National Institute of Technology Rourkela

Registration Seminar

Seminar Title	: Incorporating Jute Biochar in Cement Mortar for Improved Mechanical Properties and Carbon Footprint Reduction
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Venue	: CE Seminar Hall
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Abstract : The environmental burden of cement production, especially its high carbon emissions, has led to the exploration of sustainable cement replacements. This study focuses on the utilization of jute-derived biochar (JBC) as a partial cement substitute in mortar to improve mechanical performance and reduce carbon footprint. Jute fibers were pyrolyzed at 400°C to produce fine biochar, which was then incorporated into cement mortar at varying dosages (0%, 1%, 3%, and 5% by weight of cement). The biochar was characterized by CHNS elemental analysis (carbon content ~69.3%) and FESEM imaging, revealing a porous morphology that supports enhanced matrix bonding.

Two sets of mortar specimens (Series A and B) were tested to validate performance. In Series A, the 3% biochar mix (JBC-A3) achieved the highest compressive strength of 32.28 MPa at 28 days, an increase of ~19.4% compared to the control (27.02 MPa). Similarly, in Series B, the 3% mix (JBC-B2) attained 23.96 MPa at 28 days, slightly higher than the control mix (22.8 MPa). Both data sets show that the optimum compressive strength was consistently observed at 3% biochar replacement, while higher dosages (5%) and lower dosages (1%) resulted in reduced performance. For example, in Series B, the 1% mix dropped to 19.27 MPa, indicating poor early hydration and reduced cement content.

Early-age strength (7 and 14 days) also followed this trend, with JBC-B2 (3%) outperforming the control at all curing ages. Overall, the inclusion of 3% jute biochar offers a balanced improvement in compressive strength, material sustainability, and carbon reduction, making it a viable additive in eco-efficient mortar production.

Keywords: Jute biochar, cement mortar, compressive strength, pyrolysis, sustainable construction, CHNS analysis, FESEM, low-carbon building materials