The 2025 Bilateral Symposium on the Advanced Material for Eco-friendly and Sustainable Society

- **Presentation title:** MOFs-driven carbon neutral society: Heterogeneous catalysis and power generation
- **Invited Speaker's name and affiliation:** Prof. Kevin C.-W. Wu Department of Chemical Engineering, National Taiwan University
- **City/ Country:** Taipei / Taiwan
- **Emil:** kevinwu@ntu.edu.tw

Brief biography of the invited speaker:

Dr. Wu's research interests are the structural design and tailoring of functional nanoporous materials for sustainable chemistry & engineering applications including biomass and plastic conversion, biomedicine and energy devices. He has received several awards recently, including the Humboldt Researcher in 2018, the ACS Sustainable Chemistry & Engineering Lectureship Award (Asia/Pacific region) in 2019, and the Outstanding Researcher Award (from Asia/Pacific Associations of Catalysis Societies) in 2019, and the Outstanding Research Award from Ministry of Science and Technology (MOST), Taiwan in 2018 and 2020, and the Clarivate Highly Cited Researcher (cross-field) in 2021, 2022, 2023, and 2024, indicating his outstanding work in materials chemistry, catalysis chemistry and physical chemistry.

Abstract:

Scientific innovation in various fields is surely necessary to achieve carbon neutrality by 2050. To reduce carbon dioxide (CO_2), seven approaches including de-fossil resources and switch to renewable energy, etc. have been proposed. Meanwhile, nanoporous metal-organic frameworks (MOFs) have been well known and have shown great potential in catalysis and energy applications. In this talk, I will focus on MOFs-driven carbon neutral society by introducing MOFs in para-xylene production and osmotic power generation. (1) For heterogeneous catalysis (*Angewandte Chemie International Edition.* 2021, 60, 624-629), we synthesize a heterogeneous Bi-BTC catalyst for the conversion of bio-based 2,5-dimethylfuran and acrylic acid to para-xylene with a promising yield (92%), under relatively mild conditions (160 °C, 10 bar) with low reaction energy barrier (47.3 kJ/mol). (2) For osmotic power generation *(Science Advances.* 2021, 7, eabe9924.), we fabricated a NH2-UiO-66 MOF membrane on the surface of a porous anodic alumina substrate, which shows a high ion selectivity ($Br^-/NO3^-$) and enhanced power generation. The mechanism will be discussed in the conference.

- **Presentation title:** The improvement of basic properties of calcined oyster shells as catalyst for biodiesel production
- **Invited Speaker's name and affiliation:**
  Assoc. Prof. Cholada Komintarachat, Kasetsart University
- **City/ Country:** Chonburi / Thailand
- **Email:** cholada.k@ku.th

Brief biography of the invited speaker:

Dr. Cholada Komintarachat, an Associate Professor of Industrial Chemistry in the Faculty of Science at Siracha, Kasetsart University, received her Ph.D. in Petrochemistry from Chulalongkorn University. Her research work is synthesizing catalysts from waste materials. She applies her expertise to develop low-cost catalysts from waste materials, enhancing their efficiency for biodiesel production. By utilizing research surface methodology and experimental design techniques, she optimizes catalyst performance to minimize expenses, save time, and support more sustainable biodiesel production processes.

Abstract:

Basic properties of calcium oxide (CaO) catalyst from oyster shell calcinated by wet impregnation with potassium hydroxide (KOH) with different mass ratios of CaO/KOH (1:1-1:4) have been enhanced for catalyzing transesterification reactions of waste cooking oil (WCO) and ethanol (EtOH) to produce biodiesel. The characterization of chemical and physical properties of the catalyst using Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD) and Scanning Electron Microscopy (SEM) discloses that the CaO surface porosity which was impregnated by hydroxide ions (OH-) and potassium ions (K+) increased active sites. These absorbency characteristics enhance the basic properties and accelerate the reaction rate of biodiesel synthetization. The optimization of the catalyst amount, EtOH:WCO molar ratio, and reaction time for biodiesel production was carried out using the Box-Behnken Design (BBD) and Response Surface Methodology (RSM). The regression equation obtained for the BBD model has a coefficient of determination (R^2) of 0.9993. The result showed that 4.0 wt.% of CaO/KOH (1:2), a 15:1 EtOH to WCO molar ratio, and 180 minutes at a reaction temperature of 60°C achieved a maximum biodiesel yield of 95.58%. The fuel properties of the biodiesel produced in this research study are within the standard coverage of the Department of Energy Business of Thailand.

