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Application of Biomass-Derived Binders in Sand Casting for Sustainable Foundry Practices

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Abstract: *There is a huge requirement for environmentally compatible alternatives due to the increased environmental problem associated with synthetic resin binders in sand casting, for example, their poor recyclability and toxic gas emission. This research investigates the use of binders produced using biomass for green foundry practice. Once incorporated into silica sand molds, renewable ingredients like starch, molasses, lignin, and dextrin were systematically compared to conventional resin-bonded sand. Casting trials with non-ferrous alloys were performed following assessment of critical mold properties like green strength, dry strength, permeability, and collapsibility. Surface polish, accuracy of dimensions, and defect development were studied in the castings so formed, and the environmental cost was quantified through gas evolution tests. Based on initial findings, optimised biomass binder formulations are able to provide the same casting quality as traditional binders but, in addition, provide adequate mould strength, improved collapsibility, and a substantial reduction in toxic emissions. Based on the research, biomass-based binders present modern-day foundries with an economical and green solution that encourages the transition to green manufacturing and circular economy standards.*

Keywords: Sand Casting, Biomass Binder, Sustainable Foundry, Eco-Friendly Binders, Green Manufacturing

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