refining technologies for intermediate products for cacao

Facilities/Services
- Establishment of Sensory lab for Cacao and cocoa products

S&T Policies
- Policy Recommendation to promote use of handbook of sensory protocol for cacao and cocoa products

2021

18.9 M
- Developing the Capability of Micro and Small-Scale Processors in the Manufacture of Quality Food Products from Philippine Cocoa Beans
- Blockchain-Based System for Transparent Traceability of Halal-and-Tayeb Cacao Products (part of project of Food Sector)
- Waste to Wealth": Value-Adding Approaches to Transform Cacao (Theobroma cacao L.) Pod Husk Towards Economic Development
- Application of Natural Antioxidants Derived from Sugarcane for Food, Food Supplement, and Cosmetic Product Formulation
- Wet Processing Technology Through Microbial Fermentation for High Quality Chocolates

- Capability building for sensory analysis for cacao and cocoa products
- Initial studies for cacao pod husk powder as food ingredient and biofertilizer

2022

14.8 M
- Developing the Capability of Micro and Small-Scale Processors in the Manufacture of Quality Food Products from Philippine Cocoa Beans
- Blockchain-Based System for Transparent Traceability of Halal-and-Tayeb Cacao Products (part of project of Food Sector)
- Application of Natural Antioxidants Derived from Sugarcane for Food, Food Supplement, and Cosmetic Product Formulation
- Waste to Wealth": Value-Adding Approaches to Transform Cacao (Theobroma cacao L.) Pod Husk Towards Economic Development
- Wet Processing Technology Through Microbial Fermentation for High Quality Chocolates
- Stable Isotope and Multi-Elemental Profiling of Coffee and Cacao Beans in the Philippines by IRMS and XRF for Origin Identification (part of Food Sector)
- Bench-scale Ultrasound-assisted Extraction of Pectin from 'Saba' Banana Peel Waste

- Operational sensory laboratory and technical services for cacao and cocoa products
- Handbook of Sensory Protocol and Technical Paper
- Shelf-stable beverages from tablea (RTD and concentrated)
- Lab-scale production of natural colorant from cocoa shell for food or nonfood use, and cocoa oil for food or nonfood use
- Cacao pod husk powder as food ingredient and biofertilizer
- Application of sugarcane extract in food, food supplement, and personal care products

2023

41 M
- Stable Isotope and Multi-Elemental Profiling of Coffee and Cacao Beans in the Philippines by IRMS and XRF for Origin Identification (part of Food Sector)
- Upscaled production of pectin from calamansi wastes

- Fermentation technology for small scale producers for cacao
- Production of optimum microbial consortium for cacao
- Developed blockchain-based system for cacao
- Isotope-based methods established and ready for use to determine geographical origin of cacao

2024

20 M
- Development of refining techniq ues and technologies for chocolate and intermediate products

- Capability building for developing refining technologies for cacao

2025

25 M
- Development of refining techniques and technologies for chocolate and intermediate products
- Reactivation of Refinery Foots' Adsorption Capacity for Crude Coconut Oil Refining

- Refining techniques and technologies (i.e. use of ball mill, stone mill) for various chocolate types (fine, dark, etc.) and other intermediate and related products fit for the company scale of production

Vision

A competitive industry (cacao and sugarcane) equipped with relevant technologies and innovative products

Overall Outcomes

Human Resource
- Competent and trained S&T personnel on new technologies identified
- Production and R&D Staff from the cacao and sugarcane Industries, and related industries equipped with training and new knowledge on latest technologies and QA protocols

R&D Technologies
- Technologies for production of shelf-stable beverages from tablea, cacao pod husk as food ingredient and biofertilizer, natural colorant production from cocoa shell
- Technologies for using sugarcane extract as ingredient in food supplement and personal care products
- Fermentation technology for small scale producers of cacao
- Blockchain-based system for cacao
- Isotope-based methods to determine geographical origin of cacao
- Refining technologies for intermediate products for cacao

Facilities / Services
- Sensory lab for Cacao and cocoa products near production sites

S&T Policies
- Policy to Promote use of handbook of sensory protocol for cacao and cocoa products

PROCESS SECTOR: Agro-Industrial Processing Program

New/ Ongoing | Done | Target

Updated as of 15 February 2024

Overall Strategies:

Human Resource
- Training for extraction, refinement of compounds such as pectins, fibers, and other valuable compounds from cacao pod husks and other parts of the fruit and tree.
- Training for process improvement in rubber processing and valorization of rubber wastes

R&D Technologies
- Development of cost-effective technologies for pectin and fiber extraction and processing
- Technologies for personal care products development using valuable compounds from wastes of cacao
- Technologies for the development of cost-effective rubber fillers based on locally available materials

S&T Policies
- Policy Recommendation as input to standards development of compounds such as pectin, fibers, etc.

