PROJECT PROPOSAL
2022 DOST-GIA FUNDING

I. PROJECT PROFILE

(1) Project Title: Establishment of Laboratory-scale Research Facility for Characterization of Ground Calcium Carbonates (GCCs) from Romblon Marble Wastes for Possible Commercialization and Industrial Use

(2) Project Leader/Sex: Dr. Alfredo F. Fortu Jr./ Male
Agency: Romblon State University-College of Engineering and Technology Main Campus
Address/Telephone/Fax/Email: Odiongan, Romblon

(3) Cooperating Agency/ies: College of Arts and Sciences, RSU Romblon Campus, RSU faculty from various disciplines, Marble processors, & Industry

(4) Site/s of Implementation (Municipality / District / Province / Region)
Base Station: Odiongan, Romblon
Other Implementation Site (s): None

(5) Project Duration: 1 year project implementation/ 2 years monitoring of outcomes

(6) Total Project Cost: (indicate Counterpart Funds; use Form A for the Line-Item Budget)

Source of Fund / Site(s) of Implementation	PS	MOOE	EO	Total
A. DOST-GIA		PhP391,250.00	PhP2,137,050.00	**PhP2,528,300.00**
B. RSU		PhP140,000.00	PhP1,000,000.00	**PhP1,140,000.00**
TOTAL		**PhP531,250.00**	**PhP3,137,050.00**	**PhP3,668,300.00**

II. PROJECT SUMMARY

(7) Rationale

Romblon is known for its marble deposits that are at par with international standards. However, the market dominance of ceramic tiles in the late 90s resulted in the closure of several marble plants in the islands. Interest in reviving the industry, however, is gaining ground again. Marble is identified as the flagship priority R&D commodity of Romblon State University. The goal is to help the industry reposition itself and find its niche in the market by exploring the potential industrial uses of its wastes towards the industry's sustainable development. It is estimated that about 150 million cubic meter of marble deposits are found in Romblon. At the current state of quarrying, it would take about 3 centuries before all marble are extracted. Untapped marble resources are also found in Tablas Island. Currently, there are 11 marble quarrying sites with 71 workers, 33 cutting plants with 260 workers, and 91 registered marble traders with 456 workers in active operation in the islands. On top of this are the 47 marble processing plants for novelty items with 71 workers accounted for at present. Moreover, Romblon traders bring to processors in Manila about 340 tons of marble rubbles weekly valued at P2.30/kg or about P782,000. Alad Mining also ships about 300 tons of marble rubbles once or twice every month. These rubbles are converted to calcium carbonate. Ground calcium carbonate fetches P13.00 per kilogram. If value addition were done in Romblon, the difference could have spelled P3.6M per week or roughly P150M annually. One product that the University can develop from marble wastes is the ground calcium carbonates (GCC). As reported in the literature, GCCs can be used as fillers or extenders to manufacture paper, paint, plastic, rubber, adhesives, cosmetics, textile, sealant, coating, ink, and toothpaste. GCC is usually sourced from limestone, but the use of marble wastes as an alternative is an exciting area of exploration since both these rocks are made up of the same mineral contents. In this way, this project will strategically address the issue of marble waste mismanagement and its threat to the environment. Currently, marble chips and scraps are shipped out of the province for processing into GCCs. If there is a way that these wastes could be processed as GCCs within the province, its value would cost more, and the income of the local processors would improve.

(8) Project Description

The proposal is a laboratory-scale project which involves the following activities: processing, characterization, testing and grading. Marble wastes such as rubbles, fine powder, slurry, dust, and mud from different marble types will be grounded down to the nano-size range to produce the GCCs. GCCs will be characterized and tested for various parameters for grading purposes. The graded GCCs will be matched with the industry requirements and specifications for potential commercialization and R&D purposes.

OBJECTIVES

This project is proposed to develop GCCs from marble wastes for industrial purposes. Especially, this will address the following objectives:

1. Convert quarrying and processing wastes into GCCs down to the nano-size range;
2. Characterize the physical and chemical properties of the processed GCCs based on the standard parameters in the industry;
3. Compare and grade the characteristics of the GCCs across the marble type source.
4. Tie up results of the project to GCC-based manufacturing industries for potential commercialization and R&D purposes.

