

Development of a Lignin-Based Flocculant for Algae Harvesting

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Microalgae are photosynthetic microorganisms, which have both harmful and useful aspects. In the presence of nutrients in the water bodies, harmful algal blooms can rapidly develop, affecting the water quality. Therefore, in this study, a cationic lignin polymer as a flocculant was synthesized to harvest harmful microalgae from their water medium, for productive applications. Even though many organic, inorganic, and biopolymers have previously been used as flocculants, cationic lignin polymers have never been used to harvest microalgae. Extracting from coconut husks, or recycling the waste generated in pulp industries are some common ways that lignin can be obtained. Since lignin is abundant in nature and low in cost, it can be considered an economical raw material. The flocculant was synthesized by first increasing the active sites of lignin polymer via a phenol pre-treatment. Then secondary amine groups were introduced to the phenolated lignin polymer via a Mannich reaction and converted into quaternary amine groups. The formation of the flocculant was confirmed using FTIR analysis. Flocculant was then used in jar test experiments to find out optimum conditions required for maximum flocculation efficiency of algae, using water samples collected from Beira Lake, Sri Lanka. A series of six concentrations (0 mg/L, 5 mg/L, 10 mg/L, 15 mg/L, 20 mg/L, 25 mg/L) of the flocculant at three different pH values (pH 7, pH 8 and pH 9) were tested to obtain the optimum condition. At pH 8 a maximum flocculation efficiency of 84% was obtained using 20 mg/L of the flocculant. These preliminary results suggest that the cationic lignin polymer developed in the current study could be used as an efficient flocculant for harvesting algae from water samples.

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