Keywords: Oyster shell, Impregnated catalyst, biodiesel, design of experimentReferences:

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- **Presentation title:** Dyeing cotton with reactive dyes in non-aqueous dyeing medium
- **Invited Speaker's name and affiliation:** Prof. Chi-Wai Kan
  School of Fashion and Textiles, The Hong Kong Polytechnic University
- **City/ Country:** Hong Kong
- **Email:** tccwk@polyu.edu.hk

Brief biography of the invited speaker:

Dr. Chi-wai Kan is now Professor in the School of Fashion and Textiles, The Hong Kong Polytechnic University. Dr. Kan graduated from The Hong Kong Polytechnic University with a BSc and PhD in Textile Chemistry. He had worked in private and public sectors in the area of textile evaluation and safety and health management for more than five years before joining the School. His main duties in the School are in the area of teaching coloration and finishing.

Dr. Kan's research interests are also in the area of (i) Textile coloration and finishing, (ii) Surface treatment of textile materials, (iii) Textile products evaluation, (iv) Textile testing instrumentation, (v) Safety and health management and (vi) Environmental management.

Dr. Kan holds the professional qualification of Chartered Chemist, Chartered Colourist and Chartered Textile Technologist, Chartered Chemist; also Fellowship of the Royal Society of Chemistry, Society of Dyers and Colourists and The Textile Institute, U.K. In addition, Dr. Kan is a the Chairperson of the Hong Kong Institution of Textile and Apparel (HKITA) and Fellow of HKITA. Recently, Dr. Kan published more than 300 SCI journal papers and 350 conference papers in his research area. Since 2020, Dr. KAN is ranked in World's Top 2% Most-cited Scientists 2024 lists compiled by Stanford University. Dr. KAN is included in both career-long citation impact and single-year citation impact.

Textile dyeing is one of the most important processes in the textile industry to produce a value-added aesthetic appeal of textile products for human consumption. The conventional textile dyeing process, however, poses an undesirable threat to the environment, in which it consumes a million tons of water while it generates substantial effluent discharges containing residual dyes, chemicals, salts and alkalis with high pH, BOD and COD values.

To address the environmental concerns from the public, different sustainable and novel dyeing approaches for cotton fabric have been found in the literature. Apart from those methods, the use of surfactant as a building block for reverse micelle formation as a reactive dye carrier in non-aqueous solvent medium is also one of the promising ways to achieve a salt-free and water-saving approach for dyeing of cotton fabric. Surfactant, also known as surface active agent, is an amphiphilic molecule comprising two distinct structural moieties in which one is polar (hydrophilic) while another is nonpolar (hydrophobic). Owing to its amphiphilic property, it may either be incorporated as micelle in an aqueous phase or self-assembled as reverse micelles in nonpolar oil phase once when the surfactant concentration is above the critical micelle concentration (CMC).

Reverse micelles are nano-spherical aggregates self-assembled by surfactants in non-aqueous medium with the ability to solubilise a small amount of water, forming a water pool in their interior region. In our previous works, non-ionic polyethylene glycol (PEG)-based and alkyl polyglucoside (APG)-based surfactants and rhamnolipid biosurfactant were used for reverse micellar dyeing of cotton fabric in a different non-aqueous solvent medium. Compared with poly (ethylene glycol) (12) tridecyl ether (PEG-12), which is a mixture of C_{11} to C_{14} iso-alkyl ethers, Tegretol type 15-S-12 (T15S12) is a secondary alcohol ethoxylate (SAE) with distinctive branched hydrophobic tails, and it is readily biodegradable and specially created to meet the "designed to degrade" principle. To the best of our knowledge, using T15S12 SAE-based biodegradable non-ionic surfactant (HLB value of 14.5) as a dye carrier for reverse micellar dyeing of cotton fabric is unknown and has not yet been explored and found in the literature.

