PROCEEDINGS OF

7TH SEMINAR/WORKSHOP ON THE UTILIZATION OF WASTE MATERIALS

"FRONTIER TECHNOLOGIES IN SUSTAINABLE WASTE UTILIZATION AND MANAGEMENT"

September 14, 2019
Henry Sy Sr. Hall
De La Salle University, Manila

ISSN 2345-8968

Proceedings of the 7th Seminar Workshop on the Utilization of Waste Materials

"Frontier Technologies in Sustainable Waste Utilization and Management"

September 14, 2019 | De La Salle University

Manila, Philippines

Subthemes:

(1) Utilization of technology and practices for sustainable environment

(2) Concrete and structures using alternative materials

(3) Materials and resource recovery from waste materials

(4) Future trends and prospects for waste utilization and management

Editor:

Jason Maximino C. Ongpeng, D.Eng.

Published by: Association of Tokyo Tech Alumni and Research Scholars (ATTARS) and De La Salle University Manila

ISSN 2345-8968

Proceedings of the 7th Seminar Workshop on the Utilization of Waste Materials

"Frontier Technologies in Sustainable Waste Utilization and Management"

Manila, Philippines

Editor:
Jason Maximino C. Ongpeng, D.Eng.

Published by: Association of Tokyo Tech Alumni and Research Scholars (ATTARS) and De La Salle University Manila

7th Seminar Workshop on the Utilization of Waste Materials

September 14, 2019 | De La Salle University

Manila, Philippines

The Seminar/Workshop on the Utilization of Waste Materials is an annual innovative meeting for all researchers and engineers from around the globe where ideas and experiences from different disciplines are exchanged to promote waste utilization technology and practices towards a sustainable environment. It aims to create better awareness and application of engineering innovations towards sustainable development.

The theme of the 7th Seminar Workshop on the Utilization of Waste Materials lecture series is "Frontier Technologies in Sustainable Waste Utilization and Management." The subthemes for the seminar are as follows: (1) Utilization of technology and practices for sustainable environment, (2) concrete and structures using alternative materials, (3) materials and resource recovery from waste materials, and (4) Future trends and prospects for waste utilization and management.

The WoW conference has been hosted by De La Salle University (DLSU) – Manila, Philippines for four years since 2013. This conference has been organized together with the Association of Tokyo Tech Alumni and Research Scholars (ATTARS), and the Civil Engineering Department of the De La Salle University- Manila, Philippines. The history of the conference is shown below.

Year	Theme	Host Institution	Number of Papers
2013	Utilization of Waste Materials (organic, industrial, agricultural, construction)	ATTARS, DLSU	30
2014	Sharing Knowledge, Technology, and Expertise on Waste Utilization for the People, Economy and the Environment	Civil Engineering Department – DLSU	21
2015	Science and Engineering on Waste Utilization for the People, Economy and the environment	Chemical Engineering Department – DLSU	23
2016	Engineering Innovation towards Sustainable Waste Management	Institute of Civil Engineering – UPD	33
2017	Performance of Composite Materials formed with Waste Mixtures	ATTARS, DLSU	33
2018	Multidisciplinary Approach on Waste Utilization Technology and Practices Towards a Sustainable Environment	Civil Engineering Department – DLSU	28
		Total:	168 papers

The 7th Seminar Workshop on the Utilization of Waste Materials is organized by De La Salle University - Gokongwei College of Engineering, Association of Tokyo Tech Alumni and Research Scholars (ATTARS), Tokyo Institute of Technology, Technological University of the Philippines and the University of Santo Tomas. For this year's seminar workshop, a total of 33 papers were submitted. These are enumerated in the following section.

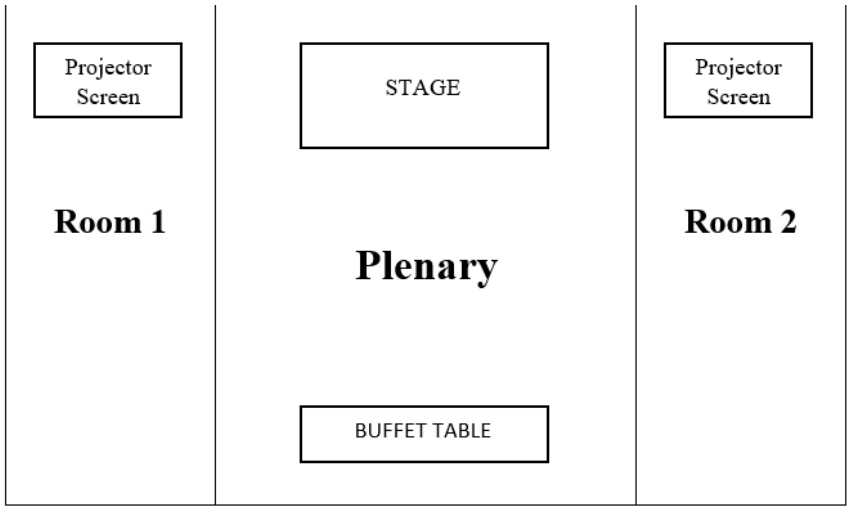
This seminar was made possible by:

TABLE OF CONTENTS

WOW 2019 Program September 14, 2019 *Hosted by:* Dr. George William Hong and Dr. Maria Cecilia Paringit			
8:00	-	8:50	**Registration**
8:50	-	9:00	a.) Philippine National Anthem b.) Japan National Anthem c.) Opening Prayer – Engr. Iona Rubinos
9:00	-	9:05	**Welcoming Remarks** Br. Bernard S. Oca, FSC, *DLSU Chancellor*
9:05	-	9:10	**Opening Remarks** Prof. Kazuya Masu, *Tokyo Institute of Technology President*
9:10	-	9:15	**Photo Opportunity**
9:15	-	9:40	Dr. Fumitake Takahashi, Tokyo Institute of Technology *The first step of waste recycles: design of trash bins and waste separation behaviors*
9:40	-	10:05	Prof. Kiyohiko Nakasaki, Tokyo Institute of Technology *A new microbial DNA analysis-based approach to improve environmental biotechnologies*
10:05	-	10:30	Engr. Reynaldo G. Tagudando, BRS, DPWH *Sustainable Engineering Technology:* *Waste Utilization and Management*
10:30	-	10:55	Engr. Joel Jude A. Tadeo, Arcadis Philippines Inc. *Zero Waste – Energy and Resources*
10:55	-	11:20	Engr. Raul C. Sabularse, DOST-PCIEERD *Innovation Works for the People: Solutions on Sustainable Waste Utilization*
11:20	-	11:45	Engr. Frederick Tan, Megawide Construction Corporation *Utilization of technology and practices for sustainable development*
11:45	-	12:00	**Discussions** By Prof. Susan Gallardo and Engr. Rajiv Abdullah
12:00	-	13:00	**Lunch Break**
13:00	-	14:30	**Parallel Sessions Batch 1 (see next page)**
14:30	-	15:15	**Presentation and Workshop** *Ecobricking: A Practical Solution to Plastic Waste Pollution* Rosalinda Lopez-Fuentes Founder, Ecobricks Philippines
15:15	-	16:30	**Parallel Sessions Batch 2 (see next page)**
16:30	-	16:45	**Closing Remarks** Dr. Jason Maximino C. Ongpeng
17:00	-	21:00	**Fellowship Dinner (by Invitation)**

PARALLEL SESSION BATCH 1 (Time and Paper ID)								
Room 1 Session Chair: **Prof. Emeritus Nobuaki Otsuki**			**Plenary Room** Session Chair: **Prof. Susan Gallardo**			**Room 2** Session Chair: **Engr. Rajiv Eldon Abdullah**		
13:00	- 13:15	1A	13:00	- 13:15	2A	13:00	- 13:15	3A
13:15	- 13:30	1B	13:15	- 13:30	2B	13:15	- 13:30	3B
13:30	- 13:45	1C	13:30	- 13:45	2C	13:30	- 13:45	3C
13:45	- 14:00	1D	13:45	- 14:00	2D	13:45	- 14:00	3D
14:00	- 14:15	1E	14:00	- 14:15	2E	14:00	- 14:15	3E
14:15	- 14:30	1F	14:15	- 14:30	2F	14:15	- 14:30	3F
PARALLEL SESSION BATCH 2 (Time and Paper ID)								
15:15	- 15:30	1G	15:15	- 15:30	2G	15:15	- 15:30	3G
15:30	- 15:45	1H	15:30	- 15:45	2H	15:30	- 15:45	3H
15:45	- 16:00	1I	15:45	- 16:00	2I	15:45	- 16:00	3I
16:00	- 16:15	1J	16:00	- 16:15	2J	16:00	- 16:15	3J
16:15	- 16:30	1K	16:15	- 16:30	2K	16:15	- 16:30	3K

Parallel Session Room Guide:



De La Salle University – Manila
Office of the Chancellor

MESSAGE

On behalf of the DLSU academic community, let me warmly welcome you to our Manila campus and to the 7th Seminar/Workshop on the Utilization of Waste Materials. I also convey my heartfelt greetings to the officers and members of the Association of Tokyo Tech Alumni and Research Scholars for organizing this well-timed event.

The theme of this conference, *Frontier Technologies in Sustainable Waste Utilization and Management*, resonates well with the DLSU Vision. We are most pleased to host this innovative meeting, particularly as it will expound on topics that would impact on our current and future generations. May this conference serve as a venue for the multi-disciplinal exchange of ideas and experiences that would promote waste utilization technology and practices toward a sustainable environment.

Congratulations to the organizers, resource speakers, paper presenters, and participants of this event! May this book of abstracts serve as a fertile ground for generating broader and stronger collaborations among engineering professionals and scholars in the allied fields in heightening awareness on and promoting the use of frontier technologies to address the challenges of sustainable waste management, and transform wastes into valuable resources for sustainable development.

I wish everyone an enjoyable and meaningful event.

Br. Bernard S. Oca, FSC
Chancellor
De La Salle University

Tokyo Institute of Technology

MESSAGE

I would like to congratulate the organizers of the 7th Seminar Workshop on the Utilization of Waste Materials held at De La Salle University.

As president of Tokyo Institute of Technology (Tokyo Tech), I value the ongoing collaboration between De La Salle University and Tokyo Tech, and I am delighted at the contributions of the Association of Tokyo Tech Alumni and Research Scholars (ATTARS), whose efforts deepen the ties between our universities.

The utilization of waste materials is an urgent task for the world. I look forward to the productive and fruitful discussions among the researchers participating in WOW2019.

Thank you.

Prof. Kazuya Masu
President
Tokyo Institute of Technology

De La Salle University – Manila
Gokongwei College of Engineering
Office of the Dean

MESSAGE

A warm welcome to everyone.

My sincerest gratitude to De La Salle University for hosting the 2019 Seminar Workshop on the Utilization of Waste Materials (WoW 2019). I would also like to thank the following co-organizers: Technological University of the Philippines, University of Santo Tomas and Association of Tokyo Tech Alumni and Research Scholars (ATTARS). This event would not also be possible without the support from Tokyo Institute of Technology.

In the past six years, this seminar-workshop discussed several studies related to the utilization of waste materials. Aside from those, this has also been the venue to meet people with common interests from the academe, government and private institutions. I am a witness of new collaborations that were established out of the discussions done in this seminar workshop.

May this conference provide an opportunity for everyone to increase awareness in responding to global concerns like waste accumulation and utilization for a more sustainable environment. Let us all continue to find ways on how we better utilize wastes for the improvement of the lives of the people and to protect our environment.

Prof. Jonathan R. Dungca
Dean
Gokongwei College of Engineering
De La Salle University

De La Salle University – Manila
Gokongwei College of Engineering
Civil Engineering Department

MESSAGE

Warm greetings to all participants and guests of the 7th Seminar Workshop on the Utilization of Waste Materials. I would also like to congratulate the Association of Tokyo Tech Alumni and Research Scholars (ATTARS), De La Salle University Gokongwei College of Engineering – Civil Engineering Department, Technological University of the Philippines, University of Santo Tomas, and Tokyo Institute of Technology for another successful hosting of this workshop.

Our resources are finite and scarce but the demand to build structures continue to increase globally. This presents a problem and at the same time an opportunity for us to innovate and create solutions to utilize and manage waste effectively for a sustainable future.

I am certain that the deliberations of this seminar / workshop will be fruitful and will continue to inspire researchers to expand and create knowledge and technology that is relevant and responsive to the growing needs of our country and the world.

Thank you.

Prof. Lessandro Estelito O. Garciano
Chair, Department of Civil Engineering,
Gokongwei College of Engineering
De La Salle University

MESSAGE

I am very pleased to address the 7th Seminar Workshop on the Utilization of Waste materials.

One of the key roles of the Tokyo Tech Philippine Office is to promote the academic exchange between the universities in the Philippines and Tokyo Institute of Technology.

Materials science and engineering is one of the strong research fields in Japan, especially in Tokyo Tech. Especially, there is a need for effective and efficient utilization of waste materials. This conference offer a valuable opportunity for such researchers in the important academic field to convene in one place.

I hope you find this conference full of new information.

Thank you.

Prof. Shin-ya Nishizaki
Director, Tokyo Tech Philippine Office

Association of Tokyo Tech Alumni and Research Scholars

MESSAGE

It is a great pleasure to welcome you all to the 7th Seminar Workshop on the Utilization of Waste Materials held here in De La Salle University Manila, Philippines.

This seminar aims to link the industry and academe in pursuit of finding solutions to environmental problems through multidisciplinary discussion on waste material utilization and management of resources. Solutions such as the use of sustainable materials by alternative materials is widely researched and utilized in both industry and academe as well. With this year's theme, new technologies and strategies on waste utilization and management are addressed.

Furthermore, I would like to thank the organizations that have contributed in the success of this annual event: Technological University of the Philippines, University of Santo Tomas, Megawide Construction Corporation, Amsteel Structures Inc., Khmaya Builders Inc., Dalcon Construction, and White Knight Hotel Intramuros.

I wish everyone an exciting and meaningful seminar workshop.

Dr. Jason Maximino C. Ongpeng
President
Association of Tokyo Tech Alumni and Research Scholars

ABSTRACT OF KEYNOTE LECTURES

The first step of waste recycles: Design of trash bins and waste separation behaviors

Fumitake Takahashi
Associate Professor

Department Interdisciplinary Science and Technology, School of Environment and Society, Tokyo Institute of Technology, I4-2, 2-12-1 Ookayama, Meguro-ku, Tokyo 142-8550 Japan.

E-mail: takahashi.f.af@m.titech.ac.jp

ABSTRACT: Waste recycles have attracted a great social concern anywhere in terms of waste management. When and where do waste recycles start? It starts when we drop off our wastes to trash bins. Trash bins are used for waste collection and separation in both public and private spaces. This means that trash bins are very important tools for waste recycles. However, scientific research on trash bins has been very limited. What is the best design of trash bins? Can appropriate designs encourage better waste separation? How wide area can a single trash bin collect wastes? If better designs improves waste separation efficiency, it might be helpful to improve the efficiency of downstream processes in waste recycles. Psychological approaches might give some answers for better management of trash bins. Some psychological and experimental results will be presented to understand waste collection/separation performances of trash bins.