METHODOLOGY

Quarrying and processing plants for marbles will be identified and geo-tagged. Different types of marbles (e.g., gray, black, and white-colored) will be collected at the sampling sites and brought to Romblon State University-Main campus for grinding. Ground samples will be dried in an oven at a temperature of 110 ± 5 °C until they reached the constant weight. Dried samples of ground marbles will be sent to analytical laboratories through One Lab to determine their physical, chemical, mineralogical, and morphological properties. The analysis will include grain size distribution, bulk density, specific gravity, color and brightness, hardness, leachable chlorides, acid solubility, pH, chemical composition (inductively coupled plasma atomic emission spectrometry, ICP-AES), mineralogical composition (X-ray diffraction analysis, XRD), and morphological quality (scanning electron microscope, SEM) of marble particles. The possible use/s of ground marbles will be identified based on the properties of the ground marbles. Some of the variables that the project team aims to know in this research is the comparison of the standards of the marble industry, and the acceptability of the developed GCCs in the industry.

A three-man team will share among the project activities. To ensure a systematic project implementation, the following project responsibilities will be observed:

Involved Personnel	Responsibilities and Output	Concerns Addressed
Project Leader	- Test physical and mechanical properties of marble from six quarry sites in Romblon - Generate enough data for mathematical modelling of marble grades; - Establish a grading system for Romblon marble; - Implement policy for the right product grading and labelling.	Grading system for Romblon marble that may lead to greater consumer satisfaction and patronage of products
Researcher 1	- Develop and test marble aggregates for the construction sector. - Develop ground calcium carbonate for the paint industry. - Develop and test marble nanoparticles as concrete strength enhancer. - Develop and test marble aggregates for water filtration.	Marble waste utilization for greater economic benefit for the industry. Value addition of marble right at home. New product development that could have huge economic impact on the industry.

Researcher 2	- Develop major products from marble wastes and marble GCCs that will have huge economic impact. - Test commercial viability of the developed products. - Establish collaborations and tie-ups with GCC-based manufacturing industries for potential commercialization and R&D purposes.	Marble R&D to respond to pressing concerns like water and sanitation.

EXPECTED OUTPUTS

Products. Product will be GCC in the nanoparticle size ranges with corresponding physical, mechanical and chemical properties of samples from 3 different marble types.

People. One master's degree graduate will be considered for this research. This will come from a faculty co-operator of this research, and this will also open opportunities for marble processors in the province.

Places and partnerships. At least 2 industry partners in the paint and construction sector and 6 marble quarrying sites for raw material supply will be tapped

Publication. At least one paper for publication in a Scopus- indexed journal will be considered. Another knowledge product that could be copyrighted is the documented process for producing the Ground Calcium Carbonate (GCC).

Protection. An application for patent, utility model or industrial design, whichever is applicable, will be made to protect intellectual property.

Policy. Draft at least one policy for marble waste utilization or marble resource value addition in the province for possible local investment in the industry.

EXPECTED OUTCOMES

1. Establish one facility complete with equipment for processing marble wastes into GCCs down to the nano-size range
2. Produce at least 50 to 300 bags of GCC per day which are already characterized for its physical and chemical properties based on the standard parameters in the industry
3. Establish at least 3 grade levels of GCCs based on the comparison and grading of its characteristics across the marble type sources
4. Tie up with at least 2 GCC-based manufacturing industries for potential commercialization of the products developed from the project, and for R&D purposes of the project

PERCEIVED IMPACT

Social Impact

- ✓ The GCC-facility would pave way to maximize and add value to the marble wastes hence reducing its adverse effects to the environment where it is currently disposed.
- ✓ The availability of the marble GCC-facility could be a push factor for innovators and entrepreneurs to conduct more research related to marble waste beneficiation.
- ✓ Improved capability of the marble processors and researchers through the related trainings included in the project

Economic impact

- ✓ Provision of additional source of income for marble processors thus increasing the economic activities in marble in the province
- ✓ Higher opportunity for investors to invest in Romblon
- ✓ Sustainable income generating project for the university where students, faculty, and teachers could also benefit from

SUSTAINABILITY PLAN

To ensure project sustainability, continuous monitoring and innovations will be made by the proponent in collaboration with the DOST PSTC Romblon. Monitoring and evaluation will focus on realization of the expected output listed above. One PSTC staff will also be assigned to monitor and oversee the project implementation together with the proponent. After the conduct of tests, analysis, and validation, the proponent will then proceed to

commercialization to transform the facility into an income generating project of the university. The proponent will also invite potential investors in the islands, which will affect the investment plan and directions of the local and provincial government units concerning the marble industry and make the necessary policies to support the industry. Marketing will be done by the person-in-charge in the operation of the facility. Price standardization will also be done after further market research. These are only some of the steps to be undertaken to ensure project sustainability.

(9) Workplan (See Form B)

(10) Project Management

The research will be implemented by the RSU Romblon Campus, CAS, CET, and other faculty researchers in the University. CET is the lead unit, with the Dean as the project leader. The project will be implemented in cooperation with the PSTC Romblon. DOST MIMAROPA will fund the project and assist in the procurement of necessary equipment and supplies.