35 M
- Process improvement to improve viscosity of processed rubber
- Integration of local material as rubber fillers to improve cost and properties
- Furnace improvement for rubber processing
- Novel uses for rubber wastes
- Sterols in VCO

2026
- Enhanced methods of rubber processing
- Published data of sterols in VCO

30 M
- Extraction and processing of Pectin from Cacao Pod Husk
- Development of Cacao Pod Husk Leather
- Development of Personal Care Products from Waste Products of Cacao
- Process improvement to improve viscosity of processed rubber
- Integration of local material as rubber fillers to improve cost and properties
- Furnace improvement for rubber processing
- Novel uses for rubber wastes
- Analysis of Sterols in VCO

2027
- Preliminary processing for pectin, fibers and other valuable compounds
- Initial formulation of personal care products and conduct of preliminary tests
- Improved properties (e.g., viscosity) of processed rubber

35 M
- Extraction and processing of Pectin from Cacao Pod Husk
- Development of Cacao Pod Husk Leather
- Development of Personal Care Products from Waste Products of Cacao

2028
- Verified process for extraction and/or purification of pectin, fibers and other valuable compounds
- Personal care products tested

Vision

A competitive industry (rubber, coconut, cacao and sugarcane) equipped with relevant technologies and innovative products

Overall Outcomes

Human Resource
- Competent and trained S&T personnel on new technologies identified
- Production and R&D Staff from the cacao industries, and related industries equipped with training and new knowledge on latest technologies and QA protocols

R&D Technologies
- Technologies for valuable compounds such as pectin, fiber extraction, refinement and processing
- Technologies for development of personal care products using valuable compounds from wastes of cacao
- Technologies for the development of cost-effective rubber fillers based on locally available materials

S&T Policies
- Policy Recommendation as input to standards development of compounds such as pectin, fiber, etc.

List of Projects under Agro-Industrial Processing Roadmap

R&D Technologies	Project Title	Budget Allocation ('000)							Status
		2022	2023	2024	2025	2026	2027	2028	
"Waste to Wealth": Value-Adding Approaches to Transform Cacao (*Theobroma cacao* L.) Pod Husk Towards Economic Development	"Waste to Wealth": Value-Adding Approaches to Transform Cacao (*Theobroma cacao* L.) Pod Husk Towards Economic Development								completed
Application of Natural Antioxidants Derived from Sugarcane for Food, Food Supplement, and Personal Care Product Formulations	Application of Natural Antioxidants Derived from Sugarcane for Food, Food Supplement, and Personal Care Product Formulations	2,259,187.72							completed
Developing the capability of Micro & Small Scale Processsors on the Evaluation & Manufacture of Quality Food Products from the Philippine Cacao Beans	Developing the capability of Micro & Small Scale Processsors on the Evaluation & Manufacture of Quality Food Products from the Philippine Cacao Beans								ongoing
The PEEL-Good Project: Bench-scale Ultrasound-assisted Extraction of Pectin from 'Saba' Banana Peel Waste	The PEEL-Good Project: Bench-scale Ultrasound-assisted Extraction of Pectin from 'Saba' Banana Peel Waste		687,197.68						ongoing
Upscaled production of pectin from calamansi wastes	Upscaled production of pectin from calamansi wastes	3,057,296.00	981,296.00						ongoing
Reactivation of Refinery Foots' Adsorption Capacity for Crude Coconut Oil Refining	Reactivation of Refinery Foots' Adsorption Capacity for Crude Coconut Oil Refining				3,269,348.84	1,730,651.16			new

PROCESS SECTOR: Chem and Bio

Updated as of 15 February 2024

New/ Ongoing | Done | Target

Overall Strategies:

Human Resource
- Training for personnel on Metrology in Chemistry and Biology, Polymer technology and Controlled Chemicals
- Disposal of Pyrotechnics
- Safety Awareness Training on CBRNE

R&D Technologies
- Development of certified reference materials and PT for inorganic toxic element for Food and water
- Process for conversion and utilization of Spent Tea Leaves and Tobacco Dust as extender and filler for plywood adhesive
- Established laboratory to produce sustainable polymers

