Reinforced Lignin Foams with Higher Adsorption Capabilities

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In last year's study, open-cell lignin foams were prepared from Kraft lignin through a simple baking process. Lignin foams demonstrated good biosorbent capabilities for removing heavy metals and spilled oil from water. However, the foams need to be reinforced in strength since raw lignin foams are brittle and exhibit poor mechanical properties, and the adsorption capability needs to be further improved. To prepare lignin foams with reinforced mechanical strength and improved adsorption capabilities, two hypotheses were made in this project: the first hypothesis was that lignin foam strength can be improved by adding plastic polymers from recycled plastics, and the second hypothesis was that the adsorption capacity of the foam can be improved by adding wood waste-derived activated carbon (AC) which has a higher surface area and adsorption capacity to heavy metals, spilled oil and other pollutants. The mechanical performance of the foam reinforced with waste plastic was tested using a mechanical compression machine; the strength of the foam was significantly improved (more than 12 times) by adding 10wt% polyethylene. To enhance the adsorption capacity of lignin foams, different amounts of AC (0.5, 1, 2 and 3wt%) were coated onto the surface of the foam. The adsorption capabilities of lignin foam to copper and oil in water were improved by at least 10% when coated with 1wt% activated carbon. According to the obtained data, two research hypotheses were proven valid through this project. The possible mechanisms of formation of reinforced lignin foams (RLFs) and the improved adsorption capacities of RLF-AC samples are proposed.

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