A new microbial DNA analysis-based approach to improve environmental biotechnologies

Kiyohiko Nakasaki
Professor

Department Interdisciplinary Science and Technology, School of Environment and Society, Tokyo Institute of Technology, I4-2, 2-12-1 Ookayama, Meguro-ku, Tokyo 142-8550 Japan.

E-mail: nakasaki@ide.titech.ap.jp

ABSTRACT: Environmental biotechnologies such as composting and biogas fermentation utilize complex microbial ecosystems in which many microorganisms co-exist and interact with each other. Recently developed molecular techniques enable us to understand dynamic changes in the behavior of characteristic microorganisms, and the roles of these microorganisms in the microbial consortia by microbial DNA analyses. The information obtained from DNA analysis can assist in controlling the composting process by defining microbial succession, which regulates compost maturity. It can also enhance efficiency of biogas production (i.e., stable biogas production) by monitoring indicator species for deterioration of biogas fermentation. New innovations in composting and biogas fermentation will help to popularize these old but important environmental biotechnologies, and promote a recycling-oriented society.

Keywords: environmental biotechnology, DNA analysis, composting, biogas fermentation

Sustainable Engineering Technology: Waste Utilization and Management

Reynaldo G. Tagudando
Director

Bureau of Research and Standards, Department of Public Works and Highways

ABSTRACT: Our environment is constantly experiencing significant damages from wastes produced by us. These damages are undeniably caused by the works of our people, and our Mother nature is calling out to us to wake up, change and do something. The wake up call comes in the form of flooding, deaths in marine life as well as wildlife, and deaths and casualties to many people brought about by the environmental disasters.

The incidents are now in alarming rate that we need to act now. Many environmental advocates are also continuously working to find a solution and somehow lessen the adverse environmental impact of unmanaged wastes.

The Government had also created a major agency, the National Solid Waste Management Commission, tasked to implement the R.A. 9003 (Ecological Solid Waste Management Act of 2000) to institutionalize a national program that will manage the control, transfer, transport, processing and disposal of solid waste in the country; and to oversee the implementation of appropriate solid waste management plans.

The Department of Public Works and Highways (DPWH) as a member of this Commission is looking to provide some solutions to waste utilization through conduct of innovative researches that integrates waste materials into the construction materials.

The Bureau of Research and Standards (BRS) as the research arm of the Department is continuously finding new technologies in line with the Department's objective in providing sustainable engineering, innovative researches and environment friendly technological advancements were being developed.

The use of indigenous materials for road and building construction has been one of the alternatives that most countries are looking for to promote economic activity without overspending on importing construction materials and to conserve deposits of other naturally occurring construction materials. The DPWH-BRS has also evaluated new or innovative products including but not limited to soil stabilizers, concrete and asphalt admixtures, and reclaimed or recycled construction materials.

Among the researches that are currently being conducted are:

1. Improvement in construction methodology through the use of new technology in Soil Stabilization.

2. Utilization of waste materials through incorporation in the existing pavement technology such as HDPE Plastic (plastic bottles) as additive to Hot Mix Asphalt; LDPE Plastic (plastic bags & wrappers) as additive to Hot Mix Asphalt; and Crumb Rubber as additive to Hot Mix Asphalt.

3. Utilization of waste materials through recycling of waste construction materials such as Reclaimed Asphalt Pavement (RAP), and Recycled Concrete Aggregate (RCA).

Addition to the above technologies are the application of Cellular Confinement System and Bio-Engineering Solutions for slope protection.

The Department of Public Works and Highways, through the Bureau of Research and Standards, shall continue to engage in research and development on techniques pertinent to sustainable engineering. We shall formulate effective standards and guidelines to improve the quality of these structures to ensure the safety of the public.

Zero Waste – Energy and Resources

Joel Jude A. Tadeo
Senior Mechanical Consultant

Arcadis Philippines Inc.
25th/F Circuit Corporate Center One, Theater Drive Circuit Makati,
AP Reyes Street, Carmona 1207, Makati City, Philippines

E-mail: joeljudetadeo@gmail.com

Abstract: Zero waste facilities may be achieved by changing how materials flow through society. The concept promotes a redesign of resource life cycles to end with the reuse of all products. This topic will explore what are the concepts behind diversion of waste through Redesign, Reduce, Reuse, Recycle, and Zero Waste Purchasing. In the context of energy, waste is energy in excess of what is needed. The presentation will also investigate the opportunities for the Energy Efficiency and Conservation Act (RA11285) as it applies to commercial and industrial buildings.

ABSTRACTS

Two Concepts of Lifetime Predictions in Marine Environment

Nobuaki Otsuki

Tokyo Institute of Technology, 2-36-2 Ookayama, Meguro, Tokyo, Japan
Tel. +(813) 5734-3127
E-mail: otsuki@ide.titech.ac.jp

ABSTRACT: In these days, from the view point of sustainability, lifetime predictions are important target in construction fields. There may be many concepts and researches on the matter.

In this paper, the author introduces two concepts on the matter. First one is about the Reinforced Concrete (corrosion of steel bars) under chloride attack and second one is about the paint deterioration on steel in marine environment.

1. The mechanism of chloride attack is assumed as follows ;
   a) Chloride concentration around the steel bars
   b) At the end of incubation period, corrosion starts on the steel bars.
   c) Then, expansion of the steel bars starts.
   d) At the end of propagation period, delamination of the concrete cover occurs.
   e) Then, there is serious section loss of steel bars (acceleration period).
   f) Finally, the loading capacity decreases (deterioration period).

In this paper, a) to c) would be explained more detailed.

2. The mechanism of the paint deterioration is assumed as follows;
   a) At first, water, chloride and oxygen penetrates through the paint.
   b) Then, corrosion starts on the surface of the steel (pile or plate).
   c) After b), expansion of the steel (at the place), and the paint swell and break.
   d) Then much of the paint delaminated, and finally the loading capacity decreases (sometimes buckling).

In this paper, a) to c) would be explained more detailed.

On the two deterioration mechanisms, the author summarizes and introduces some concepts how to predict the lifetimes.

REFERENCE:

LIFETIME PREDICTION OF REINFORCED SEAWATER CONCRETE MIXED WITH FLY ASH WHICH WERE PRODUCED IN JAPAN OR PHILIPPINES AGAINST CHLORIDE ATTACK, Nobuaki Otsuki1, Cheng Yi, Ronaldo Gallardo, Cheryl Lyne Roxas, Proceedings of the WOW CONCRETE 2017 @ DLSU

Effects of University effluent in the properties of concrete

Jan Nicholas S. Baldo[1] ,Dexter Hansel C. Apnoyan[2], Marizol Marie C. Bautista[3] , Kenia E. Balacdao[4], Ahl-vhi R. Dela Cruz[5] , Arvin E. Esteban[6], Elvielyn S. Maala[7]

University of the Cordilleras ,Governor Pack Road , Baguio City
E-mail :janbsangway@gmail.com

ABSTRACT: The concrete industry has been working for several decades to reduce its environmental impact. To minimize consumption of fresh water in the concrete industry, this paper seeks to utilize effluent from the treatment facility of University of the Cordilleras as mixing and curing water for concrete production. The concrete mix is evaluated in terms of time of setting, workability and compressive strength. American Society for Testing Materials (ASTM) procedures were carried out in determining the properties of materials, in preparing and curing concrete and in testing specimens. Chemical tests on effluent were limited to the laboratory results available at the University. Results indicated lower values of workability and compressive strength for the concrete mixed with effluent. Higher values of final setting time and compressive strength were obtained from cement paste mixed effluent, concrete mixed and cured with effluent respectively.

Keywords: *Potable water, effluent, concrete, workability*

REFERENCES :

Alqam, M., Jamrah , A., Al-hafith, B.A., Al-Zubi, R. & Al-Shamari, N. (2014). Fresh and hardened properties of sustainable concrete using recycled household greywater. Arab Journal for Science and Engineering, 39(1), 1701- 1708.Doi:10.1007/s13369-013-0733-8.

Al- Ghusain, I. & Terro, M. (2003). Use of treated wastewater for concrete mixing in kuwait. Kuwait Journal of Science and Engineering 30(1). 213-227.

Kucche, K.J., S.S & Sadgir, P.A. (2015). Quality of water making concrete : A review of literature . Int. J. Sci. Publ. 5(1) , 1-1

Optimization on the use of Geopolymer and Cement (OPC) as Stabilizer in Compressed Earth Block

Emerson O. Gapuz[1], Jason Maximino C. Ongpeng[2], Jester Joseph San Andres[2], Darlene June O. Prudencio[2], James Dean B. Cuadlisan[2], Mark Allen A. Tadina[2], Arnold Ian Janssen C. Zacarias[2], Danna Alexis O. Benauro[2], Alyanna Era Felipe[2], Samantha V. Pabustan[2]

Saint Louis University, Upper Bonifacio St, Baguio, Benguet, Philippines
Tel. (074) 442 2793
E-mail: emerson.gapuz.slu@gmail.com

ABSTRACT: Filipino citizens suffer housing crisis due to economic problems in a developing country like the Philippines. Compressed Stabilized Earth Blocks is an alternative building material which aims to provide a resilient building material at a low cost. The advantages of this building material are: cost efficiency, energy efficiency, eco-friendly, naturally non-toxic, fireproof and biodegradable. Compressed earth block (CEB) composed of soil alone compromises its mechanical strength and can be enhanced through the process of adding ordinary portland cement (OPC) or geopolymer as stabilizer for the block. This research presents a low-cost working mixture that uses a combination of fly ash (FA) mixed with Sodium Hydroxide (NaOH) to create a geopolymer with comparable performance to OPC. The effectiveness of adding Geopolymer and OPC were investigated to see their effect to the absorption rate, erosion rate, and compressive strength under the uni-axial compression test at at a curing age of 7 days and 28 days. A total of 52 CEBs with dimensions of 295mm x140mm x100mm were made. As an alternative to conventional concrete hollow blocks, a baseline value of 2.50MPa compressive strength referenced from the code provision of Philippine National Standard (PNS) was used as the basis in assessing the strength of CEB in this study. With component-soil percentages of 5% and 15%, the following lowest and highest compressive strengths were recorded; 1.92Mpa and 5.07Mpa for cement as component, 0.42Mpa and 2.92Mpa for geopolymer as component. Additionally, lowest percentages of water absorption were assessed from the 15% mixtures of cement and 10% mixtures of geopolymer with values of 10.39 and 12.83, respectively. To achieve a strength of 2.50 MPa the block should contain 5.5382% cement for cement-stabilized earth block and for geopolymer-stabilized earth block, the block should contain 12.74% geopolymer.

REFERENCES:

De Sousa, S. M. T., De Carvalho, C. M., Torres, S. M., Barbosa, N. P., Gomes, K. C., & Ghavami, K. (2014). Mechanical Properties and Durability of Geopolymer Stabilized Earth Blocks. Retrieved November 13, 2018, from https://www.researchgate.net/publication/245024883

Egenti, C., Khatib, J.M., & Oloke, D. (2012). High carbon fly ash and soil in a shelled compressed earth block. Retrieved November 13, 2018, from https://www.researchgate.net/publication/263175607

Norkhairunnisa, M. & Muhammad Fariz, M. N. (2015). Geopolymer: A review on physical properties of inorganic aluminosilicate coating materials. Retrieved November 13, 2018, from https://www.researchgate.net/publication/271961722

Ongpeng, J. M., Gapuz, E., & Roxas, C. L. (2017). Optimization of mix proportions of compressed earth blocks with rice straw using artificial neural network. Retrieved November 13, 2018, from https://ieeexplore.ieee.org/document/8269450

UTILIZATION OF COAL FLY ASH AND BAGASSE FLY ASH FOR PERVIOUS GEOPOLYMER SYNTHESIS

Jacen Mariel Catapang[1], Charles Steven Chang[1], Kenneth Collo[1], Winarto Kurniawan[2], Hirofumi Hinode[2], Aileen Orbecido[1], and Michael Angelo Promentilla[1,*]

[1]Chemical Engineering Department, De La Salle University, Manila 1004, Philippines
[2]Department of Transdisciplinary Science and Engineering, Tokyo Institute of Technology, Tokyo 152-8550, Japan

Corresponding Author: michael.promentilla@dlsu.edu.ph

ABSTRACT: Geopolymer has recently gaining popularity as an eco-friendly material because of its potential to valorize waste. It is a new class of inorganic material formed upon dissolution of aluminosilicate in the presence of an activating solution. The aluminosilicate minerals become reactive and then form into aluminosilicate oligomers.This study thus explores the use of combining coal fly ash and bagasse fly ash as the aluminosilicate source to produce geopolymer. While coal fly ash (CFA) is a by-product of coal-fired power plant, bagasse fly ash (BFA) is a waste product of the co-generation plant of sugar mills from burning bagasse. These raw materials were mixed with coarse aggregates and activating solution composed of sodium hydroxide and sodium silicate to produce a pervious geopolymer. The effect of the mix proportions of CFA and BFA on the compressive strength were investigated. Future work will be investigated further the permeability of the material and its potential application for wastewater treatment.

ANALYSIS OF LAHAR BASED EMBANKMENT MATERIALS USING BIO-SILICA FROM IMPERATA CYLYNDRICA ASH

Julian Abelard Pasco[1], Oliver Celis[1], Mary Jane Lusung[1], Ernesto Villarica[1], Nichols Manarang[1], John Joseph Pinlac[1], Carmelo Nikko Mercado[1], Joseph Edgar Rufo[1], Allan Sahagun[1], Elbert John Galang[1] and Arvin JamesDavid[1]

[1]Department of Civil Engineering, College of Engineering,
Our Lady of Fatima University, Dela Paz Norte, City of San Fernando, Pampanga 2000

ABSTRACT. This study aimed to develop an alternative, sustainable and eco-environmentally friendly source of raw material for soil embankment using lahar and evaluating its properties. The main raw material used in this research is the bi-silica ash of Imperata Cylindrica, widely known as cogon grass.

In this research, three different percentage of imperata cylindrica ash were used, 10%, 20% and 30%, and produced a samples for every percentage of ash with dimensions of 30cm x 30cm x 1.2cm.The samples were then burn to ashes to be used in the analysis of its properties. The physical properties consists of moisture content, dry density and unit weight were determined according to the procedures specified by the American Association of State Highway and Transportation Officials (AASHTO). The tests were all conducted at the Department of Public Works and Highways, Dela Paz Norte, City of San Fernando Pampanga.

The relationship of lahar properties to its dry density and moisture content were considered in each test results in the experiments. As specified by the standards for embankment, the physical property test depend on the change in its maximum dry density and its optimum moisture content.

