The Planter, Kuala Lumpur, 102 (1207)

Valorisation of Oil Palm and Rice Biomass Waste for Sustainable Construction Materials in Malaysia: A Plantation-Based Review

CHEAH CHAN FATT

Malaysia's oil palm and rice industries produce large quantities of agricultural biomass residues, much of which remains underutilised and poses environmental and disposal challenges at plantation and milling levels. In response, increasing attention has been directed towards the conversion of these residues into value-added products within a circular economy framework. This paper presents a structured review of the utilisation of selected agricultural wastes as sustainable construction materials in Malaysia, with particular relevance to plantation systems. The review focuses on palm oil fuel ash (POFA), rice husk ash (RHA), oil palm biochar, and fibre-based residues, drawing on 55 studies published between 2020 and 2025. The results show that POFA and RHA are effective as partial cement substitutes, typically at levels of 10-20 per cent and 10-15 per cent, respectively, leading to greater long-term strength, lower permeability, and improved durability. Biochar incorporation at lower levels (2%-5%) provides additional environmental benefits, including carbon emission reduction. From a plantation perspective, the utilisation of biomass residues reduces waste disposal, minimises open burning, and creates opportunities for additional value generation. However, wider adoption is constrained by variability in material quality, processing requirements, and the lack of standardised regulatory frameworks. Overall, the integration of biomass waste utilisation into plantation-linked systems represents a practical pathway to improve resource efficiency and support sustainable construction development in Malaysia.

Keywords: Oil palm biomass, rice husk ash, plantation waste utilisation, sustainable construction materials, circular economy, Malaysia