Review on Comparing The Characteristics of Sugarcane Bagasse Ash, Copper Slag And Eggshell Powder For Sustainability

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Abstract- *In this research we studied the research papers on utilization of eggshell powder, copper slag, and sugarcane bagasse in concrete mixtures to enhance sustainability and performance. Eggshell powder, a waste byproduct, is examined for its pozzolanic properties, potentially improving concrete strength. Copper slag, an industrial waste, is explored as a partial replacement for conventional aggregates, aiming to enhance durability and reduce environmental impact. Additionally, sugarcane bagasse, an agricultural residue, is investigated for its potential as a supplementary material to enhance the concrete's thermal and insulation properties. After studying this research papers, the feasibility and effectiveness of incorporating eggshell powder, copper slag, and sugarcane bagasse in concrete, providing a sustainable pathway for construction practices. These findings contribute to the growing body of knowledge on eco-friendly construction materials and to create more resilient and environmentally conscious concrete structures.*

Keywords- Eggshell powder, Copper slag, Sugarcane bagasse, Eco-friendly construction materials.

I. INTRODUCTION

This research delves into the utilization of eggshell powder, copper slag, and sugarcane bagasse in concrete mixtures to enhance sustainability and performance. Eggshell powder, a waste byproduct, is examined for its pozzolanic properties, potentially improving concrete strength. Copper slag, an industrial waste, is explored as a partial replacement for conventional aggregates, aiming to enhance durability and reduce environmental impact. Additionally, sugarcane bagasse, an agricultural residue, is investigated for its potential as a supplementary material to enhance the concrete's thermal and insulation properties.

Portland cement is the most common type of cement worldwide and is used in concrete, mortar, plaster and mortar. It was created in England in the 19th century by Joseph Aspidi, who produced clinker in a kiln from limestone and clay minerals. The most common type is ordinary silicate cement (OPC), which is gray in color and named after Portland stone. But Portland cement is corrosive and can cause chemical burns, skin irritation and lung cancer. Environmental concerns include high energy consumption and air pollution from mining, manufacturing and cement transportation, which account for approximately 10% of global carbon dioxide emissions.

Copper slag is now used in many applications, but only 15-20% is used. Additional materials that are not useful for excavation and sandblasting are used. Copper slag can easily replace cement and fine aggregate and is used as an additive in concrete. Maximum compressive, tensile and flexural strength can be achieved when copper slag is changed from fine aggregate to 40%. Copper slag can be used in construction, partially replacing sand and used in the production of building materials. Granulated slag (<3 mm small fraction) has insulation and water flow that helps prevent ground freezing and cracks in winter. orange ash.

Bagasse is a byproduct of the sugar industry and is burned to generate electricity for various industrial enterprises. Sugar production in the world exceeds 1.5 billion tons, 30% of which is bagasse recovery and 10% is sugar recovery. Approximately 8% of bagasse ash is discarded as waste, and its pozzolanic properties make it useful as a cement substitute. Bagasse ash has been found to improve the properties of slurry, mortar and concrete, including compressive strength, waterproofing and fineness. The high silica content in bagasse ash is believed to be the main reason for these improvements.

Eggshell powder is a fine powder made from ground eggs and is a good and beneficial calcium supplement. It can be used as an ingredient in garden fertilizer, pesticides and skin care products. It can also be used as an abrasive for site cleanup and composting. To make flour, wash and dry the eggs, crush them into small pieces, and store in a dry, airtight

container. Talk to a doctor or nutritionist before using egg powder for health.

II. OBJECTIVES

- To investigate the convenience of incorporating sugarcane bagasse ash, copper slag, and eggshell powder in concrete mixes.
- To assess the mechanical properties, durability, and sustainability of quaternary concrete compared to conventional concrete.
- To analyse the effect of quaternary concrete on the environment Read already published work in the same field.

III. LITERATURE REVIEW

Siddique, R. (2018). Materials, 11(7), 1430. "Utilization of Waste Materials and By-Products in Concrete: Towards Sustainable Construction" This review provides a comprehensive overview of various waste materials and by-products used as supplementary cementitious materials in concrete production. It covers materials such as fly ash, ground granulated blast furnace slag, silica fume, rice husk ash, and more. The study discusses their effects on concrete properties, including strength, durability, and workability, and emphasizes the sustainable aspects of their utilization.

Ganesh Babu, (2019). Construction and Building Materials, 223, 416-431. "Review on the Utilization of Industrial By-Products in Concrete." This review focuses on the utilization of industrial byproducts, including fly ash, copper slag, blast furnace slag, and rice husk ash, in concrete production. It discusses the effects of these by-products on concrete properties and provides insights into their potential applications and challenges. The study emphasizes the sustainable and economic advantages of incorporating these materials in concrete.

Giaccio, G. (2017) Sustainability, 9(11), 2017. "Recycled Aggregate Concrete for Structural Use – An Overview of Technologies, Properties, and Sustainability" This review provides a comprehensive overview of the utilization of recycled aggregates in concrete production. It discusses the technical, mechanical, and environmental aspects of using recycled aggregates, including their effects on concrete properties and structural behaviour. The study also addresses the challenges and opportunities associated with the use of recycled aggregates in sustainable construction.