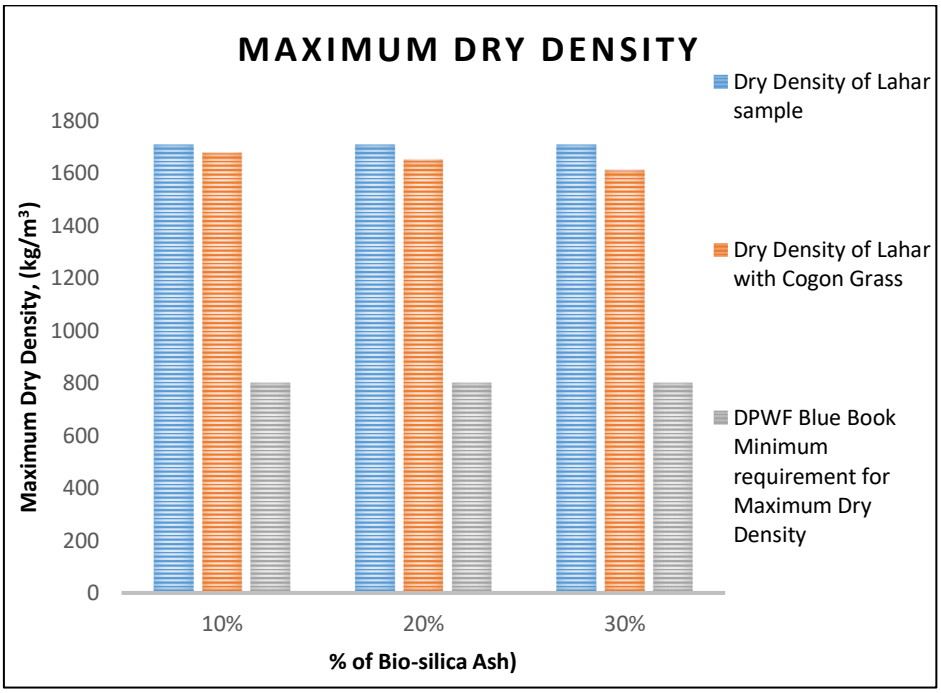


Figure 1. Comparison of Maximum Dry Density to DPWH Minimum Requirement

Figure 2, shows that the maximum dry density values of lahar mixed with bio-silica surpassed the minimum requirement set by DPWH in their standards.

The lahar with 10% cogon grass ash replacement passed all the physical property test required for AASHTO T99: (Method C) Standard Proctor Test which lessen its maximum dry density. The lahar with 20% cogon grass ash replacement also passed the physical property test

but with reduced maximum dry density. The lahar with 30% cogon grass ash replacement also passed all the requirements but with high reduction in its maximum dry density. Therefore, bio-silica ash from Imperata Cylindrica can be used to improved strength of Lahar embankment material up to 10% replacement, beyond 10% the strength decreases based on the laboratory test results.

REFERENCES

ASSHTO T99 and T180 (ND T 99 AND ND T180): Moisture-Density Relation of Soil, Viewed January 2019 <apps.itd.idaho.gov/apps/manuals/QA/Archive/files/2013Jan/.../t99t180wpr11.pdf>

AASHTO T27 ASTM C136: Sieve Analysis of Fine and Coarse Aggregate, Viewed January 2018 <https://www.youtube.com/watch?v=GPKQQZ2rbvs>

AASHTO Soil Compaction System: Soil Classification Chapter 4, Viewed January 2018 <www.ce.memphis.edu/4151/.../06%20-%20Soil%20Classification%20(2- Up).pdf>

ASTM D698 (Standard): Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12400ft-lb/ft^3 (600 KN- m/m^3)) Viewed January 2019. <www.resolutionmineeis.us/sites/default/files/references/astm-D698.pdf>

DPWH Standard Specification for Public Works and Highways, 2004 Edition Volume 2 Highways, Bridges and Airports.Embankment Materials for Construction, Viewed February 2019, http://www.fhwa.dot.gov/publications/reseach/infrastucture/structures/9714 8/app4.cfm

Ganiron Jr. and Ganiron Sr. et. al., Utilization and end-Users Acceptability of Compressed Lahar Sediment Block as Wall Panel for Low-Cost Housing, Auckland City, New Zealand. College of Architecture, Qassim University, Buraidah City, KSA, 2007.

Lahar, Wikipedia: The Free Encyclopedia, Viewed January 2019, <http://en.wikipedia.org/wiki/Lahar>

Loreto G. Aguila., The compressive strength, flexure strength abrasion resistance of Concrete paving blocks made of lahar added with shredded plastic waste. Philippine Journal of Industrial Education & Technology. 2004 January to June.

Maximum Dry Density and Optimum Moisture Content of Soil, Viewed February 2019, http://nicholls- colton.co.uk/optimum-moisture-content-maximum-dry- density-omcmdd/

Standard Proctor Test, Viewed January 2019. <https://www.youtube.com/watch?v=AP-lvZqLDYM>

STRENGTH CHARACTERIZATION OF NYPA FRUITICAN FIBER-REINFORCED CONCRETE

Nichols Manarang[1], Alfred C. Santos[1], Oliver C. Celis[1], Almira Camarote[1], Charlene H. Gopez[1], Matt Ivan H. Ladrillo[1], Mary Jane Lusung[1], Reymart A. Rivera[1], Kimberly Terogo[1], Ernesto Villarica[1]

[1]Civil Engineering Department, Our Lady of Fatima University Pampanga Campus, Dela Paz Norte, MacArthur hi-way, City of San Fernando, Pampanga 2000
Email: miacamarote1625@gmail.com, charrgopez@gmail.com, ivanladrillo@gmail.com, mac03rivera@gmail.com, kimberlyterogo31@gmail.com.

ABSTRACT – This study aimed to determine the strength characteristics of concrete when mixed with Nypa Frutican fibers. Nypa Frutican, commonly known as the nipa palm is one of the oldest angiosperm plants and probably the oldest palm species. The largest natural nipa stands are found in Indonesia (700,000 ha), Papua New Guinea (500,000 ha) and the Philippines (8000 ha). The experimental study was conducted by the researchers and assisted by Mr. Marphy Conception of N2B Material Testing Center Construction at Fil-Am Friendship Highway, Cutcut, Angeles City. Three sets of cylinder and beam specimen with three specimens each set were prepared and cured for 14 days. Each concrete cylinder and beam specimens were tested for their compressive and flexural strengths respectively. The data were gathered and evaluated according to American Society for Testing and Material (ASTM) Standards. After analysis of test results, the researchers arrived at relevant findings. The mix proportions with the 30% and 20% Nypa Frutican fiber (NFF) were classified as low workability mixes, and the mix proportion with 10% Nypa Frutican fiber was classified as medium workability mix. The 30% NFF, 20%NFF, and 10%NFF attained an averages compressive strength of 20.90MPa, 21.44MPa, and 22.20MPa respectively against the plain concrete specimen with s strength of 20.7MPa. The 30%NFF, 20%NFF and 10%NFF attained an average flexural strength of 3.69MPa, 3.99MPa and 4.20MPa against the plain concrete beam specimen with a strength of 3.62MPa. Based on the results, Nypa Frutican fiber-reinforced concrete passed all the minimum standards for compressive strength and flexural strength of concrete as shown in Table 1. Therefore, Nypa Frutican fiber can be utilized as natural fiber for the production of fiber-reinforced concrete.

Table 6. Compressive and Flexural Strength of Nypa Frutican Fiber Reinforced Concrete

SN	Specimen Number	Percentage of the Concrete Mixture	Compressive Strength (MPa)	Average Standard for Compressive Strength (MPa)	ASTM Standard for Compressive Strength in (MP)	Flexural Strength (MPa)	Average Flexural Strength (MPa)	ASTM Standard for Flexure in Concrete (MPa)
1	1	10%	21.70	22.20	20.7	4.13	4.20	3.62
	2		22.57			4.26		
	3		22.32			4.19		
2	1	20%	21.65	21.45		3.98	3.98	
	2		21.31			4.08		
	3		21.39			3.90		
3	1	30%	20.92	20.90		3.68	4.08	
	2		20.82			3.75		
	3		20.95			3.64		

REFERENCES

Maranon Jr., J. (2018). Potentiality of Coconut Rachies Fiber as Fiber – Reinforced Concrete. Our Lady of Fatima University.

Aguiala J. (2018). Comparative Analysis of Compressive Strength of Concrete Using Lahar and River and as Fine Aggregates. Our Lady of Fatima University.

Cortes, E (2018). Compressive and Flexural Strength Characteristics of Concrete Reinforced with Metal Metals. Our Lady of Fatima University.

Infante A. (2018). Concrete Hollow Blocks Reinforced with Eihornia Crassipes Fibers. Our Lady of Fatima University.

Aguila V. (2014). Rice Hull Material for Lightweight Concrete, Batangas State University.

Cometa M. C. (2012). Acceptability of Red Sand as Fine Aggregates in Concrete. Batangas State University.

Experimental Behavior and Modeling of Partial CFRP Confined Concrete with Different Height-to-Diameter Ratio under Axial Compression

Rodolfo Mendoza Jr., Ralph John A. Lee, Kyle Justine S. Gaw, Aaron Cedrick S. Sosiong, Karl Benjamin S. Benedicto

De La Salle University, 2401 Taft Avenue, 0922 Manila, Philippines
Tel. +(632) 524-4611 Local 226
E-mail: rodolfo.mendoza@dlsu .edu.ph

ABSTRACT: The use of partial CFRP confined concrete in existing concrete structures provides a cost-effective alternative for retrofitting. Partial strips can be a product of trimmings from full FRP confinement application. In contrast to full FRP confinement, however, numerical and analytical models used to predict the compressive behavior of such system are limited and are commonly based on experimental results of specimens with height-to-diameter (H/D) ratio of equal to 2.0. When concrete is confined partially, depending on the level of confinement, concrete damage may localize when the load applied approaches its peak strength. Due to this localization, the stress-strain behavior will no longer be a material property but rather would be dependent on the H/D ratio of the specimen—with higher H/D ratios having lower axial ductility. To prove this behavior, an experimental program was carried-out which include specimens with H/D ratio of 2, 3 and 4, and with constant clear spacing ratio (ratio of FRP strip spacing to diameter of the specimen) of 0.5 as shown in Figure 1. It was found that the axial ductility and confined compressive strength of concrete decreases with increasing H/D. Predictions of existing analytical models with test results are shown in Figure 2 which shows that these models can provide a reasonable estimate of confined peak strength for specimen with H/D equal to 2.0 but tend to overestimate the capacity of specimens with H/D equal to 3 and 4. This proves that these models were developed without considering the effect of localization in concrete. Hence, a new proposed numerical model which combines the use of Rigid Body Spring Model (RBSM) and a Mixed Interpolation Tensorial Component (MITC) shell is introduced to partial CFRP confined concrete.

FIGURE 1

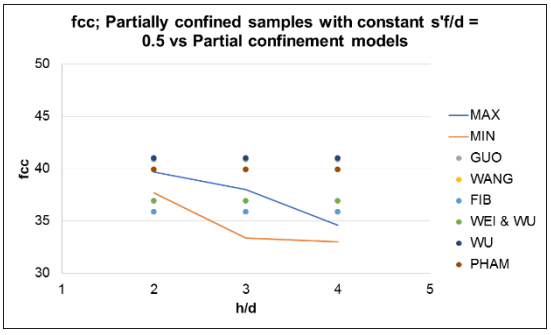


FIGURE 2

REFERENCES:

Mendoza, R., Yamamoto, Y., Nakamura, H., & Miura, T. (2018). Numerical evaluation of localization and softening behavior of concrete confined by steel tubes. Structural Concrete, 1956-1970. doi:10.1002/suco.201700266.

Zeng, J., Guo, Y., Gao, W., Chen, W., & Li, L. (2018). Stress-strain behavior of concrete in circular concrete columns partially wrapped with FRP strips. Composite Structures, 200, 810-828. doi:10.1016/j.compstruct.2018.05.001.

ANALYSIS ON THE STRENGTH PERFORMANCE OF MYCELIUM BRICKS AS A POTENTIAL CONSTRUCTION BUILDING MATERIAL

Edward Daniel R. Inciong[1], Vince Bryan C. Sendo[2], Adrian William T. Siggaoat[3], Crizia Anne S. Soliman[4]

De La Salle University, 2401 Taft Avenue, 0922 Manila, Philippines
Tel. +(632) 524-4611 Local 226
E-mail: edward_inciong@dlsu.edu.ph

ABSTRACT: The rapid growth of the construction industry has led to numerous innovations and structures which inevitably increases the consumption of earth's resources, and ultimately contributes to the destruction of the environment. Thus, this study aims to utilize the ability of mycelium, the root fibers of fungi, from indigenous microorganisms found in the Philippines to act as a fibrous binder for agricultural wastes and industrial raw materials used for construction. The analysis on the strength performance of mycelium in the form of bricks proves mycelium's potential in innovative construction materials. Hence, compressive and flexural strength tests were conducted to determine the behavior of the mycelium induced brick specimens. Based on the analysis of the tests, the bricks with mycelium obtained up to 38.58% increase in average compressive strength as compared to the bricks without mycelium. Furthermore, the mycelium bricks experienced up to 148.07% increase in bending force capacity and up to 85.57% increase in total midpoint deflection. Thus, mycelium acting as a binder, has created a significant improvement on the mechanical properties of the brick. The appearance of mycelium in bricks with agricultural wastes such as rice bran and sawdust is shown in Figures 1 and 2 below respectively. This shows that incorporating mycelium can reduce the usage of the traditional construction materials while improving its strength performance, and at the same time gives new life to wastes that man produces every single day. Through this research, a sustainable process of manufacturing and enhancing bricks can be optimized towards the development of green cities through green engineering.

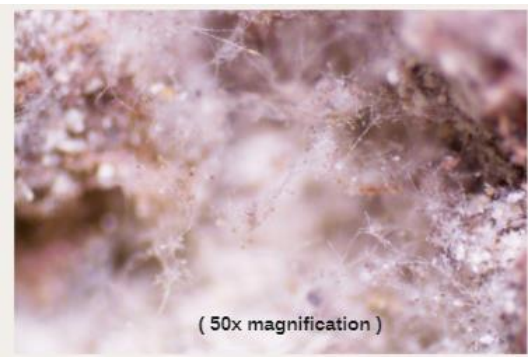


FIGURE 1

FIGURE 2

REFERENCES:

Arifin, Y., & Yusuf, Y. (2013). Mycelium Fibers as New Resource for Environmental Sustainability. *Procedia Engineering*, 53, 504-508. Retrieved on September 27, 2018. Retrieved from: https://ac.els-cdn.com/S1877705813001847/1-s2.0-S1877705813001847-main.pdf?_tid=aeaf6777-b019-42a9-9152-eacf517385d2&acdnat=1538015114_39d2534a488751dae2e0b72e763fc850.

Bafkar O. (2015). Mycelium material new replacement for Thermoplastics. Retrieved on July 4, 2018, from https://www.researchgate.net/publication/290401443_MYCELIUM_MATERIAL_NEW_REPLACEMENT_FOR_THERMOPLASTICS.styrene, Construction and Building Materials, 25(9), 3721-3731.