In this study, the feasibility of using T15S12 non-ionic surfactant as a building block for reverse micelle formation and as a reactive dye carrier for dyeing of cotton fabric is investigated. Several purposes of this work include: (a) to optimise the parameters for reverse micellar dyeing of cotton fabric; (b) to compare the colour properties of the SAE-dyed fabrics with water-dyed fabrics in terms of colour yield, levelness, reflectance and CIE L*a*b* values; (c) to examine the surface damage of the SAE-dyed fabric; (d) to observe the morphology of dye-encapsulated reverse micelle formed by T15S12 surfactant; and (e) to assess the colourfastness properties of SAE-dyed fabrics.

Keywords: Cotton, Reactive Dye, Non-aqueous, Reverse Micelle

The 2025 Bilateral Symposium on the Advanced Material for Eco-friendly and Sustainable Society

- **Presentation title:** Tailoring the electrospun nanofibers based-on biopolymers for driving carbon neutral society
- **Invited Speaker's name and affiliation:** Assoc. Prof. Tongsai Jamnongkan Faculty of Science at Sriracha, Kasetsart University
- **City/ Country:** Chonburi / Thailand
- **Email:** Jamnongkan.t@ku.ac.th

Brief biography of the invited speaker:

Dr.Tongsai Jamnongkan currently serve as the associate professor in the Faculty of Science at Sriracha, Kasetsart University, Thailand. His research interests mainly focus on biomaterials, material science and engineering, fiber materials processing, polymeric materials and composites, nanomaterials, biomaterials, nanofabrication, and testing, as well as polymer composites for electrical and biomedical applications.

Abstract:

The idea of generating the high-value practical application and low carbon emission materials from bio-based materials, which are produced from renewable resources, are quite important trend recently due to its positive contributions to the reduced environmental impact. Besides, these materials also can contribute to carbon neutrality by storing and repurposing carbon from carbon dioxide. Nowadays, electrospinning has received a lot of attention in recent years because it is relatively simple to produce continuous fibers from a variety of polymers using this technique. In fact, the diameter of the produced fibers can range from a few nanometers to several micrometers. For biomedical applications, human safety concerns are of paramount importance. Biopolymers, being biocompatible and biodegradable, is especially attractive and has been successfully used in several biomedical applications. Recently, biocomposite materials that combine organic and inorganic components have attracted great interest as they exhibit advantages characteristic to both organic materials, such as good processability, and inorganic materials, such as thermal stability and chemical resistance. Biocomposites have successfully produced nanofibers from biopolymers composited with inorganic materials with high functionality of those materials such as PVA/ZnO, PVA/Ag, PLA/ZnO, and PLA/AgTiO2 for biomedical applications. One such material is ZnO especially in the form of nano-sizes. ZnO not only exhibits superior antimicrobial activity but is also nontoxic to humans and is environmentally friendly [3]. Owing to these reasons, we expect that nanofibers made from biopolymers with added ZnO nanoparticles will possess antibacterial

properties and hence be potentially attractive for applications such as a bandage materials.

Keywords: Biocomposites; Nanofibers; Nanomaterials; Biopolymers

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The 2025 Bilateral Symposium on the Advanced Material for Eco-friendly and Sustainable Society

- **Presentation title:** Sustainable minerals and materials toward carbon neutrality
- **Invited Speaker's name and affiliation:** Prof. Peng Yuan
  Guangdong University of Technology
- **City / Country:** Guangzhou / China
- **Email:** yuanpeng@gdut.edu.cn

Brief biography of the invited speaker:

Dr. Peng Yuan has been serving as a Distinguished Professor under the "Hundred Talents Program" at Guangdong University of Technology since 2022, following his tenure as a research professor at the Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, from 2008 to 2022. He is the Editor-in-Chief of the SCI journal Applied Clay Science and the Series Editor of the Elsevier book series Development in Clay Science. In addition, he serves as the Vice Chairman of the Mineral Materials Branch of the Chinese Ceramic Society and the Deputy Director of the Non-metallic Mineral Resource Efficient Utilization Committee of the Chinese Society for Mineralogy, Petrology, and Geochemistry. Dr. Yuan has dedicated his career to research on the application of mineral resources, their environmental effects, and the development of mineral-based materials. He has led more than 30 scientific projects, including 10 funded by the National Natural Science Foundation of China. His prolific academic contributions include over 180 SCI-indexed papers published in leading journals such as Nature Communications and PNAS, which have obtained over 12,000 SCI citations, earning an h-index of 60.

