

The Impact of Liquid Glass-Infused Lignin Waste Particles on Performance of Polyurethane Foam for Building Industry

Authors : Agnė Kairyte, Saulius Vaitkus

Abstract : The gradual depletion of fossil feedstock and growing environmental concerns attracted extensive attention to natural resources due to their low cost, high abundance, renewability, sustainability, and biodegradability. Lignin is a significant by-product of the pulp and paper industry, having unique functional groups. Recently it became interesting for the manufacturing of high value-added products such as polyurethane and polyisocyanurate foams. This study focuses on the development of high-performance polyurethane foams with various amounts of lignin as a filler. It is determined that the incorporation of lignin as a filler material results in brittle and hard products due to the low molecular mobility of isocyanates and the inherent stiffness of lignin. Therefore, the current study analyses new techniques and possibilities of liquid glass infusion onto the surface of lignin particles to reduce the negative aspects and improve the performance characteristics of the modified foams. The foams modified with sole lignin and liquid glass-infused lignin had an apparent density ranging from 35 kg/m³ to 45 kg/m³ and closed-cell content (80-90%). The incorporation of sole lignin reduced the compressive and tensile strengths and increased dimensional stability and water absorption, while the contrary results were observed for polyurethane foams with liquid glass-infused lignin particles. The effect on rheological parameters of lignin and liquid glass infused lignin modified polyurethane premixes and morphology of polyurethane foam products were monitored to optimize the conditions and reveal the significant influence of the interaction between particles and polymer matrix.

Keywords : filler, lignin waste, liquid glass, polymer matrix, polyurethane foam, sustainability

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