INSPECTION OF THE EXTERIOR DEFECTS OF HIGH-RISE BUILDINGS WITH THE AID OF AN UNMANNED AERIAL VEHICLE

Theodore S. Angliongto[1], Archlee Juleo G. Arceno[1], Patric Jerome M. Lao[1], Gianna Therese S. Sta. Ana[1], Cheryl Lyne C. Roxas[2], Jason Maximino C. Ongpeng[2]

De La Salle University, 2401 Taft Avenue, 0922 Manila, Philippines
Tel. +(632) 524-4611 Local 226
E-mail: theodore_angliongto@dlsu.edu.ph

ABSTRACT: High rise buildings develop exterior damages due to aging and natural disasters on its surfaces that cannot be easily inspected because of the lack of accessibility and high risk for the inspector. Currently, there are continuous advancements in technology within the civil engineering field that can help assess this issue such as sending a certified inspector to assess the conditions with the use of rappelling, scaffolding, or swing stage. The paper focuses on the use of an unmanned aerial drone (UAV) and python Artificial Intelligence (AI) to aid the inspector in detecting and locating damages such as cracks and rust. The final results of the program will be used in a rapid assessment tool for the inspection of the exterior defects of high-rise buildings. The methodology of collecting pictures and analyzing data was tested in two buildings, and the overall output was evaluated based on its effectiveness. Based on a structured survey of 30 professionals and results validation, the proposed inspection method was proven to be 63% effective. Time efficiency was the most advantageous aspect of the UAV inspection, and data collection planning was found to be the least advantageous. Results validation showed that the program used was only 80% accurate and would affect the detection of damages. The study compares the proposed inspection with conventional methods. Moreover, it was concluded that with further development, the UAV method could be a possible option for inspectors to consider.

REFERENCES:
A.K. Singh, et al., Vision based rail track extraction and monitoring through drone imagery, ICT Express (2018), https://doi.org/10.1016/j.icte.2017.11.010.
Seo, J., Duque, L., & Wacker, J. (2018, June 29). Drone-Enabled Bridge Inspection Methodology and Application [PDF]. Automation in Construction. https://doi.org/10.1016/j.autcon.2018.06.006

Prediction of Compressive Strength of Concrete Mixed with Waste Materials using Machine Learning

Ronaldo S. Gallardo[1], Kenneth Jae T. Elevado[2] and Joenel G. Galupino[3]

[1]De La Salle University, 2401 Taft Avenue, Manila, Philippines, ronaldo.gallardo@dlsu.edu.ph;
[2]De La Salle University, 2401 Taft Avenue, Manila, Philippines, kenneth_elevado@dlsu.edu.ph;
[3]De La Salle University, 2401 Taft Avenue, Manila, Philippines, joenel.galupino@dlsu.edu.ph.

ABSTRACT: As the construction industry continues to grow, the demand for construction materials likewise increases. The manufacturing of these materials unavoidably corresponds to waste generation such as ceramics. Furthermore, the Philippines heavily rely on coal-based electricity production, which in turn produces industrial by-products such as fly ash. To promote sustainable construction practice, waste materials such as fly ash and damaged ceramic tiles are being considered as alternative construction materials. Furthermore, the concrete specimens were mixed with fly ash and waste ceramic tiles as partial replacements of Portland cement and coarse aggregates, respectively. These waste materials were incorporated in the concrete mix since they possess properties similar to the conventional materials. In this study, machine learning was used in modelling the compressive strength of concrete due to the availability of a wide range of data. Specifically, k-nearest neighbor (k-NN) algorithm and artificial neural network (ANN) modelling were considered. Compressive strength tests were performed after the specified curing period of 7, 28 and 56 days. Moreover, the generated KNN and ANN models were compared and validated to ensure that the predictions are acceptable.

Determination of the Mechanical Properties of Borosilicate Glass Powder as a Partial Replacement to Fine Aggregates in Concrete

Abbygail M. Daez [1], Juan Miguel R. Eugenio[1], Timothy S. Laohoo[1], Edward Christian M. Nacpil[1], Cheryl Lyne C. Roxas [2]

De La Salle University, 2401 Taft Avenue, 0922 Manila, Philippines
Tel. +(632) 524-4611 Local 226
E-mail: abbygail_daez@dlsu.edu.ph

ABSTRACT: Millions of tons of glass are generated and only a small portion is being recycled and the rest is placed in landfills. This method of disposing glass, however, is not an eco-friendly solution because it is not biodegradable. Borosilicate glass is commonly used in laboratory glassware and food storage because it is resistant to high temperatures. This study introduces borosilicate glass at 0%, 5%, 10%, 15%, 20%, 25% and 30% partial replacement to fine aggregates in the concrete mix. Properties of concrete that were tested include compressive strength, strength loss due to high temperature exposure, and thermal conductivity. The results can also be used to determine how much strength loss is experienced by each sample for a corresponding thermal conductivity. An increase of 30% was found in the compressive strength of concrete samples with 5% replacement. This was found to be the highest compared to the other concrete mixes. Further experimentation also showed that mixes with higher percentage of borosilicate glass powder had lower thermal conductivity as the amount of replacement increases. This means that the concrete will be more resistant to high temperatures at higher amounts of borosilicate glass.

REFERENCES:

Ammash, H., Muhammed, M., and Nahhab, A. (2009). Using of waste glass as fine aggregate in concrete. Al-Qadisiya Journal For Engineering Sciences, 2, 206-214. Retrieved from https://www.researchgate.net/publication/309618481_Using_of_waste_glass_as_fine_aggregate_in_concrete

Environmental Protection Agency. (2018). Facts and Figures about Materials, Waste and Recycling. Retrieved from:
www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/glass-material-specific-data

Hager, I. (2013). Behaviour of cement concrete at high temperature. Bulletin of the Polish Academy of Sciences, Technical Sciences , 61 (1). doi: 10.2478/bpasts-2013-0013.

Husem, M. (2006). The effects of high temperature on compressive and flexural strengths of ordinary and high-performance concrete. Fire Safety Journal , 41(2), 155-163. doi:10.1016/j.firesaf.2005.12.002

Konijnendijk, W. L. (1975). The structure of borosilicate glasses Eindhoven: Technische Hogeschool Eindhoven DOI: 10.6100/IR146141

Lee, J. C., and Choi, H. G. (2019). Effect of Borosilicate Glass on Thermal Neutron Shielding Performance and Compressive Strength of Cement Mortar. Applied Sciences, 9(04). doi.org/10.3390/app9040763

Removal of Copper and Nickel in Leachate from Payatas Dumpsite by Electrocoagulation Process

Alyanna L. Castronuevo,[1] Kate Ann M. Lojica,[1] Adonis P. Adornado,[1] Ian A. Navarrete,[2] Allan N. Soriano[3]

[1]School of Chemical, Biological, and Materials Engineering and Sciences, Mapua University, Intramuros, Manila City
[2]Department of Environmental Science, School of Science and Engineering, Ateneo de Manila University, Quezon City
[3]Chemical Engineering Department, Gokongwei College of Engineering, De La Salle University, Taft Avenue, Manila City
Tel. +(632) 524-4611 Local 218
E-mail: allan.soriano@dlsu.edu.ph

ABSTRACT: One of the major issues with landfill is the generation of leachate which must be properly managed to prevent environmental pollution. Leachates raise threat to the environment since it usually contains various pollutants such as persistent organic pollutants, heavy metals and other perverse organic pollutants. Thus, leachate treatment is quite challenging because of its complex nature. In this work, the effectivity of electrocoagulation process using aluminum electrodes for simultaneous removal of copper and nickel from Payatas leachate was studied. Several parameters influencing the treatment process such as initial pH, electrolysis time, and voltage were investigated. After digestion, inductively coupled plasma optical emission spectroscopy (ICP-OES) was used to determine the final metal concentrations of the sample. The best removal capacity for copper was achieved at pH 5, supplied at 4 V, in 90 minutes. Though, voltage supplied at 4 V for 30 minutes at any pH is ideal enough for effluent discharge since the concentration is already within the standards for class C waters. Nickel, on the other hand was effectively removed at pH 5, in 60 minutes, and supplied at 8 volts. Yet, 4 volts at 30 minutes at any pH is ideal enough for effluent discharge since the concentration is now within the standards for class C waters. Results revealed that the most favorable parameters for removal of the heavy metals, if not the highest percent removal efficiency, are cost-effective with less energy consumed. Electrocoagulation process using aluminum electrode was successfully utilized for treating Payatas wastewater sample where copper and nickel contaminants were effectively reduced within 60-90 minutes at certain power supply. Hence, electrocoagulation process is a safe, reliable, and cost-effective technique in removing heavy metal contaminants from wastewater.

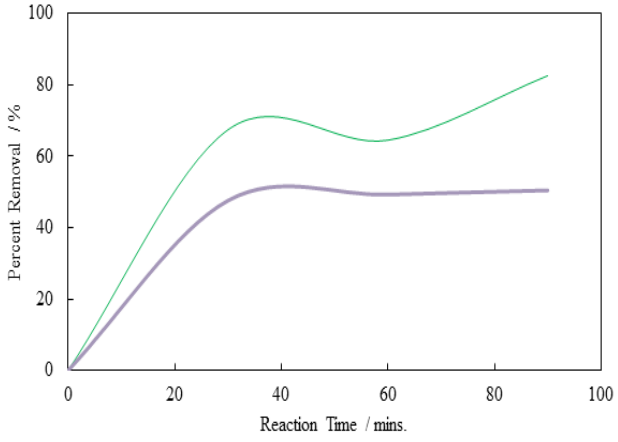


FIGURE 1

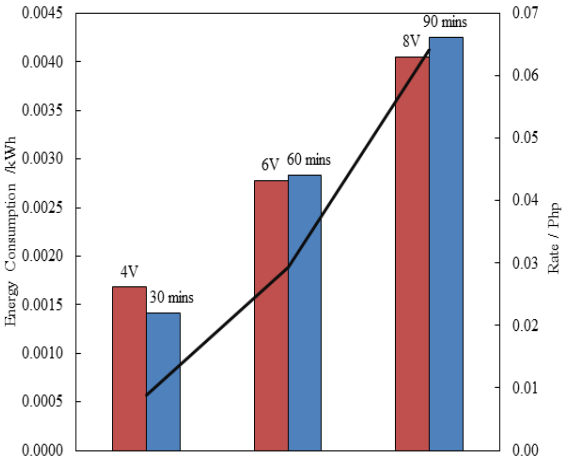


FIGURE 2

REFERENCES:

Heidmann, I. and Calmano, W. (2008). Removal of Zn(II), Cu(II), Ni(II), Ag(I) and Cr(VI) present in aqueous solutions by aluminium electrocoagulation. Journal of Hazardous Materials 152, 934-941.

Huda, N., Raman, A.A.A., Bello, M.M., Ramesh, S. (2017). Electrocoagulation treatment of raw landfill leachate using iron-based electrodes: Effects of process parameters and optimization. Journal of Environmental Management. 204, 75-81.

Verma, A.K. (2017). Treatment of textile wastewaters by electrocoagulation employing Fe-Al composite electrode. Journal of Water Process Engineering 20, 168-172.

Yavuz, Y. and Ögütveren, B. (2018). Treatment of industrial estate wastewater by the application of electrocoagulation process using iron electrodes. Journal of Environmental Management. 207, 151-158.

Comparative Life Cycle Assessment of Rice Straw-Based Bunker Fuel Using Footprint Indicators

Iliana Tan[1], Kathleen B. Aviso, Raymond R. Tan, Luis F. Razon

De La Salle University, 2401 Taft Avenue, 0922 Manila, Philippines
E-mail: iliana_tan@dlsu.edu.ph

ABSTRACT: Rice straw is one of the most abundant agricultural waste materials in the Philippines. Usually, rice straw is being openly burnt because these wastes have low value and farmers look for an easy way to discard these. However, due to increasing environmental concerns, strategies towards converting rice straw into higher valued products have been investigated. Such strategies include thermochemical or biochemical conversions such as combustion, gasification, or pyrolysis for thermochemical and anaerobic digestion or fermentation for biochemical processes. One pathway in the rice straw utilization process is pyrolysis to form bio-oil, which has similar properties as bunker fuel. This study aims to evaluate the change in environmental impact when bunker fuel is obtained from rice straw. Since the processes are energy intensive and requires thermal conversion, one significant indicator to consider is carbon footprint. In addition, another important indicator is nitrogen footprint since an agricultural process is being considered. The processes are then evaluated on a life cycle basis per footprint indicator determined. The evaluation done in the study is a comparative life cycle assessment between the current practice which involves open burning of rice straw and the use of crude oil as bunker fuel for marine engines, versus, the modified process which entails conversion of rice straw to bunker fuel. Data from relevant literature and Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model (GREET) software were used for the life cycle inventory. A total of 43,000 GJ of bunker fuel is used as the functional unit as it is the current demand of bunker fuel in the Philippines. It was found that utilizing 0.01% of the total available rice straw in the Philippines is enough to satisfy the full demand of bunker fuel. It was also found that converting rice straw to bunker fuel is 81.47% better in terms of carbon footprint and 66.94% better in terms of nitrogen footprint. Despite a significant improvement, the pyrolysis of rice straw phase contributes to almost 100% for both footprints. This means that much can still be done in improving the overall environmental efficiency of the pyrolysis process. Apart from pyrolysis of rice straw, other conversion technologies should also be studied. Other environmental impacts may also be examined when doing a comparison of the two pathways in rice straw utilization.

REFERENCES:

Cai, J., He, Y., Yu, X., Banks, S. W., Yang, Y., Zhang, X., … Bridgwater, A. V. (2017). Review of physicochemical properties and analytical characterization of lignocellulosic biomass. Renewable and Sustainable Energy Reviews, 76(January), 309–322. https://doi.org/10.1016/j.rser.2017.03.072

Intergovernmental Panel on Climate Change. (2014). Climate Change 2014 Synthesis Report - IPCC. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. https://doi.org/10.1017/CBO9781107415324

Leach, A., Andrews, J., Galloway, J., Cattaneo, L., Uva, E. C., & Unh, J. A. (2015). Calculating the Campus Nitrogen Footprint Calculating the campus nitrogen footprint.

Silalertruksa, T., & Gheewala, S. H. (2013). A comparative LCA of rice straw utilization for fuels and fertilizer in Thailand. Bioresource Technology, 150, 412–419. https://doi.org/10.1016/j.biortech.2013.09.015

Steele, P., Puettmann, M. E., Penmetsa, V. K., & Cooper, J. E. (2013). Life-Cycle Assessment of Pyrolysis Bio-Oil Production*. Forest Products Journal, 62(4), 326–334. https://doi.org/10.13073/fpj-d-12-00016.1

Evaluation of the Iron Extraction Characteristics of Nickel Mine Mixed Dump for Potential Carbon Sequestration Application

Bernard Jomari B. Razote[1,2], Mark Kenneth M. Maranan[3], Ramon Christian P. Eusebio[3], Richard D. Alorro[4], Arnel B. Beltran[1,2], Aileen H. Orbecido[1,2,*]

[1] Chemical Engineering Department, Gokongwei College of Engineering, De La Salle University, Malate, Manila 1004, Philippines
[2] Center for Engineering and Sustainable Development Research (CESDR), De La Salle University, Malate, Manila 1004, Philippines
[3] Department of Chemical Engineering, College of Engineering and Agro-Industrial Technology, University of the Philippines-Los Baños, Laguna 4031, Philippines
[4] Western Australian School of Mines: Minerals, Energy and Chemical Engineering, Curtin University, Kargoorlie, Australia

*De La Salle University, 2401 Taft Avenue, Maniila 1004, Philippines
Tel. +(632) 524-4611 Local 218
E-mail: aileen.orbecido@dlsu.edu.ph

ABSTRACT: Indirect mineral carbonation has been sought as one of the carbon capture and sequestration (CCS) techniques capable of stably and efficiently storing carbon dioxide. Extraction of iron for carbonation was performed for a mixed dump sample collected from a nickel laterite mine in Southern Philippines using HCl, employing the Face-Centered Cube (FCC) Design for Response Surface Methodology (RSM). Through raw sample characterization, goethite was found out to be the dominant component of the sample, and comparative analyses of the sample before and after leaching tests through SEM showed extensive surface area consumption for iron release. A maximum iron extraction efficiency of 95.37 % was reported at 100 °C, 2.5 M HCl, and 2.5 hrs. Based on the actual concentration of iron extracted, the theoretical amount of carbon (in the form of CO_2) that can be sequestered was calculated. And it was reported that the mixed dump can sequester a maximum of 327.2 mg CO_2 / g sample, which is higher than other raw waste materials such as cement, slag, and fly ash.