Tavakoli, M. (2019) Journal of Cleaner Production, 234, 167- "Sustainability Assessment of Concrete Incorporating Waste and Supplementary Cementitious Materials: A Review" This review focuses on the sustainability assessment of concrete incorporating waste materials and supplementary cementitious materials. It discusses the environmental, economic, and social aspects of incorporating these materials in concrete production. The study provides insights into the life cycle assessment, carbon footprint, and cost-effectiveness of using waste materials and supplementary cementitious materials.

Mancio, M. (2020) Construction and Building Materials, 242, 118099 "Review on the Use of Recycled Aggregates in Concrete Production." This review provides an overview of the use of recycled aggregates in concrete production. It discusses the mechanical properties, durability, and environmental impact of concrete incorporating recycled aggregates. The study highlights the importance of proper quality control and mix design considerations when utilizing recycled aggregates.

Mohammadi, M. (2014). "Investigation of Mechanical and Durability Properties of Concrete Containing Eggshell Powder as a Sustainable Binder." Construction and Building Materials, 72, 303-312. This study investigates the mechanical and durability properties of concrete incorporating eggshell powder as a sustainable binder. It examines parameters such as compressive strength, flexural strength, water absorption, and chloride ion penetration resistance. The findings suggest that the addition of eggshell powder can enhance the properties and durability of concrete.

Ali, M. (2014). "A Review on Utilization of Copper Slag in Geotechnical Applications." International Journal of Geosciences, 5(9), 1050-1057. This review focuses on the use of copper slag in geotechnical applications. It discusses the effects of copper slag on soil stabilization, pavement design, embankments, and retaining walls. The study highlights the improvement in geotechnical properties achieved by incorporating copper slag and emphasizes its potential in sustainable geotechnical engineering.

Nazeer, A. (2020). "Mechanical and Durability Properties of Concrete Incorporating Eggshell Powder as Partial Replacement of Cement." Construction and Building Materials, 255, 119384. This study investigates the mechanical and durability properties of concrete incorporating eggshell powder as a partial replacement for cement. It examines parameters such as compressive strength, split tensile strength, water absorption, and chloride ion penetration resistance. The findings suggest that the addition of eggshell powder can improve the properties and durability of concrete.

Cordeiro, G. (2012). "Effects of Sugarcane Bagasse Ash on the Properties of Mortar." Construction and Building Materials, 28(1), 466-472. This study investigates the effects of SCBA on the properties of mortar. It examines parameters such as compressive strength, water absorption, porosity, and microstructure. The findings indicate that SCBA can be used as a partial replacement for cement, leading to improved mechanical properties and enhanced durability of mortar.

Rukzon, S., & Chindaprasirt, P. (2013). "Utilization of Sugarcane Bagasse Ash in Foam Concrete." Construction and Building Materials, 43, 229-236. This research focuses on the utilization of SCBA in foam concrete. It investigates the effects of SCBA on the fresh and hardened properties of foam concrete, including compressive strength, water absorption, and microstructure. The study demonstrates the potential of SCBA as a suitable material for improving foam concrete properties.

Suthar, S., (2015). "Effect of Sugarcane Bagasse Ash on Strength and Durability Characteristics of Concrete." Journal of Materials in Civil Engineering, 27(7), 04014157. This study explores the impact of SCBA on the strength and durability characteristics of concrete. It investigates parameters such as compressive strength, split tensile strength, water absorption, and resistance to chloride ion penetration. The research indicates that SCBA can enhance concrete properties and improve durability performance.

SuaIam, G. (2017). "Effect of Sugarcane Bagasse Ash on the Properties of High-Strength Concrete." Construction and Building Materials, 147, 37-44. This study examines the influence of SCBA on the properties of high-strength concrete. It investigates parameters such as compressive strength, splitting tensile strength, and chloride ion penetration resistance. The findings suggest that SCBA can be used as a cement replacement up to a certain level without significantly compromising the concrete performance.

Bentz, D. P., et al. (2017). "Supplementary Cementitious Materials: Changing the Sustainability Paradigm of Concrete." Journal of Materials Science, 52(1), 316-352. This review article discusses the role of supplementary cementitious materials (including SCBA) in enhancing the sustainability of concrete. It provides an overview of the influence of SCBA on concrete properties, including workability, strength, durability, and environmental impact. The review emphasizes the potential benefits of using SCBA as a sustainable alternative in concrete production.

IV. CONCLUSIONS

Sugarcane bagasse ash, copper slag and eggshell powder are more economical. Overall, the study concluded that sugar cane bagasse ash, copper slag and eggshell powder have promise as supplementary cementitious materials to enhance the sustainability of concrete construction.

The findings indicate that SCBA can be used as a partial replacement for cement, leading to improved mechanical properties and enhanced durability of mortar. The findings suggest that the addition of eggshell powder can improve the properties and durability of concrete.

The findings suggest that SCBA can be used as a cement replacement up to a certain level without significantly compromising the concrete performance. the influence of SCBA on concrete properties, including workability, strength, durability, and environmental impact. The review emphasizes the potential benefits of using SCBA as a sustainable alternative in concrete production.

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