Facilities/Services
- Establishment of Biometrology Laboratory and Metrology in Chemistry Building

S&T Policies
- Policy Recommendation to promote metrology

2021
- Chemical Metrology for Inorganic Toxic Elements in Food and Water
- Biological Metrology for Microorganisms in Food
- Utilization of Spent Tea Leaves and Tobacco Dust as Additives for Plywood Adhesive
- Production of Polyurethane-Modified Concrete (PMC) – Nanomaterial Composite from Crude Glycerol for Industrial Flooring System Application
- Development of Extracellular Matrix from Fish Processing Wastes for Nutraceutical and Biomedical Application
- Processing of Coconut Monoglycerides (CMG) into Functionalized Polyols for Industrial Polyurethane Applications

2022
- Chemical Metrology for Inorganic Toxic Elements in Food and Water
- Biological Metrology for Microorganisms in Food
- Nanobiotechnological Interventions for Enhanced Productivity in Ethanol Distilleries
- Bio-composite from Waste Vetiver Roots and thermoplastic for Industrial Application
- Production of Polyurethane-Modified Concrete (PMC) – Nanomaterial Composite from Crude Glycerol for Industrial Flooring System Application
- Development of Extracellular Matrix from Fish Processing Wastes for Nutraceutical and Biomedical Application
- Processing of Coconut Monoglycerides (CMG) into Functionalized Polyols for Industrial Polyurethane Applications

2023
- Development of reference and PT materials
- Basic Training Course for PNP Personnel on the Fundamentals of Chemical Safety and the Safety Data Sheet (SDS)
- Production of Sea Salt in Ponds lined with High-Density Polyethylene (HDPE) Platform and Different Filtration System
- Nanobiotechnological Interventions for Enhanced Productivity in Ethanol Distilleries
- Bio-composite from Waste Vetiver Roots and thermoplastic for Industrial Application
- Production of Polyurethane-Modified Concrete (PMC) – Nanomaterial Composite from Crude Glycerol for Industrial Flooring System Application
- Development of Extracellular Matrix from Fish Processing Wastes for Nutraceutical and Biomedical Application
- Processing of Coconut Monoglycerides (CMG) into Functionalized Polyols for Industrial Polyurethane Applications

2024
- Trained PNP Personnel regulating Controlled Chemicals (RA 9156) on the Fundamentals of Chemical Safety and the Safety Data Sheet (SDS)
- Polyols that match industry standards for various applications such as viscoelastic foam, superoleophilic foams, polymer modified concrete
- Extracellular matrices and collagen produced from fish processing waste tested against competing products
- Determined root cause in the low yield of bioethanol production.
- Prototypes to produce thermoplastic composites using natural fibers
- Nanobiotechnological Interventions for Enhanced Productivity in Ethanol Distilleries
- Bio-composite from Waste Vetiver Roots and thermoplastic for Industrial Application
- Production of Polyurethane-Modified Concrete (PMC) – Nanomaterial Composite from Crude Glycerol for Industrial Flooring System Application
- Development of Extracellular Matrix from Fish Processing Wastes for Nutraceutical and Biomedical Application
- Processing of Coconut Monoglycerides (CMG) into Functionalized Polyols for Industrial Polyurethane Applications
- PHA-based Composites for Commodity Polymer Products Development (PH-App)
- Polyhydroxyalkanoate (PHA) Production from Less Recalcitrant Biomass and Waste Feedstocks: Process Efficiency Enhancements, Strain Improvement, and Scale-up Validation

2025
- Upscaled production of polyols that match industry standards for various applications such as viscoelastic foam, superoleophilic foams, polymer modified concrete
- Standardized methods to produce Extracellular matrices and collagen produced from fish processing waste tested against competing products
- Improved yield and reduced losses in the bioethanol production
- Thermoplastic composites using natural fibers
- Initial genetic modification of microbes used in PHA production
- Initial screening of materials for the compounding of PHA products
- Laboratory- scale verification of the use of low-cost sugars in the production of PHA
- Determining Laboratory Competency by Interlaboratory Comparison Scheme Using Locally Developed Proficiency Test Items for Dairy Product
- Proficiency Testing materials for interlaboratory comparison of the microbiological analysis of dairy
- PHA from low-cost sugars using improved fermentation techniques
- Industry compliant PHA composites

New/ Ongoing | Done | Target

PROCESS SECTOR: Chem and Bio

Updated as of 15 February 2024

Overall Strategies:

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S&T Policies
- Policy Recommendation to promote metrology

200M
- Reduction of the cost of production of bio-based polymers from indigenous feedstock for industrial application
- Chemical Recycling of Polymers towards Cost Reduction
- Development of Mono-material flexible packaging towards improved recyclability
- Development of recyclable adhesives
- Catalyst development for waste-to-fuel applications
- Development of materials in mitigating accidents (e.g. Bomb suit or PPE against explosion-related hazards, Antistatic and Fire-retardant standardized uniform, spills detection and decontamination) (directed call)
- Establishment of laboratory for pyrotechnics testing (directed call)
- Innovative solutions to support Human Security/ Biosecurity for chemical and biological defense (e.g. Testing services to ensure compliance to cross border trade, rapid test kits for identifications of chemicals in fieldwork)
- Feasibility Study on Modular Manufacturing Facility for Vaccines
- Metrology in Chemistry for controlled and regulated substances

2026

- Proficiency Testing materials for interlaboratory comparison of the microbiological analysis of dairy
- PHA from low-cost sugars using improved fermentation techniques
- Industry compliant PHA composites

100M
- Localization for the method validation to address the lack of standard method for determining the explosive potential
- Development of recyclable adhesives
- Catalyst development for waste-to-fuel applications
- Reduction of the cost of production of bio-based polymers from indigenous feedstock for industrial application
- Chemical Recycling of Polymers towards Cost Reduction
- Development of Mono-material flexible packaging towards improved recyclability
- Development of recyclable adhesives
- Catalyst development for waste-to-fuel applications
- Development of materials in mitigating accidents (e.g. Bomb suit or PPE against explosion-related hazards, Antistatic and Fire-retardant standardized uniform, spills detection and decontamination)

2027

- Innovative solutions to address cost, recyclability, and applications of bio-based polymers and its wastes
- Materials for mitigating accidents related to significant CBRNE
- Profiling of controlled chemical substances
- Feasibility study on vaccine manufacturing

50M
- Establishment/ upgrading of testing laboratory for testing of explosive potential
- Facility for pyrotechnics automatic fuses
- Sustainable alternative solutions using bio-based polymers

2028

- Innovative solutions to address cost, recyclability, and applications of bio-based polymers and its wastes
- Materials for mitigating accidents related to significant CBRNE
- Profiling of controlled chemical substances
- Feasibility study on vaccine manufacturing
- Localized method for determining explosive potential

List of Projects under the Chem and Bio Roadmap

R&D Technologies	Project Title	Budget Allocation ('000)							Status
		2022	2023	2024	2025	2026	2027	2028	
Chemical Metrology for Inorganic Toxic Elements in Food and Water	Chemical Metrology for Inorganic Toxic Elements in Food and Water	3,212,789.31							completed
Biological Metrology for Microorganisms in Food	Biological Metrology for Microorganisms in Food	1,628,745.00							completed
Bio-composite from Waste Vetiver Roots and thermoplastic for Industrial Application	Bio-composite from Waste Vetiver Roots and thermoplastic for Industrial Application	3,265,700.00	1,734,300.00						on-going
Nanobiotechnological Interventions for Enhanced Productivity in Ethanol Distilleries	Nanobiotechnological Interventions for Enhanced Productivity in Ethanol Distilleries	3,354,987.80	1,644,987.80						on-going
Production of Sea Salt in Ponds lined with High-Density Polyethylene (HDPE) Platform and Different Filtration System	Production of Sea Salt in Ponds lined with High-Density Polyethylene (HDPE) Platform and Different Filtration System		4,189,899.20						on-going
Basic Training Course for PNP Personnel on the Fundamentals of Chemical Safety and the Safety Data Sheet (SDS)	Basic Training Course for PNP Personnel on the Fundamentals of Chemical Safety and the Safety Data Sheet (SDS)		2,566,029.00						on-going
PHA-based Composites for Commodity Polymer Products Development (PH-App)	PHA-based Composites for Commodity Polymer Products Development (PH-App)			11,713,956.00	2,671,956.00				new
Polyhydroxyalkanoate (PHA) Production from Less Recalcitrant Biomass and Waste Feedstocks: Process Efficiency Enhancements, Strain Improvement, and Scale-up	Polyhydroxyalkanoate (PHA) Production from Less Recalcitrant Biomass and Waste Feedstocks: Process Efficiency Enhancements, Strain Improvement, and Scale-up			49,434,037.00	7,796,935.60	7,624,435.60			new