REFERENCES:
Arce, G.L.A.F., Neto, T.G.S., Luna, C.M.R., dos Santos, J.C., Carvalho Jr., J.A. (2017) Influence of physicochemical properties of Brazilian serpentinites on the leaching process for indirect CO_2 mineral carbonation, Hydrometallurgy, 169, 142-151.
Kunzler, C., Alves, N., Pereira, E., Nienczewski, J., Ligabue, R., Einloft, S., Dullius, J. (2011). CO_2 storage with indirect carbonation using industrial waste, Energy Procedia, 4, 1010-1017.
Lammers, K., Murphy, R., Riendeau, A., Smirnov, A., Schoonen, M.A.A., Strongin, D.R. (2011). CO_2 sequestration through mineral carbonation of iron oxyhydroxides, Environ. Sci. Technol., 45, 10422-10428.
Mun, M., Cho, H. (2013). Mineral carbonation for carbon sequestration with industrial waste, Energy Procedia, 37, 6999-7005.
Olajire, A.A. (2013). A review of mineral carbonation technology in sequestration of CO_2. J Petrol Sci Eng, 109, 364-392.

Ultrasound and High-Shear Mixing Assisted Oxidative Desulfurization of Simulated Diesel

G. R. H. Barilla[1], C. A. W. Chen[1], M. Z. M. Valencia[1], A. N. Soriano[1], N. P. Dugos[1]

Chemical Engineering Department
De La Salle University, 2401 Taft Avenue, 0922 Manila, Philippines
Tel. +(632) 524-4611 Local 226
E-mail: nathaniel.dugos@dlsu .edu.ph

ABSTRACT: Sulfur content in diesel is continually increasing which calls for an efficient process to extract the sulfur compounds from it. The conventional hydrodesulfurization (HDS) process usually operates at extreme conditions and does not sufficiently remove sulfur compounds such as dibenzothiophene (DBT) and benzothiophene (BT). Oxidative desulfurization is a process wherein oxidizing agent is used to react with the sulfur compounds inside fuels and operates at milder conditions. The present work determines the extent of desulfurization on simulated diesel, containing 2.3% S from DBT and BT, with the use of Ultrasound Assisted Oxidative Desulfurization (UAOD) and Mixing Assisted Oxidative Desulfurization (MAOD). The research conducted made use of activated carbon-supported phosphotungstic acid as a catalyst for the two methods. The parameters varied were ultrasound temperature, time, and catalyst dosage for UAOD and mixing speed, temperature, and time for MAOD. It was found that MAOD had a higher efficiency in the oxidation of sulfur reaching 62.73% compared to UOAD which only reached 39.74%. For the UAOD process, it was found that the catalyst dosage was the only parameter that had a significant effect in the process therefore optimization of the process was not attempted. For the MAOD process, it was observed that the mixing time and mixing temperature were the only significant parameters. It was concluded that DBT was removed more efficiently compared with BT due to higher electron density of DBT. The research determined the most favorable parameters for UAOD were 30 minutes ultrasonication time, 18% catalyst dosage, and at 70 C while the optimum parameters determined for MAOD were 90 minutes mixing time, 16800 rpm mixing speed, and at 65 °C. The fuel properties were also tested for the samples for optimized MAOD and UAOD parameters and the properties fits the Euro 4 standard.

CHARACTERIZATION OF NICKEL LATERITE WASTE AS GEOPOLYMER PRECURSOR

April Anne Tigue[1], Roy Alvin J. Malenab[1], Ithan Jessemar Dollente[1], Winarto Kurniawan[2], Hirofumi Hinode[2], and Michael Angelo Promentilla[1,*]

[1]Chemical Engineering Department, De La Salle University, Manila 1004, Philippines
[2]Department of Transdisciplinary Science and Engineering, Tokyo Institute of Technology, Tokyo 152-8550, Japan

Corresponding Author: michael.promentilla@dlsu.edu.ph

ABSTRACT: The tremendous amount of nickel laterite waste generation is one of the significant concerns of nickel mining industry. At present, these nickel laterite wastes are treated by naturally drying it in the settling pond. However, the problem arises during rainy season as these deposits are being washed off downstream, which contaminates the nearby bodies of water. Hence, there is a need to develop solutions for sustainable mine waste management, for example, waste valorization. In this study, the feasibility of utilizing these nickel laterite wastes as a geopolymer precursor was investigated. Geopolymer precursor can be any pozzolanic compound or source of silica and alumina that can readily be dissolved in activating solution. Characterization techniques such as X-ray Fluorescence (XRF) and X-ray Diffraction (XRD) were performed to evaluate the chemical and mineralogical property of these mine wastes. Future work will focus on improving the reactivity of these nickel laterite wastes and investigating its potential application as geopolymer composite.

CHARACTERIZATION OF FLY ASH- BASED GEOPOLYMER MORTAR WITH STEEL SLAG AND PARTIAL REPLACEMENT OF GROUND COFFEE AND GROUNDNUT SHELL

Jasinne C. Garna[1] , Edgardo S. Legaspi[2] Alyssa Marie Q. Aleida[3], Vemon Butch L. Araves[3], Leonard Brian J. Banias[3], Paulo D. Dayrit[3], Cyrus Paul A. Galvez[3]

Integrated Research and Training Center- Technological University of the Philippines, Ayala Boulevard, Ermita, Manila, Philippines
Tel.+(632) 301-3001 loc. 403
E-mail: jasinne_garna@tup.edu.ph

ABSTRACT: This study is focused on the characterization of the physical and mechanical properties of fly-ash based geopolymer mortar with steel slag with different mix design of coffee grounds and groundnut shell ash. The geopolymer mortar was produced using fly ash, waste coffee ground, groundnut shells ash, steel slag, sodium hydroxide (12M) and sodium silicate and superplastisizer. The parameters to produce the geopolymer mortar were ash ratio, alkaline to ash ratio, curing temperature and curing age. The coffee grounds and groundnut shell ash total ratio were 0%, 5%, 10% and 15%; the alkaline to ash ratio used was 0.45; curing temperature were at 60°C and at ambient curing; curing age were 1 day, 7 days and 28 days. The waste coffee ground and groundnut shells were oven dried and grinded into finer particle and burnt into the furnace. The steel slags were also grinded into smaller particles. The mixing procedure was designed using the tools and procedure currently available for Portland cement mortar. The dry materials which consist of fly ash, coffee grounds and groundnut shell ash, sand, steel slag were first mixed together. The alkaline solution prepared 1 day prior to the mixing day was added to the dry mixed materials. Also, superplastizer was added to improve the workability of the mixture. Mixing of the total mass continued until the mixture became homogenous and uniform in color and was poured into the mold. It was observed that as the percentage of coffee grounds and groundnut shell ash ratio increases the mixing of the fresh geopolymer concrete became difficult. Also, at 15% ash ratio the fresh geopolymer mortar did not produced a homogenous mixture and some ash did not react on the alkaline liquid. In addition, the effect on the physical and mechanical properties of using different volume ratio of coffee grounds and groundnut shell ash to the strength of geopolymer mortar was also studied. The results showed that the geopolymer with 5% replacement and oven cured at 14 days attained the highest compressive strength and flexural strength of 17.7 MPa and 7.8 MPa, respectively. Moreover, the results for the 15% replacement showed great reduction in strength as compared to the 10% and 5% replacements. Hence, this implies that the geopolymer mortars with coffee grounds and groundnut shell ash have the potential to be used as partial replacement for fly-ash and can be used for light load bearing mortar.

REFERENCES:

Arulrajah, A., Kua, T. (2016). Spend coffee grounds-fly ash geopolymer used as an embankment structural fill material. Journal of Cleaner Production, 1-7. doi:10.1016/j.jclepro.2014.03.010

Buari, T.A., Ademola S, A., (2013). Characteristics strength of groundnut shell ash (gsa) and ordinary Portland cement blended concrete in Nigeria. IOSR Journal of Engineering. 1-7. doi:10.9790/3021-03760107

Ouda, A., Abdel-Gawwad, H. (2015). The effect of replacing sand by iron slag on physical, mechanical, and radiological properties of cement mortar. HBRC Journal, Volume 13, Issue 3, 225-261. doi:/ 10.1016/j.hbrcj.2015.06.005

Production and Property Characterization of High Density Particle Board Utilizing Dried Calamansi Peel Bonded with Polyester Resin

Teodinis P. Garcia[1,2], Melito A. Baccay[2], Marjun B. Macasilhig[2], John Dave L. Agravante[2], Joseph Roden B. Bonita[2], Ayalyn Faye V. Clado[2], Jay Benedict T. Sanidad[2], Austin John D. Valencia[2]

[1] Integrated Research and Training Center, Technological University of the Philippines
[2] College of Engineering, Technological University of the Philippines
Tel. +(632) 301-3001 Local 401
E-mail: teodinis_garcia@tup.edu.ph

ABSTRACT: This study is focused on the utilization of agro-waste materials generated from the food processing industry such as extraction of juice from calamansi also known as calamondin or Philippine lime. Normally, calamansi peels are thrown away after extraction of the juice which, contributes to the volume of solid waste generated everyday. In this purview, this study was conducted aimed at producing and characterizing the properties of a particle board bonded with polyester resin using dried calamansi peels. In this study, a total of nine (9) mix designs of dried calamansi peel particles filler-resin ratio (20:80, 30:70 and 40:60) and three varying particle size (3.35 mm – 2.50 mm, 1.68 mm – 1.19 mm, and 0.590 mm – 0.105 mm) were considered to produce a 30 cm x 30 cm x 1.50 cm particle boards. The physical properties of the boards such as water absorption and thickness swelling, as well as the mechanical properties namely, modulus of rupture, face and edge screw holding strength were characterized following ASTM standard. Based on the results of the study, the mix design with a filler-resin ratio of 20:80 and a particle size range of 0.59 mm - 0.105 mm was identified as the best mix design among the nine mix designs that satisfies the criteria for PNS 230:1989 – Type 200 high-density particleboard. The results indicate that dried calamansi peels can be optimized and used as an alternative material for the production of high density particle boards.

REFERENCES:

Anoopisan, Barath I., Nagakalyan S. (2015). Interfacial Behaviour of Composites of Polymer and Orange Peel Particulates. International Journal on Theoretical and Applied Research in Mechanical Engineering (IJTARME). ISSN (Print): 2319-3182, Volume -4, Issue-4.

Cheong MW, Chong ZS, Liu SQ, Zhou W, Curran P, Bin Yu (2012). Characterization of calamansi (Citrus microcarpa). Part 1: Volatiles, aromatic profiles and phenolic acids in the peel. J. Food Chem, 134(2):686-95. doi: 10.1016.

Macatangay, P.M., Magundayao, E.C., Rosales, C.A.M. (2012). Utilization of Agricultural wastes in the Manufacture of Composite Boards. ASEAN J. Sci. Technol. Dev., 29(2): 129 – 140.

Pereira, H. F. P., De Freitas Rosa, M., Cioffi, M. O. H., Benini, K. C. C., Milanese, A. C., Voorwald, H. J. C., Mulinari, D.R. (2015). Vegetal fibers in polymeric composites: a review. Polímeros 25(1):9, DOI: 0.1590/0104-1428.1722.

Philippine Agricultural Engineering Standard (PAES) 320. 2002. *Engineering Materials – Wood-based Panels* – Specifications from Philippine National Standards 230:1989. Retrieved from https://amtec.uplb.edu.ph/images/downloads/paes/320.pdf.

Philippine Statistics Authority (2018). *Major Fruit Crops Quarterly Bulletin, October-December 2018: Calamansi*. Retrieved from https://psa.gov.ph/fruits-crops-bulletin/calamansi.

Sound Absorbing and Fire Resistivity Properties of Concrete Utilizing Bottom Ash and Crumb Rubber Tire as Partial Fine Aggregates Replacement

Melito A. Baccay[1], Teodinis P. Garcia[2], Marjun B. Macasilhg[2], Karl Andrei M. Camata[3], Ervin James C. Castillo[3], John Aries M. Lopez[3], Leanor Anne S. Olivar[3], Stephanie D. Siwagan[3]

Technological University of the Philippines, Ayala Blvd., San Marcelino St. Ermita, Manila
Tel. +(632) 301-3001 local 103
E-mail: melito_baccay@tup.edu.ph or melbaccay@yahoo.com

ABSTRACT: Today, scrap tire disposal and the accumulation of bottom ash are some of the major environmental issues of serious concern. Hence, proper utilization of these industrial by-products is necessary. This study is focused on the determination of the sound absorbing properties and fire resistivity of wall cladding concrete utilizing bottom ash and crumb rubber as partial fine aggregate replacement. In this study, two variations of bottom ash (50% and 60%) were considered to determine the effect of higher amounts of aggregate replacement, three varying processed ground crumb rubber content (15%, 20%, and 25%) with a particle size of 0.425 mm from Vermillion Ventures Inc. were used, and three wall cladding designs (flat, ridged, and corrugated) were considered. The properties of concrete were tested for their physical, mechanical, sound absorbing and fire resistivity. Based on the results, it was established that as the amount of crumb rubber and bottom ash increases, the compressive strength, flexural strength and split tensile strength decreases. This is due to the weak bonding of cement and crumb rubber and the high porosity of bottom ash. Generally, all the mix design except for the specimens with the highest percentage replacement of bottom ash and crumb rubber passed the ASTM requirements for non-load bearing concrete. The concrete with the lowest percentage replacements of crumb rubber and bottom ash (MD1, 15% CRT and 50% BA) exhibited the highest strength. Moreover, sound test on the said concrete showed a reduced sound level of 2.39 dB, indicating its effectiveness as an acoustic indoor wall cladding. Moreover, its fire resistivity showed better thermal resistance (151°C) as compared to normal concrete (225°C).

REFERENCES:

Aggarwal, P., Aggarwal, Y., & Gupta, S. M. (2007). Effect of Bottom Ash as Replacement of Fine. Asian Journal of
Civil Engineering (Building and Housing) Vol., 8(1), 49–62. http://doi.org/10.1007/s12303-009-0004-6

Antil, Y., Verma, E. V., & Singh, E. B. (2014). Rubberized Concrete Made with Crumb Rubber, 3(5), 2012–2014.