Abstract:

"Carbon-Neutral Mineralogy" (CNM) is proposed as a new sub-discipline of mineralogy aimed at achieving net-zero greenhouse gas emissions. CNM focuses on studying mineralogical mechanisms of greenhouse gas cycling and developing strategies for carbon reduction, sequestration, and utilization. Key research areas include minerals in Earth's carbon cycle, mineral-based carbon reduction technologies, and functional materials for CCUS. This presentation highlights case studies showcasing the potential of natural minerals as sustainable materials in carbon neutrality applications, emphasizing CNM's role in advancing both carbon reduction technologies and minerals applications.

Keywords: Sustainable Minerals; Carbon Neutrality; Mineral Materials.

- **Presentation title:** Preparation and surface modification of titania nanoparticles
- **Invited Speaker's name and affiliation:** Prof. Makoto Ogawa Vidyasirimedhi Institute of Science and Technology (VISTEC)
- **City/ Country:** Rayong / Thailand
- **Email:** waseda.ogawa@gmail.com

Brief biography of the invited speaker:

Makoto Ogawa was born in Shizuoka, Japan, in 1964. He joined Department of Earth Sciences, Waseda University in 1995 where he became a full Professor in 2004. He was a researcher of PRESTO, Japan Science and Technology Corporation (JST) from 1995 to 2000. In 2015, he moved to Vidyasirimedhi Institute of Science and Technology (VISTEC) as a professor. His research interests include the syntheses and applications of nanomaterials and their host-guest systems from the preparation to the application.

Abstract:

Hybridization of functional particles with other components have been examined for several objectives including catalysts' design. [1,2] For the materials design of titania, the immobilization of titania particles with solid supports such as clays have been reported. [1,2] For some application, coating of titania particle with silica has been examined.[3]. On the other hand, preparation of nanoparticles in nano spaces is a way to obtain well-defined nanoparticles without aggregation/fusion. The preparation of well-defined semiconductor nanoparticles using mesoporous silica as template has been reported. [4-6] The preparation is based on the infiltration of molecular precursor into the pore and the subsequent crystallization in the pore. Anatase nanoparticles with the diameter similar to the pore size of the template (cylindrical mesopore of SBA-15 with the pore diameter of 8 nm) were prepared by the infiltration of titanium alkoxide and the subsequent in-situ crystallization in the mesopore by the calcination.[4] Rutile nanoparticles were obtained by the infiltration of titanium alkoxide and the subsequent in-situ crystallization by the reaction with HCl vapor at room temperature.[5] In addition, porous polymer film was utilized to design anatase nanoparticles.[6].

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Keywords: anatase, rutile, nanoparticle, photocatalyst

The 2025 Bilateral Symposium on the Advanced Material for Eco-friendly and Sustainable Society

- **Presentation title:** Photocatalysts for environmental remediations and producing valuable products.
- **Invited Speaker's name and affiliation:** Dr. Kanlayawat Wangkawong Faculty of Science at Sriracha, Kasetsart University
- **City/ Country:** Chonburi / Thailand
- **Email:** kanlayawat.w@ku.th

Brief biography of the invited speaker:

Dr. Kanlayawat Wangkawong currently works as a lecturer in the Faculty of Science at Sriracha, Kasetsart University, Sriracha campus, Thailand. She graduated her PhD in Chemistry, Faculty of Science, Chiangmai University, Thailand. Her expertise is in the field of photocatalysis that she has currently studied on her research projects about photocatalyst synthesis and characterization in many reactions such as dye degradation, oxidative valuable organic compound synthesis, and in the desulfurization process to remove sulfur compound from the fuel. Also, she has recently joined the project with Prof. Dr. Jih-Mirn Jehng from National Chunh Hsing University, Taiwan to conduct research on CO2 reduction topics. Additionally, various physical/chemical characterizations are used to describe the photocatalytic mechanism involved in her work.

