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GREEN RETROFITTING OF REINFORCED CONCRETE BEAMS EMPLOYING SUSTAINABLE NATURAL SISAL FIBRE COMPOSITES AS ALTERNATIVE TO ARTIFICIAL FIBRE COMPOSITES FOR ENHANCED SHEAR STRENGTH

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Abstract

Sustainability and renewability in constructional materials and also utilization of such materials for various engineering purpose is the need of the hour. Green retrofitting with the aid of green FRP (fibre reinforced polymer) materials, made up of natural bio fibres like sisal would contribute to sustainable development. Non fossil-fuel carbon precursor organic fibres, i.e. sisal FRP composites were used for retrofitting of reinforced concrete (RC) beams, designed to undergo shear failure. Study in this field aimed at understanding the effect of natural sisal FRP retrofitting scheme over carbon FRP and glass FRP retrofitting schemes. Two wrapping configurations i.e. full wrapping and strip wrapping technique both in U-shaped wrap configurations, were used here for evaluating the shear strengthening effect. The effectiveness of the retrofitting scheme using natural sisal FRP was compared to that of carbon FRP and glass FRP in terms of ultimate shear strengths, load-deflection behavioural curves and obtained failure modes of the tested reinforced concrete beams. Failure mode study of retrofitted RC beams displayed promising performance by sisal FRP similar to that of carbon FRP and glass FRP. Also sisal FRP promoted ductile failure of beams with sufficient warnings and huge deflections unlike carbon FRP, which underwent sudden FRP rupture and Glass FRP, which underwent sudden debonding. Test results of this research indicate that lower embodied energy, renewable, sustainable, environment friendly and green materials like natural sisal fibre FRP, can be effectively utilized for reinforced concrete strengthening in contrast to other artificial FRP products such as carbon FRP or glass FRP.

Key words: FRP, retrofitting, shear strength, strengthening, sustainability

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