Nadig, V. R., & M, K. B. (2015). Bottom Ash as Partial Sand Replacement in Concrete-A Review. IOSR Journal of Mechanical and Civil Engineering, 12(2), 2320–334. http://doi.org/10.9790/1684-1226148151

Olatubosun, A. E., Jones A. O, & Oyedele O. A. (2007). The Behaviour of Sound in an Enclosed Space. ARC 507 –
Environmental Control Report, 6-7 PSR. (1985). Coal Ash: Hazardous to Human Health, 1–3. Retrieved from http://www.psr.org/assets/pdfs/coal-ash-hazardous-to-human-health.pdf

Singh, M., & Siddique, R. (2014). Strength properties and micro-structural properties of concrete containing coal bottom ash as partial replacement of fine aggregate. Construction and Building Materials, 50, 246–256. http://doi.org/10.1016/j.conbuildmat.2013.09.026

Utilization of low grade nickel laterite ore rock for acid mine drainage treatment

Casey Oliver A. Turingan[1], Kim Ahmed Sadol[1], Divina Joyce A. Fabella[1], Richard D. Alorro[2], Arnel B. Beltran[1], Aileen H. Orbecido[1]

De La Salle University, 2401 Taft Avenue, Malate, Manila 1004, Philippines
Tel. +(632) 524-4611 Local 157
E-mail: casey_turingan@dlsu .edu.ph

ABSTRACT: Acid mine drainage (AMD) is one of the most serious environmental problems being addressed globally. It is common in mine sites containing sulfide-bearing minerals which act as the precursor to the formation of AMD. Different treatment methods are utilized to treat AMD before it is discharged to nearby bodies of water. Most of which makes use of limestone as the treatment media due to its alkaline-generating potential and availability. The study investigates the potential of low grade nickel laterite ore rock (LGO) as an alternative media for AMD neutralization. The LGO was characterized through BET, SEM-EDX, XRD, and XRF analyses. Its neutralization potential was compared with limestone through jar testing at different AMD-to-media ratios. Then, the optimal ratio was used in batch tests measuring the treatment efficiency at different residence times. The following parameters were monitored before and after each experiment to determine the efficiency of each material: pH, oxidation-reduction potential (ORP), conductivity, total dissolved solids (TDS), dissolved oxygen (DO), heavy metals, and sulfates. Results indicate that the LGO may be a viable treatment media for the removal of heavy metals.

REFERENCES:

Bernier, L.R. (2005). The potential use of serpentinite in the passive treatment of acid mine drainage: Batch experiments. Environmental Geology, 47, 670-684. doi: 10.1007/s00254-004-1195-9

Kamal, N. & Sulaiman, S. (2014). Bench-scale study of acid mine drainage treatment using local neutralization agents. Malaysian Journal of Fundamental and Applied Sciences, 10(3), 150-153.

A Proposed Clustering Solution for Material Recovery and Garbage Collection in Santa Maria, Bulacan, Philippines

Maria Emilia P. Sevilla[1], Ma. Klarissa M. Daly[2], Miller DL. Cutora[3]

De La Salle University, 2401 Taft Avenue, 0922 Manila, Philippines
Tel. +(632) 524-4611 Local 226
E-mail: maria.emilia.sevilla@dlsu.edu.ph

ABSTRACT: Sta. Maria, Bulacan is located in Central Luzon, Philippines, comprised of 24 barangays with 48,837 households. Data shows that 76.80% of the garbage collected by the municipal government ends up in landfills. The second-most used waste disposal method is burning with 18.61%. Various other traditional methods of waste disposal make up the next 3.82%, and only .77% of households recycle their waste. This paper is intended to map the routes each barangay will take to reach the solid waste facility, and perform a clustering solution to propose an optimized garbage collection method for the municipality.

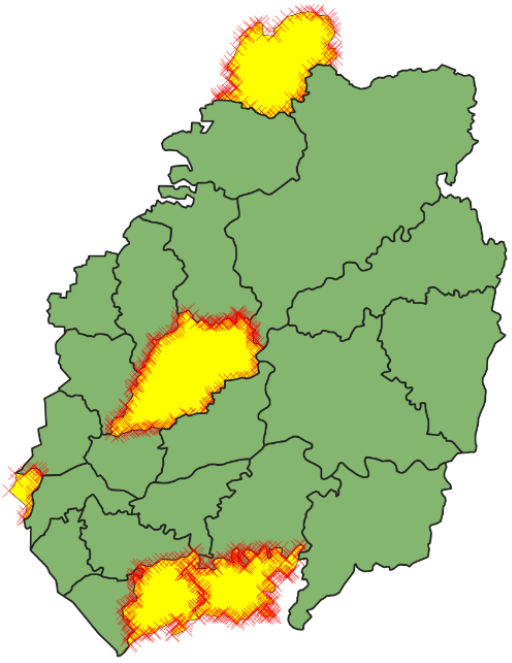


FIGURE 1

Figure 1 shows the map of Sta. Maria and its associated barangays. The green-filled barangays maintain their own Material Recovery Facility (MRF) while the yellow-filled ones indicate that the barangays rent land for waste management. The nearest landfill is in Norzagaray, Bulacan which is not covered in the municipality, but is located in the north eastern part of the next municipality. With the use of GIS, the MRF were clustered among the most feasible and practical locations considering optimal distances and volume of waste to be collected. Resolutions show that the optimal solutions may include more than clustering due to land size. Consideration must be given to land accessibility, number of households and the presence of industrial areas that may necessitate their own or additional MRF's, and whether a particular barangay practices Reuse, Reduce and Recycle (3R's). Le et. al (2018) highlights the role of stakeholders involvement in the endeavor.

REFERENCES:

Zhou, A., Wu, S., Chu, Z. and Huang, W. (2019). Regional Differences in Municipal Solid Waste Collection Quantities in China. Sustainability 11 (15), 4113; https://doi.org/10.3390/su11154113

Le, P., Nguyen, T. and Zhu, D. (2018). Understanding the Stakeholders' Involvement in Utilizing Municipal Solid Waste in Agriculture through Composting: A Case Study of Hanoi, Vietnam, Sustainability, 10 (7), 2314; https://doi:10.3390/su10072314

Safavian, S., Fatae, I., Ebadi, T and Mohamadian, A. (2015). Site Selection of Sarein's Municipal Solid Waste Landfill using the GIS Technique and SAW Method. International Journal of Environemntal Science and Development, 6 (12), 934-937

Separation of Lithium and Cobalt by Synthetic Zeolite-A and Potassium Periodate for recycling Lithium-ion Batteries

Daisuke AKAZAWA, Eden Gan MARIQUIT, Winarto KURNIAWAN, Hirofumi HINODE

Tokyo Institute of Technology, 2-12-1, Ookayama, Meguro-ku, Tokyo, Japan
Tel. +(81) 03-3726-1111 Local 3245
E-mail: akazawa.d.aa@m.titech.ac.jp

ABSTRACT: Cobalt and lithium are very important and valuable materials and that are contained in cathodes of lithium-ion batteries. To recover both lithium and cobalt from spent lithium-ion batteries, feasible methods to separate lithium and cobalt are required. As an alternative method to the use of organophosphorus solvents for recovering lithium and cobalt, this study verifies the selectivity of ion-exchange and precipitation methods. Synthetic zeolite-A and cation exchanged zeolite-A were tested to separate lithium and cobalt from mixture solution by ion-exchange. The selectivity was calculated by the exchange ratio. On the other hand, separation by precipitation was also studied using potassium hydroxide to precipitate cobalt and potassium periodate to precipitate lithium. The recovery ratio and purity were calculated by analyzing the precipitation. The selectivity, recovery ratio and purity of the precipitates were discussed further in the study.

Keywords: *Lithium-ion battery, Cobalt, Lithium, Recovery, Zeolite-A, Chemical precipitation*

Utilization of Clam Shells (Venerupis Philippinarum) as an Air Filter for Tricycles in Antipolo City, Rizal

Dolores S.D. Cleofas[1], Shane Hilary Abado[2], Schnn Ymyllana Adato[2], Chally Rose Arceo[2], Niyell Rupert Eding[2], Christian Joriz Sotta[2]

University of Santo Tomas, España Boulevard, Sampaloc, Manila, Philippines
Tel. +(632) 406-1611 Local 8516
E-mail: dscleofas@ust.edu.ph

ABSTRACT: Tricycles serve as the main mode of public transportation for Antipolo City. Carbon monoxide and hydrocarbon are the two most emitted pollutants by motorcycles compared to other air pollutants. These may cause health problems, hindrance to motor functions, and raise more environmental problems. The researchers studied the capability of clam shells, scientifically known as Venerupis Philippinarum, to adsorb the carbon monoxide and hydrocarbon. Clam shells were cleaned, dried at ambient temperature (about 25°C), and pulverized to size smaller than 4.75mm but larger than 2.38mm. An 8in. long, steel cylindrical tube from 8 gauge galvanized iron sheet was designed to contain the clam shell filter media and attach to the tailpipe of a typical tricycle. Two tricycles were tested first for their baseline emissions. Afterwards, the tricycles were made to travel their regular route carrying a similar load of 25kg. The amount of air pollutant without and with the filter were compared by using an exhaust gas analyzer. The adsorbed carbon monoxide by the clam shells air filter in percentage for Tricycle A were 61.11% in Trial 1, 50.01% in Trial 2 and 33.35% in trial 3. As for Tricycle B, the results showed adsorption percentage of 80.67%, 39.34% and 26.01%, respectively. The adsorbed hydrocarbon in percentage for Tricycle A, the clam shells immediately adsorbed 52.06% of the initial amount of hydrocarbon in the first trial. During the second and the third trials, no hydrocarbon was adsorbed which then led to higher emissions. While for Tricycle B, the hydrocarbon content adsorbed by the clam shell air filter were 81.01% in trial 1, 81.96% in trial 2 and 48.11% in the last trial. For the estimated time length that the clam shells can be capable of adsorbing hydrocarbon, the projected time on Tricycle A and Tricycle B are 43 minutes and 188 minutes. The average longevity of the clam shells' hydrocarbon adsorption capability is 116 minutes or 1 hour and 56 minutes of exposure to emission.

Figure 1 Clam Shell Preparation

Figure 2 Clam Shell Air Filter Tube

REFERENCES:

Environmental Management Bureau. (2015). Air Quality. Retrieved November 14, 2018, from https://emb.gov.ph/wp-content/uploads/2015/09/1-Air-Quality-1.8-National-Air-Quality-Status-Report-2008-2015.pdf.

Shaw, E. (n.d.). Calcium Carbonate and Seashells. Retrieved November 16, 2018, from https://www.livestrong.com/article/532928-calcium-carbonate-and-seashells/

Hain, P. O. (1978). Automotive Exhaust System Using Filter Containing Calcium Carbonate Coating. Retrieved November 9, 2018, from https://patents.google.com/patent/US4093422A/en.

Faiz, A., Walsh, M. P., & Weaver, C. S. (1996). Air Pollution From Motor Vehicles: Standards and Technologies for Controlling Emissions. Washington, D.C.: The World Bank.

Pet Bottles as Geocells Applied as Soil Stabilizer in Dirt Roads

Rajiv Eldon E. Abdullah[2], Peter S. Lim[2], Alecsa Nicole C. Branbante[1], Kyle Joshua Caralde[1], Nuary Deniece Coloma[1]

University of Santo Tomas, España Boulevard, Sampaloc, Manila, Philippines
Tel. +(632) 406-1611 Local 8516
E-mail: pslim@ust.edu.ph

ABSTRACT: A huge fraction of the roads in the Philippines are still unpaved causing inconveniences to people as these roads are usually easily damaged. Geocells are helpful in reducing permanent soil deformation and increasing soil stiffness by providing soil confinement. The purpose of this study is to determine the possibility of using PET bottles as an economical geocellular confining system as a soil stabilizer for the dirt roads in the Philippines. The PET geocell mattresses included PET bottles of two different volume variation of the same brand, cut in the label section, and were joined together by cable ties. The testing of the geocells were done on 1 m x 1 m test pits. The test pits were first excavated, then the geocell mattresses were laid, filled with the infill, and then compacted. Plate Load Testing were done on each of the set-up to determine the soil settlement and the change in stiffness. The test results showed that the set-ups reinforced with PET geocell mattresses showed lesser value of soil settlement and higher change in stiffness proving that there was soil stabilization. These results confirmed that PET geocell mattresses, made from inexpensive materials, are an effective economical geocellular confining system for the specific infill material used in the study.

Table 1 PET bottle Properties

Type	Thickness mm	Width mm	Maximum Load N	Tensile Strength MPa
300mL	0.17	14.99	463	169.5
300mL (soldered)	0.19	13.98	392	147.8
1.5L	0.22	15.64	583	181.7
1.5L (soldered)	0.23	13.96	517	160.9
Cable tie 1	1.02	2.55	85	32.7
Cable tie 2	1.02	2.42	88	35.6

Figure 1 Geocell Configuration

REFERENCES:

Bach, G. (2001). System perforated cell confinement. United States. 6296924 B1.

Dey, A. and Debnath, P. (2016) Static and dynamic behaviors of geocell reinforced soft clay. Soil mechanics and Geotechnical Engineering. 2248-2253 Print.

Dhane, G., Kumar, D., et al. (2015) Geocell: An Emerging Technique of Soil Reinforcement in Civil Engineering Field, 59-63 Print.

Hedge, A., Sitharam, T.G. (2015) Experimental and Analytical Studies on Soft Clay Beds Reinforced with Bamboo Cells and Geocells. Geosynthetic and Ground engineering 2015, 1 (13)

Sahu, R., Banerjee G. (2014). Undrained Pore Pressure Prediction in Clayey Soil under Cyclic Loading. 2014 International Journal of Geomechanics, 15(5).

Electric Arc Furnace Dust as Partial Replacement for Cement in the Construction of Interlocking Plastic Concrete Hollow Blocks

Rocel Pioquinto[2], Jose Jesus Fajardo[2], Michellene Joy Camcam[1], Jugielyn Gracia[1], Syo Kimizuka[1], Eric John Mendoza[1], Francis Oliver Santos[1]

University of Santo Tomas, España Boulevard, Sampaloc, Manila, Philippines
Tel. +(632) 406-1611 Local 8516
E-mail: jpfajardo@ust.edu.ph

ABSTRACT: With the increase of production of various construction materials, there comes an increase in the production of its waste. Therefore, finding new ways and replacement for these materials makes good environmental sense. In this research, we presented a study on the effects of Electric Arc Furnace Dust as a partial replacement for cement in the construction of plastic concrete hollow blocks. Electric arc furnace dust, a by-product of steel production has been studied as a possible replacement to Portland Cement. Different design mixes have been made with varying amounts of EAFD to replacement cement was molded as Interlocking CHB specimens. The specimens were then subjected to compressive loading via the Universal Testing Machine in order to determine its compressive strength. As such, partially replacing cement with varying amounts of Electric Arc Furnace Dust (EAFD) is expected to increase the compressive strength of Interlocking Plastic Concrete Hollow Blocks, compared to those without.