Abstract:

This study explores the development and characterization of hybrid semiconductor photocatalysts utilizing visible light-responsive Bi-based oxides in conjunction with TiO_2, aimed at enhancing photocatalytic performance for environmental remediation and resource recovery based on the successful synthesized ternary phase of n-type $BiVO_4$, p-RGO, and n-BiOBr synthesized via a one-pot hydrothermal method. Improved photocatalyst demonstrated superior photocatalytic efficiency (100%) compared to binary and individual phases, including BiOBr and $BiVO_4$, which exhibited efficiencies of 87%, 25%, and 55%, respectively from the RhB degradation reaction. The formation of heterojunctions is expected to minimize electron-hole pair recombination and improve charge separation, vital for efficient photocatalysis. X-ray photoelectron spectroscopy indicates successful synthesis and charge transfer facilitation through chemical interactions at the heterointerfaces. The photocatalysts will be deployed for applications such as desulfurization of fuel oil, degradation of dyes, antibiotics, and/or CO_2 reduction, with proposed mechanisms and energy band diagrams elucidating the structure-activity relationship. This research aims not only to remediate environmental pollutants but also to

produce valuable chemicals through efficient photocatalytic processes.

Keywords: Hybrid semiconductor, Photocatalyst, Bi-based oxides, TiO_2, Environmental remediation

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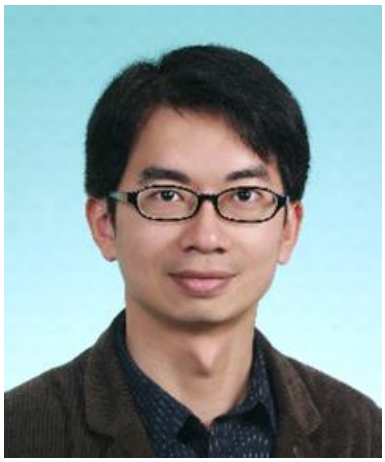

- **Presentation title:** Incorporations of dynamic covalent bonds for the development of sustainable high-performance polymers
- **Invited Speaker's name and affiliation:** Prof. Chih-Feng Huang
  Distinguished Professor (Department of Chemical Engineering.)
  Director, Semiconductor and Green Technology Program (SGTP)
  Section Chief, iCenter for Advanced Science and Technology (iCAST)
  National Chung Hsing University (NCHU), Taichung, Taiwan
- **City/ Country:** Taichung / Taiwan
- **Email:** huangcf@dragon.nchu.edu.tw
- (ORCID: 0000-0002-8062-8708)

Brief biography of the invited speaker:

Dr. Huang received his Ph.D. in 2004 from National Chiao Tung University, Taiwan. From 2007 to 2009, he conducted postdoctoral research at Carnegie Mellon University, USA, under Professor Matyjaszewski. He then worked with Professor Yokozawa of Kanagawa University, Japan, from 2009 to 2010. He is a distinguished professor in the Department of Chemical Engineering at NCHU. Dr. He focuses on controlled/living polymerizations, organic-inorganic nanocomposites, cellulose nanofibers, functional hydrogels, degradable polymers, vitrimers, and stretchable devices for 5G and other advanced applications. He has authored over 145 SCI articles (h-index 45, Google Scholar), with more than 5,900 citations, alongside 6 patents and 3 book chapters. He serves as an Editorial/Advisory Board Member for Polymers and Mater. Today Commun.

Abstract:

In the 1st part, tough double network (DN) hydrogels were prepared with various rhodamine (Rh) mechanophore contents. The obtaining Rh–DN attained strong Rh–DN hydrogels. The spirolactam units within Rh–DNs resulted in linear relationships between the external stresses and intensities traced by UV–Vis spectrometer and CIE coordinate. Taking a photograph from a hand-pressed sample, as an example, the macroscopic color changes can be reversibly digitalized to the hand-pressed stresses via the platform and converted to a mechanograph.

In the 2nd part, introducing a dynamic covalent bond (DCB) network has become an important approach due to the emergence of a circular economy. We combined the advantages of Passerini-type multicomponent polymerization (e.g., one-pot synthesis, high atom economy) with **α**-lipoic acid (LA) to create novel polyamides as potential sustainable vitrimers. The resulting dynamically crosslinked polymer exhibited characteristics of adaptable elastomers, such as re-processability and recyclable adhesion.