III. ATTACHMENTS (Please refer to the DOST-GIA Guidelines for the necessary documents.)

Prepared by:

DR. ALFREDO F. FORTU JR
Dean, College of Engineering and Technology
Romblon State University

Endorsed by:

MARCELINA V. SERVAÑEZ
Provincial S&T Director
DOST Provincial Office Romblon

Approved by:

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DR. MA. JOSEFINA P. ABILAY
Regional Director
DOST-MIMAROPA

DOST Form A

DEPARTMENT OF SCIENCE AND TECHNOLOGY
Project Line-Item Budget
CY 2022

Program Title : Grants-In-Aid (GIA)
Project Title : Establishment of Laboratory-scale Research Facility for Characterization of Ground Calcium Carbonates (GCCs) from Romblon Marble Wastes for Possible Commercialization and Industrial Use

Implementing Agency : DOST-MIMAROPA
Total Duration : 1 year for project implementation / 2 years for monitoring of outcomes
Current Duration : 1 year
Cooperating Agency : RSU- Main Campus (CET)
Project Leader : Dr. Alfredo F. Fortu Jr.
Monitoring Agency : DOST-MIMAROPA PSTC-Romblon

		Counterpart Funding	
		DOST	**RSU**
II.	**Maintenance and Other Operating Expenses**		
	Traveling Expenses - local	60,000.00	20,000.00
	Supplies and Materials		30,000.00
	Office supplies	20,000.00	
	Other Supplies and Materials Expenses	40,000.00	
	Communication Expenses		
	Telephone Expenses - Mobile	6,000.00	30,000.00
	Other Professional Services *(PSTC's RT-PCR tests)*	30,000.00	40,000.00
	Printing and Publication Expenses *(project tarp)*	250.00	
	Representation Expenses	27,000.00	
	Transportation and Delivery Expenses *(sending samples to one lab)*	20,000.00	20,000.00
	Other Maintenance and Operating Expenses *(Application for IP protection)*		25,000.00
	Testing fee	188,000.00	
	Sub-Total for MOOE	**P 391,250.00**	**P 140,000.00**
III.	**Equipment Outlay**		
	1 unit Lab Ball Mill, Volume: 1L*4, Stainless Steel, Maximum Loading capacity of jar: No more than 2/3 of the jar volume(including the material and the balls), input size; 10 to 0.1 micron, rotational speed; revolution 335r/min, rotation 670r/min, way of speeding: inverter stepless speed regulation, speed precision is 0.2r/min, way of drive: gear drive, motor power:750w, 220v, 50Hz, way of working: work with 2 or 4 jars simultaneously, input size <10mm, output size:13-75 micron, maximum continuous working time: 72h	605,000.00	

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DOST Form A

DEPARTMENT OF SCIENCE AND TECHNOLOGY
Project Line-Item Budget
CY 2022

Program Title	:	Grants-In-Aid (GIA)
Project Title	:	Establishment of Laboratory-scale Research Facility for Characterization of Ground Calcium Carbonates (GCCs) from Romblon Marble Wastes for Possible Commercialization and Industrial Use
Implementing Agency	:	DOST-MIMAROPA
Total Duration	:	1 year for project implementation / 2 years for monitoring of outcomes
Current Duration	:	1 year
Cooperating Agency	:	RSU- Main Campus (CET)
Project Leader	:	Dr. Alfredo F. Fortu Jr.
Monitoring Agency	:	DOST-MIMAROPA PSTC-Romblon

Equipment Outlay

1 unit PARTICLE ANALYZER Detecting type: Photoelectric Measuring range: （10-1000）mg/m³（customized） Display accuracy: ≤±20% Voltage Range: DC24V±10% Sampling: Diffusion Power consumption: ≤3W (DC24V) Output: 4~20mA（mA). GND(OP)and (COM, NO) output .H-alarm/L-alarm is adjustable Communication (optional): 4 wire ABUS 3 wire 4~20mA /RS485（wire/wireless）/LoRa(wireless) Communication range: Range (wire)≤ 1000 m(1.5mm²) wire Range(wireless)≤3500 m Ex mark : Ex ib IIB T4 Gb/Ex ibD 21 T130°C IP ratting: IP6X Enclosure material: Aluminum alloy. 304 Stainless steel. Tempered glass Cable entries: G3/4Internal screw thread Temperature-Humidity Range: -40℃~+70℃, ≤85%RH Operating Pressure Range: 86kPa~106kPa Temperature measurement precision: ±0.5℃（-40℃-120℃） Humidity measurement precision: ±3%RH（0-100%RH） Temperature resolution: 0.1℃ Humidity resolution: 0.1%RH Display type:2.5 inch LED.4 and 5 Bit Nixietube. 8-Segment Numeric +Graphical display IR control range: ＜8m Expected Operating Life: 2 years Low-alarm: 50mg/m³ (Factory default) High- alarm: 100mg/m³ (Factory default) Response time: <30s(T90) Output range: ≤30V, 2A(maximum Limiting current) Weight: 2.2Kg Circuit protection: Over-range protection circuitDimension: 280mm× 160mm× 90mm		1,532,050.00		
		P		P
Indirect Cost				
(Implementing Agency)				
Land and Building		P		P 1,000,000.00
	Sub-Total for EO	**P**	**2,137,050.00**	**P** **1,000,000.00**
	GRAND TOTAL	**P**	**2,528,300.00**	**P** **1,140,000.00**

Certified Funds Available:

LOU V. FOJA
Head, Romblon State University Budget Office

JEFFREY D. VARELA
Accountant III, DOST-MIMAROPA

Approved by:

Digitally signed by Abilay Ma. Josefina Pormento
Date: 2022.01.28 16:06:04 +08'00'

DR. MA. JOSEFINA P. ABILAY
Regional Director, DOST-MIMAROPA

DOST Form B

PROJECT WORKPLAN

(1) Program Title: Grants-in-Aid (GIA)

(2) Project Title: Establishment of Laboratory-scale Research Facility for Characterization of Ground Calcium Carbonates (GCCs) from Romblon Marble Wastes for Possible Commercialization and Industrial Use

(3) Total Duration (in months): 12 months implementation & 24 months monitoring **(4) Planned Start Date:** January 2022 **(5) Planned End Date:** December 2022

(6) OBJECTIVES	(7) TARGET ACTIVITIES	(8) TARGET ACCOMPLISHMENTS (quantify, if possible)	Y1				Y2				Y3			
			Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
1. Convert quarrying and processing wastes into GCCs down to the nano-size range;	Collect enough marble wastes from at least six quarry sites in Romblon to be converted into GCCs down to the nano-size range Generate enough data for mathematical modelling of marble grades	Establish one facility complete with equipment for processing marble wastes into GCCs down to the nano-size range	x x x	x x x	x x x									
2. Characterize the physical and chemical properties of the processed GCCs based on the standard parameters in the industry;	Test the physical and mechanical properties of the marble wastes Characterization of the physical and chemical properties of the processed GCCs based on the standard parameters in the industry	Produce at least 50 to 300 bags of GCC per day which are already characterized for its physical and chemical properties based on the standard parameters in the industry				x								
3. Compare and grade the characteristics of the GCCs across the marble type source.	Establish a grading system for the GCCs developed from Romblon marble wastes Implement policy for the right product grading and labelling	Establish at least 3 grade levels of GCCs based on the comparison and grading of its characteristics across the marble type sources				x								
4. Tie up results of the project to GCC-based manufacturing industries for potential commercialization and R&D purposes.	Develop and test marble aggregates for the construction sector and for water filtration. Develop and test marble nanoparticles as concrete strength enhancer. Develop ground calcium carbonate for the paint industry and other major products from marble wastes and from the marble GCCs that will have huge economic impact.	Tie up with at least 2 GCC-based manufacturing industries for potential commercialization of the products developed from the project, and for R&D purposes of the project				x x								

	Test commercial viability of the developed products. Establish collaborations and tie-ups with GCC-based manufacturing industries for potential commercialization and R&D purposes.													

(9) EXPECTED OUTPUTS (6Ps)	(10) DETAILS (quantify, if possible)	Y1				Y2				Y3			
		Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Publications	At least one paper for publication in a Scopus- indexed journal will be considered. Another knowledge product that could be copyrighted is the documented process for producing the Ground Calcium Carbonate (GCC).												
Patents/IP	At least one application for patent, utility model or industrial design, whichever is applicable, to be made to protect intellectual property.												
Products	Product will be GCC in the nanoparticle size ranges with corresponding physical, mechanical and chemical properties of samples from 3 different marble types.												
People Services	One master's degree graduate will be considered for this research. This will come from a faculty co-operator of this research, and this will also open opportunities for marble processors in the province.			x	x								
Places and Partnerships	At least 2 industry partners in the paint and construction sector and 6 marble quarrying sites for raw material supply will be tapped.	x	x										
Policy	Draft at least one policy for marble waste utilization or marble resource value addition in the province for possible local investment in the industry.												