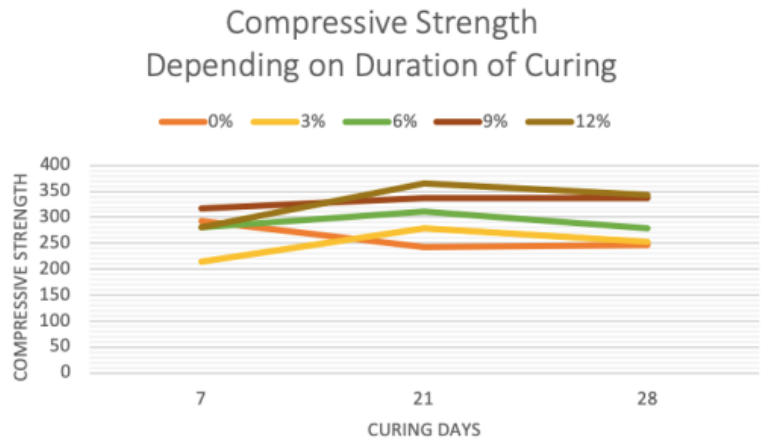


Figure 1 Average Compressive Strength of Specimen vs Curing

Figure 2 Specimen Before and After Testing

REFERENCES:

Al-Zaid, R. Z., Al-Sugair, F. H., & Al-Negheimish, A. I. (1997). Investigation of potential uses of electric-arc furnace dust (EAFD) in concrete. Cement and Concrete Research, 27(2), 267-278. doi:10.1016/s0008-8846(96)00204-9

Iffat, S. (2015). Relation Between Density and Compressive Strength of Hardened Concrete. Concrete Research Letters,6(4), 182-189.

Galang, V. P. (2018, November 6). How to solve the waste plastic problem one 'ecobrick' at a time. Business World. Retrieved from https://www.bworldonline.com/how-to-solve-the-waste-plastic-problem-one-ecobrick-at-a-time/

Effects of Fly Ash and Rice Husk Ash as Partial Replacement of Cement for Binding a Soil-Cement Mixture

Rocel Pioquinto[2], Ryan A. Ramirez[2], Kevin Gomez[1], Bren Rudolf Nieto[1], Edriann Lingad[1], Alfred Justin Pabustan[1], Gabriel Pangan[1]

University of Santo Tomas, España Boulevard, Sampaloc, Manila, Philippines
Tel. +(632) 406-1611 Local 8516
E-mail: raramirez@ust.edu.ph

ABSTRACT: Increase in the demand of conventional construction materials and the need for providing a sustainable growth in the construction field has prompted the designers and developers to opt for alternative materials feasible for use in construction. These industrial wastes and agricultural byproducts such as Fly Ash and Rice Husk Ash can replace cement because of their pozzolanic behavior, which otherwise requires large tract of lands for dumping. In this study, compressive strength for pavement quality concrete mixtures for different percentage replacement of cement are reported. It is found that fly ash and rice husk ash can be used as an alternative for cement. This study also shows that 11% cement, 1.5% fly ash, and 0.5% rice husk ash replacement of cement yields the highest value of compressive strength, making it ideal for a soil cement mixture.

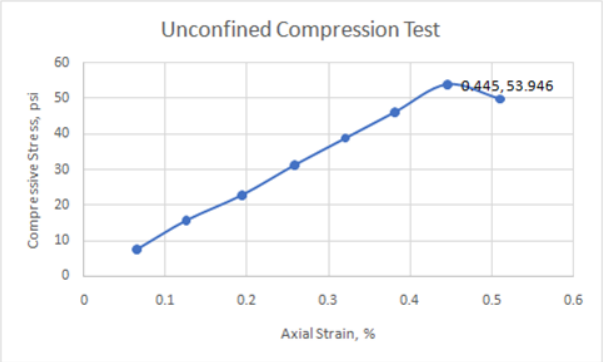


Figure 1 UCT Of Untreated Soil Sample

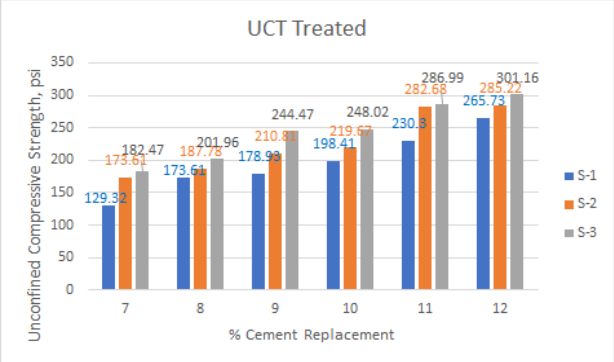


Figure 2 UCT of Treated Soil Sample

REFERENCES:

Wilson, W. H., Jr. (2013). Strength Assessment of Soil Cement. Dependent Incompressible Navier-Stokes equations, part 1, Int. J. Numer. Meth. Fluids, Vol. 4, pp. 557-598, 1984.

Sathawane, S. H., Vairagade, V. S., & Kene, K. S. (2013). Combine Effect of Rice Husk Ash and Fly Ash on Concrete by 30% Cement Replacement. Procedia Engineering, 51, 35-44. doi:10.1016/j.proeng.2013.01.009

Soil-cement construction handbook: Engineering bulletin. (1995). Skokie: PCA.

Soil Cement - Types, Composition, Mix, Applications and Advantages. (2016, November 25). Retrieved from https://theconstructor.org/building/soil-cement-types-mix-composition-applications-advantages/14292/

A Study on the Effects of Waste Construction Safety Nets on the Geotechnical Properties of Clay Soils

Rommel Roxas[2], Ryan A. Ramirez[2], Gabriel Joshua Chua[1], Enrico Paolo Co[1], Josiah Jireh Dela Cruz[1], Julian Andrew Galang[1], Daisy Irish Ocampo[1]

University of Santo Tomas, España Boulevard, Sampaloc, Manila, Philippines
Tel. +(632) 406-1611 Local 8516
E-mail: raramirez@ust.edu.ph

ABSTRACT: In the Philippines, numerous infrastructure projects are expected to take place and the amount of safety nets to be used may contribute to the increase in plastic waste. Thus, the researchers sought to assess waste construction safety nets made of polypropylene as an economic alternative for improvement of the geotechnical properties of clayey soils with swell/expansion potential. The nets were cut into fiber and incorporated into the soil. The fiber produces bond strength and friction in the mixture that improves the shear strength and permeability of fine-grained soil. Design mixtures of 0%, 0.8%, 1.0% and 1.2% were used. The unconfined compressive strength increased from 2.96 kg/cm^2 to 12.441 kg/cm^2 from the inclusion of 1.0% net fiber while the lowest increase in the coefficient of permeability was attained from 1.0% from 2.38 x 10^{-4} cm/sec to 3.23 x 10^{-4} cm/sec, and the California bearing ratio increased from 4 to 11 from the inclusion of 0.8% net fiber.

Table 1 Results of Unconfined Compression Test

Proportions		TM	Peak UCS (qu), kg/cm^2	Peak Average UCS (qu), kg/cm^2	Average Shear Strength (c), kg/cm^2
Soil	Net Fiber				
100%	0.00%	1	5.438	5.951	2.976
		2	6.464		
99.20%	0.80%	1	15.573	15.536	7.885
		2	15.498		
99%	1.00%	1	22.635	24.777	12.441
		2	26.919		
98.80%	1.20%	1	10.473	11.539	6.358
		2	12.604		

Figure 1. Samples Photos of Specimen

REFERENCES:

Hejazi, S. M., Sheikhzadeh, M., Abtahi, S. M., & Zadhoush, A. (2011). A simple review of soil reinforcement by using natural and synthetic fibers. Construction and Building Materials, 30, 100-116. doi:10.1016/j.conbuildmat.2011.11.045

Chen, 1988; Nelson and Miller, 1992; Yong and Ouhadi, 2007. Impact of wetting–drying cycles on swelling behavior of clayey soils modified by silica fume. (2011, April 16). Retrieved from https://www.sciencedirect.com/science/article/pii/S0169131711001244

Ideris, M. S. (2015). Strength of kaolin stabilized with various percentage of Lime and 4% silica fume. Faculty of Civil Engineering & Earth Resources, Universiti Malaysia Pahang.

Adili, A. A., Azzam, R., Schrader, J., & Spagnoli, G. (2012). Strength of soil reinforced with fiber materials (Papyrus). University of Technology, Building and Construction Engineering Department, Baghdad, Iraq and Dept. of Engineering Geology and Hydrogeology, RWTH Aachen University, Germany.

Effects of Copper Slag as Soil Stabilizer on the Geotechnical Properties of Sandy Lean Clay

Rajiv Eldon Abdullah[2], Ryan A. Ramirez[2], Virgil Balmadrid[1], Joe Daryl Cayco[1], Joseph Rafael Cruz[1], Joshua Filip Inciong[1], Ma. Elaine Valencia[1]

University of Santo Tomas, España Boulevard, Sampaloc, Manila, Philippines
Tel. +(632) 406-1611 Local 8516
E-mail: raramirez@ust.edu.ph

ABSTRACT: The view of today's world is an unimaginable turmoil of the exponentially increasing number of waste materials. Waste production is an unavoidable issue worldwide; nonetheless, new innovations and applications are emerging to lessen the magnitude of these waste products. In relation to Civil Engineering, the presence of expansive soil is problematic because of its strength and behavior. To counter act this problem, soil stabilization using solid wastes is done in the field. Copper slag is a waste product of copper smelting. The said waste material was used in this study together with cement. The results from various test in accordance with the ASTM show that copper slag can improve the geotechnical properties of soil specifically; maximum dry density, compressive strength, permeability, and stiffness. T the S32C proportion (60% soil + 32% copper slag + 8% cement) displayed the highest unconfined compressive strength with a value of 1.73 kg/cm^2. A trend of increasing compressive strength was also observed in relation to the content of copper slag and cement. the CBR value of the S40C proportion (60% soil + 40% copper slag + 0% cement) are 8.7 for 95% max dry density, and 10.8 for 100% max dry density. The CBR values of the treated sample per blow has increased compared to the untreated sample. the U100 proportion (100% soil + 0% copper slag + 0% cement) displays the minimum permeability coefficient with a value of 8.103X10-6 cm/s at 20°C. The remark for this soil sample is very low permeability and there is no trend in the hydraulic conductivity of the soil with regards to the addition of copper slag and cement.

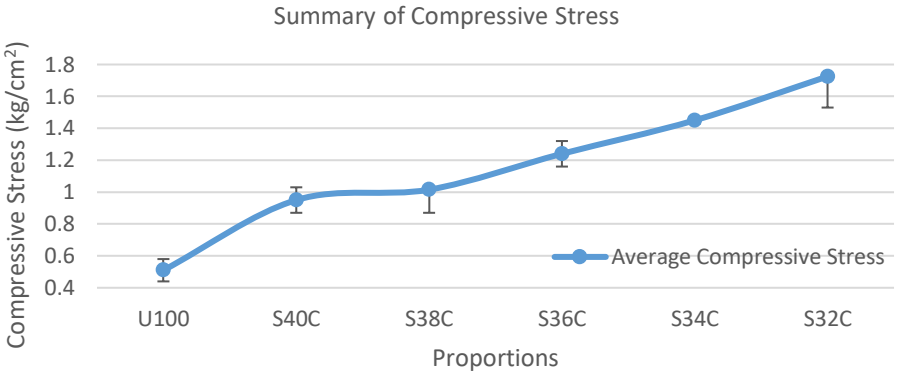


Figure 1 Summary of Compressive Stress (Average)

REFERENCES:

Bell, F. G. (1995). Cement Stabilization and Clay Soils, with Examples Environmental & Engineering Geoscience, I(2), 139-151. doi:10.2113/gseegeosci.i.2.139

Gupta, R. C., Thomas, B. S., Gupta, P., Rajan, L., & Thagriya, D. (2012). "An Experimental Study of Clayey Soil Stabilized by Copper Slag". ". International Journal of Structural and Civil Engineering Research.

Lavanya, C., Sreerama Rao, A., & Darga Kumar, N. (2011). "A Review on Utilization of Copper Slag in Geotechnical Applications". Proceedings of IndianGeotechnical Conference.

Effectiveness of Modified Bioswale Design with Asian Green Mussel (Perna Viridis) on the Reduction of Copper and Lead in Urban Stormwater Runoff

Rommel V. Roxas[1], Joshie May S. Balbuena[2], Jonalind Jane L. Cruz[2], Benedict PM Lualhati[2], Rhoi Vincent Angelo M. Gutierrez[2], Zeedrick Ray M. Veras[2]

University of Santo Tomas, España Boulevard, Sampaloc, Manila, Philippines
Tel. +(632) 406-1611 Local 8516
E-mail: rvroxas@ust.edu.ph

ABSTRACT: Stormwater runoff is a major cause of water pollution in urban areas since it contains trash, bacteria, and heavy metals. The study aimed to reduce the metal contaminants in stormwater runoff, specifically lead and copper, through low impact development bioswales. Two prototypes were used for this study, the standard bioswale design and the modified. Figure 1 illustrates the laboratory setup of the prototypes. Asian green mussel shells were utilized as the transition layer of the modified bioswale design. Synthetic stormwater containing lead and copper was used throughout the experiment. The results of this study showed that the standard and modified bioswale have excellent heavy metal reduction capacities. However, the modified bioswale yielded higher heavy metal removal efficiency in all consecutive trials. This result was attributed to the presence of mussel shells. It was found that there were 73.02% and 72.09% reductions of lead and copper, respectively after the first trial for the modified bioswale prototype. The trends of lead and copper reduction for the two bioswale designs were shown in Figures 2a and 2b. In terms of lead removal, the effluent water quality of both standard and modified bioswale pass the qualification of classes A, B, C, and D as set by the water guidelines of DENR.

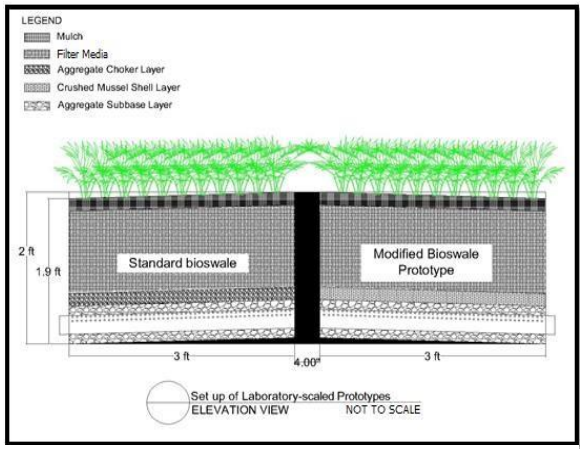


Figure 1 Set-up of Bioswale Design

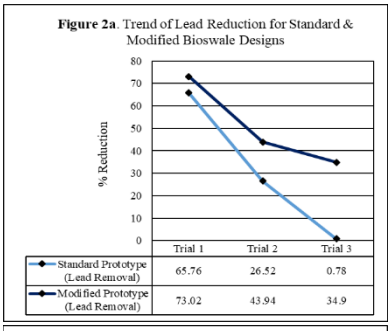


Figure 2a. Trend of Lead Reduction for Standard & Modified Bioswale Designs

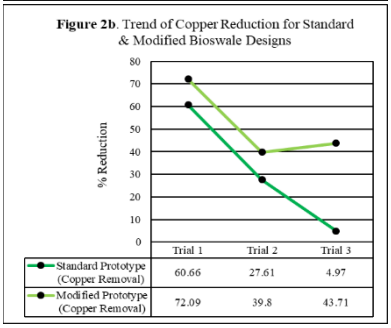


Figure 2b. Trend of Copper Reduction for Standard & Modified Bioswale Designs

REFERENCES:

Aris A. Z., Ismail F. A., Ng, H. Y. and Praveena, S. M. (2012). An experimental and modelling study of selected heavy metals removal from aqueous solution using scylla serrataas biosorbent. Retrieved from:http://www.pertanika.upm.edu

Good, J.F., O'Sullivan, A.D., Cochrane, T.A. (2013). pH Buffering in Stormwater Infiltration Systems—Sustainable Contaminant Removal with Waste Mussel Shells. Retrieved from: https://www.researchgate.net

Muthukrishnan (2006). Treatment of heavy metals in stormwater runoff using wet pond and wetland mesocosms. Retrieved from: https://www.researchgate.net

Evaluation on the Strength, Bulk Density, Drying Shrinkage and Durability of Autoclaved Aerated Concrete with Rubber Powder as a Partial Replacement for Sand

Reyjenson Yambao[1], Patrick Michele Alberto[1], John Olipas[1], Jayvee Tungol[1], Jose Jesus Fajardo[2]

University of Santo Tomas, España Boulevard, Sampaloc, Manila, Philippines
Tel. +(632) 406-1611 Local 8516
E-mail: USTCEB5@gmail.com

ABSTRACT: Autoclaved aerated concrete (AAC) is classified as a lightweight concrete commonly utilized for non-bearing walls. The prominent advantage of AAC concrete is its lightweight property which lessens the cost of the design of supporting structures and the amount of materials needed for wall production. The objective of this study is to produce an autoclaved aerated concrete incorporating rubber powder as a partial replacement for sand for non-bearing walls and evaluate its strength, bulk density, drying shrinkage, and durability. This study found that incorporating rubber powder as a partial replacement for sand will decrease the density, compressive strength and sorptivity of the AAC. Results show that 0.2% aluminum powder content mixture obtained higher dry bulk density than mixtures with 0.4% aluminum powder content. In addition, both set of mixtures resulted in a decrease of dry bulk density as rubber powder content increases. It has also been concluded that all the resulting strength, bulk density, and drying shrinkage have passed in the ASTM C1693 requirements.