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Keywords: Tough double network, Force sensors, Dynamic covalent bond, Vitrimers.

- **Presentation title:** Histopathological changes in alloxan-induced diabetic rats treated with *cissus modeccoides* extract
- **Invited Speaker's name and affiliation:** Dr. Taddaow Khumpook
  Faculty of Science at Sriracha, Kasetsart University
- **City/ Country:** Chonburi / Thailand
- **Email:** taddaow.k@ku.th

Brief biography of the invited speaker:

Dr. Taddaow Khumpook graduated with a Ph.D. in Biology from Chiang Mai University. She is currently a lecturer at the Faculty of Science at Sriracha, Kasetsart University, Sriracha Campus, Thailand. Her research interests primarily focus on natural products, toxicology, animal physiology, histology, and biomaterials. She has worked on numerous projects investigating the medicinal properties of plant extracts, including their anti-inflammatory, antioxidant, and antibacterial activities, as well as exploring their potential applications in the development of biomaterials for medical treatments.

Abstract:

"Khruea Khao Puun" (*Cissus modeccoides* Planc.) is a woody vine used in folk medicine for its antidiabetic properties and is widely used in Lamphun Province, Northern Thailand. Since this plant species also has pesticidal properties, its long-term use in diabetic patients may affect organ systems. This research project was conducted to examine the safety of *C. modeccoides* (CM) in diabetic rats. A hot aqueous extract of CM at concentrations of 0.12, 0.18, and 2.40 mg/ml was orally administered to diabetic rats for 30 days (1 ml/day), compared to normal control rats and diabetic rats that received only distilled water. Histopathological examinations revealed that alloxan-induced diabetic rats treated with CM in all groups exhibited islets of Langerhans in the pancreas that were smaller than those in the normal control group. Furthermore, the epithelial cells of the collecting duct in the kidneys were sloughed off, and histological features of the liver were similar across all groups. Therefore, the CM extract may not be able to restore cells damaged by diabetic induction.

Keywords: Alloxan-induced diabetic rats, *Cissus modeccoides* Planc, Histopathological examination

The 2025 Bilateral Symposium on the Advanced Material for Eco-friendly and Sustainable Society

- **Presentation title:** Sugarcane bagasse ash utilization in geopolymer derived from various aluminosilicate sources
- **Invited Speaker's name and affiliation:** Mr. Thammaros Pantongsuk Guangzhou Institute of Geochemistry, Chinese Academy of Sciences
- **City / Country:** Guangzhou / China
- **Email:** thammaros@gig.ac.cn

Brief biography of the invited speaker:

Thammaros PANTONGSUK is currently a PhD student at Guangzhou Institute of Geochemistry, Chinese Academy of Sciences (CAS), under supervision by Prof. LIU Dong (CAS) and co-supervision by Prof. YUAN Peng (Guangdong University of Technology) from 2023 to present, and recipient of Royal Thai Government's Scholarship studying PhD program under the joint scholarship scheme with the University of Chinese Academy of Sciences (UCAS). His research focuses on geopolymer and solid waste utilization, and he has been working in the geopolymer field since his master's degree from the Department of Materials Engineering, Faculty of Engineering, Kasetsart University. His bachelor's degree was from the Department of Forest Products, Faculty of Forestry, Kasetsart University.

Abstract:

Sugarcane bagasse ash (SCBA) is a residual waste by-product from the sugar industry and is considered a pollutant due to unsustainable disposal methods. Thailand is one of the largest sugar producers, generating approximately 600,000 tons of SCBA in 2023. By incorporating SCBA into construction materials, there is an opportunity to utilize and reduce SCBA waste. Geopolymer, an eco-friendly novel construction material, is an inorganic polymer formed by activating aluminosilicate resources with acidic or alkaline solutions. This study aims to optimize the use of SCBA as a substitute for various aluminosilicate resources, such as clay minerals, clay-containing engineering muck, and iron mine tailings, which are viewed as both natural sources and industrial waste products. Performance evaluation and life cycle assessment will be included to support the promising strategy of upcycling SCBA and enhancing sustainability.

Keywords: Sugarcane bagasse ash; Geopolymer; Sustainability.