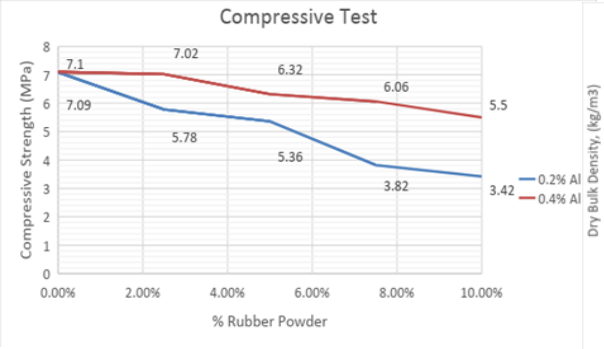


Figure 1 Average Compressive Strength of Mortar Cube Specimens

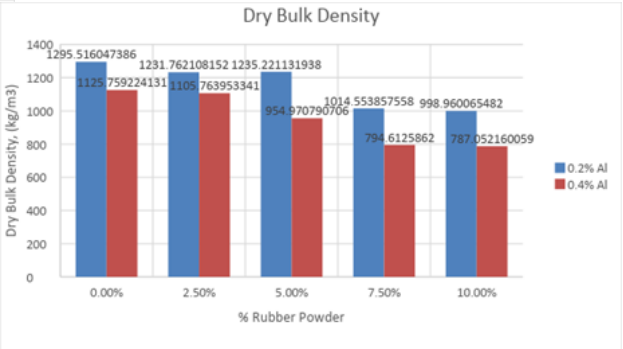


Figure 2 Average Dry Bulk Density of Mortar Prism Specimen

REFERENCES:

Abdulla, Aziz Ibrahim, Ahmed, Salwa Hadi, 2011. Effect of rubber treated by acidic solution on some mechanical properties of rubberize cement mortar. Eng. Technol. J. 29 (13), 2793–2793.

Abdulla, Aziz Ibrahim, Aules, Wisam Amer, Ahmed, Salwa Hadi, 2010. Cement mortar properties contain crumb rubber treated with alkaline materials. Mod. Appl. Sci. 4 (12), 146–163.

Al-Akhras, Nabil, Samadi, Mohammed M., 2004. Properties of tire rubber ash mortar. Cement Concr. Compos. 26, 821–826.

ASTM Standard C33, 2003e1, "Specification for Concrete Aggregates," ASTM International, West Conshohocken, PA, 2009, DOI: 10.1520/C0033-03E01, www.astm.org.

Optimization of Recycled High-Density Polyethylene as Partial Replacement to Bitumen Binder in the Enhancement of Hot-Mixed Asphalt

April Marie Selina Vargas[1], Dominique Aguinaldo[1], Jose Jesus Fajardo[2]

University of Santo Tomas, España Boulevard, Sampaloc, Manila, Philippines
Tel. +(632) 406-1611 Local 8516
E-mail: amsdv11@gmail.com

ABSTRACT: To alleviate the deterioration of roads, there is a need to determine innovative ways to improve the quality of materials and the construction methods. This study determined the optimum amount of recycled high-density polyethylene [HDPE] as a partial replacement to the bitumen binder of hot-mixed asphalt [HMA]. The mechanical properties of the polymer modified bitumen [PMB], namely, consistency and softening point, and of HMA utilizing PMB as binder, namely, air void content, maximum loading capacity, deformation resistance, and rut resistance were evaluated. These properties were determined by conducting tests according to American Society for Testing and Materials [ASTM] Standards. The data obtained were compared to ASTM and Department of Public Works and Highways [DPWH] Standards. This study will determine the optimum recycled HDPE content as a partial replacement to bitumen binder in the enhancement of HMA. In accordance to the recommendation of DPWH-BRS, the asphalt mix was composed of 94.5% aggregates and 5.5% bitumen. The percentage content of recycled HDPE that were tested in the study varied as 10%, 11%, 12%, 13%, and 14% of the total weight of the bitumen. When the recycled HDPE content reached 12% of the total weight of the bitumen, the properties of the asphalt mixture started to degrade. This was due to the excessive recycled HDPE content that acted as an aggregate instead of acting as a binder. Some results exceeded the limits set by ASTM and DPWH Standards, therefore not all values obtained within the percentages tested passed. The objective to find the required optimum recycled HDPE content that produces a bituminous mixture with maximum qualities was met at 12% of the total weight of the bitumen, with all its properties passing all the tests conducted and having values closest to the limits set by ASTM and DPWH Standards. Moreover, there is significant improvement in the mechanical properties of the modified mix compared to the standard mix.

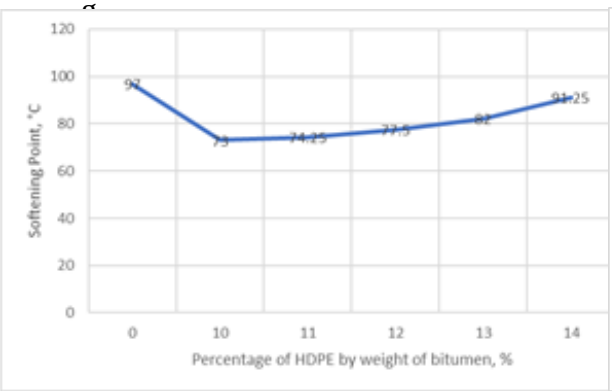


Figure 1 Average Softening Point Values

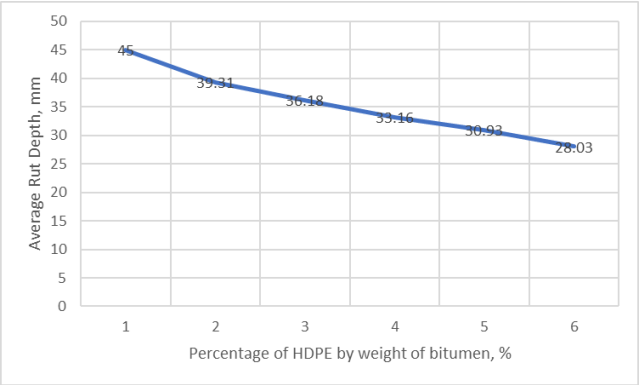


Figure 2 Average Rut Depth Values

REFERENCES:

Pavement Interactive: HMA Mix Design Fundamentals. www.pavementinteractive.org/reference-desk/design/mix-design/hma-mix-design-fundamentals/, 2018.

Pavement Interactive: HMA Performance Tests. www.pavementinteractive.org/reference-desk/testing/asphalt-tests/hma-performance-tests/, 2018.

Performance of Concrete Hollow Blocks with Plastic Waste Aggregates Using Fly Ash and Powdered Green Mussel Shells as Partial Cement Replacement

Bernardo Lejano[1], Renzo Jasper W. Ang[2], and Victor Joseph M. Dagdagan[2]

[1]Professor, De La Salle University, 2401 Taft Avenue, 0922 Manila, Philippines
Tel. +(632) 524-4611 Local 226
E-mail: bernardo.lejano@dlsu .edu.ph

ABSTRACT: Waste materials are added in concrete in an effort to possibly improve concrete properties, lower the cost, and address environmental concerns. There were previous studies that attempted to use plastic as partial substitute for aggregates in concrete hollow blocks (CHB). However, it resulted to a decrease in compressive strength. With fly ash and powdered green mussel shell (known locally as Tahong) being able to improve the compressive strength of concrete mixes and provide lower cost based on previous studies, this paper presents the investigation done to determine whether the same materials would be able to improve the strength of CHB with plastic waste aggregates. The plastic waste aggregates were shredded PET bottles. The study used varying amounts of fly ash and powdered green mussel shell as partial replacement to cement in CHB with and without plastic waste aggregates. The partial replacement of cement was done at 10%, 20%, and 30%. The proportions of fly ash – mussel shell replacement were at 0:100, 25:75, 50:50, 75:25 and 100:0. The decrease in strength due to the addition of plastic waste aggregates was augmented with the addition of fly ash or powdered mussel shells. Fly ash was found to be more effective at 20% cement replacement, while 10% for powdered mussel shells. However, when the two were combined as cement replacement, beneficial effects were seen only at certain select mixes. At combined fly ash and mussel shells, the recommended cement replacement is 20% for CHB with plastic waste aggregates while 10% for CHB without plastic waste aggregate.

Evaluation of the Mechanical Properties and Corrosion Rate of Reinforced Concrete with Gold Mine Tailings as Partial Replacement to Fine Aggregates

Joshua Andrei Macatangay[1], Ken Joshua Chan [1], Tristan Roy Chua [1], Benjamin Daniel Sembrano[1], Cheryl Lyne C. Roxas [2]

De La Salle University, 2401 Taft Avenue, 0922 Manila, Philippines
Tel. +(632) 524-4611 Local 226
E-mail: joshua_macatangay@dlsu.edu.ph

ABSTRACT: Mining has become one of the main sources of economic development in the Philippines for the last decade, with a net income of over Php 12 billion in the first quarter of 2019 alone. As of 2019, the country currently ranks 24th in the world when it comes to gold production and 23rd in terms of gold reserves. Although mining has contributed to the country's economy, the rise in the production of gold, for example, has led to an increase in mining wastes called gold mine tailings from gold ore extraction. Various studies have been conducted to determine ways of alleviating the possible risks of gold mine tailings. Utilizing the high compressive strength and lightweight structure of gold mine tailings, potential incorporation of these mining wastes as a partial substitute to fine aggregates could potentially increase the mechanical properties of concrete and positively impact its production. As such, the study aims to evaluate the mechanical properties and corrosion rate of concrete with gold mine tailings at 0%, 5%, 10%, 15%, 20%, and 25% partial substitution to fine aggregates. The results of this study show that the optimal percentages of fine aggregate substitution with gold mine tailings to attain the highest compressive and flexural strengths are 5% and 0% respectively. In addition. it was also determined that as the amount of gold mine tailings in the mix is increased, the probability of corrosion and rate of corrosion decreased based on corrosion current density obtained at the 7th and 21st day.

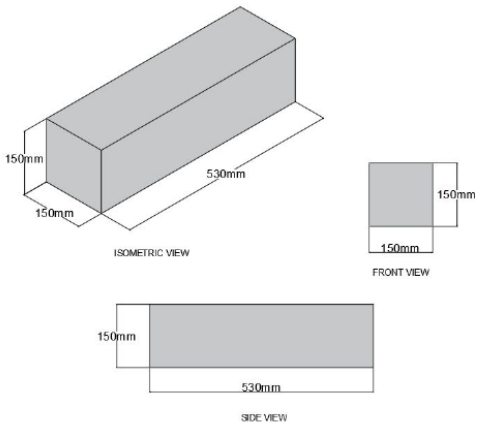


FIGURE 1. Concrete Beam Test Specimen Design

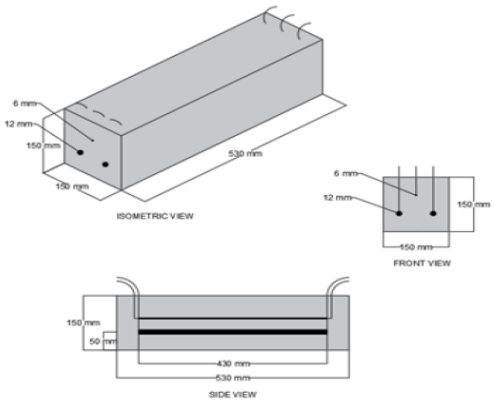


FIGURE 2. Reinforced Concrete Test Specimen Design

REFERENCES:

Adajar, M.A. (2012). Geotechnical Characterization of Gold Mine Tailings and Wastes from Aggregate Quarry in
the Philippines. Retrieved August 1, 2018, from https://www.researchgate.net/publication/301790255_geotechnical_characterization_of_gold_mine_tailings_and_wastes_from_aggregate_quarry_in_the_philippines

Adajar, M. A., & Zarco, M. A. (2013, April 11). Compressibility and Hydrocompression of Mine Tailings. The Philippine Engineering Journal, 34(1), 11-30.

Ramalinga Reddy, B., Satyanarayanan, K., Jagannatha Reddy, H., & Parthasarathi, N. (2016). Use of Gold Mine Tailings in Production of Concrete - A Feasibility Study. International Journal of Earth Sciences and Engineering, 09(3). Retrieved August 3, 2018, from http://icee.cafetinnova.org/sites/default/files/#SPL02090332.pdf

DENR - Mines and Geosciences Bureau. (2019). Philippine Metallic Mineral Production. Retrieved fromhttp://mgb.gov.ph/attachments/article/162/Q1%202019%20Metallic%20Mineral%20Production.pdf?fbclid=IwAR2orP1oQLV96EyLTFDq9r9ohMGC-Zx4t39UYulANcDqeG5oMq1dyuyDDhA

Gold Hub. (2019, April 4). Gold Mine Production. Retrieved from https://www.gold.org/goldhub/data/historical-mine-production?fbclid=IwAR0Nhouz30jf2jE0fRKPaN0M4AS9iQLZiXKEmZB3HBOo6D945fNoCr70wfw

Trading Economics. (2019). Gold Reserves. Retrieved from https://tradingeconomics.com/country-list/goldreserves?
fbclid=IwAR2d91rmvOH7oAOPPoSl1JE_kzM-c3MS55F87v7l0u46c4CvXIT9mCVcihg

NOTES:

NOTES: