

Title : Enhancement of Scalp Sebum Reduction in Kaffir Lime Shampoo Using Lignin Extracted from Sugarcane Bagasse

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ABSTRACT

Excessive scalp oiliness arises from sebaceous gland hyperactivity, resulting in excess sebum, follicular blockage, and microbial proliferation. Therefore, effective and sustainable agents for sebum regulation and microbial inhibition are required. This study aimed to investigate the potential of lignin extracted from sugarcane bagasse as a natural material for enhancing scalp sebum reduction and to evaluate its antibacterial activity against scalp-associated bacteria. Lignin was extracted from sugarcane bagasse via the organosolv method and subsequently characterized for its physicochemical properties. The extraction yield was 3.44 ± 0.12 , and the average particle size was approximately 777.2 nm. Moreover, the oil adsorption capacity of lignin was evaluated in vitro by quantitatively measuring the amount of oil absorbed and comparing it with a control sample. The results demonstrated that lignin extract exhibited a high oil adsorption capacity, with an average value of 3.127 ± 0.167 g of oil per gram of lignin, which was significantly higher than that of the control. In addition, lignin showed antibacterial activity, with the minimum inhibitory concentration (MIC) values of approximately 5 mg/mL against *Staphylococcus aureus*, *Staphylococcus epidermidis*, and *Pseudomonas aeruginosa*. The minimum bactericidal concentration (MBC) against *S. aureus* was approximately 10 mg/mL, whereas lignin concentrations greater than 10 mg/mL were required to achieve bactericidal activity against *S. epidermidis* and *P. aeruginosa*. This study demonstrates that sugarcane bagasse-derived lignin is a promising natural active ingredient for hair care applications, providing sebum-regulating and antibacterial effects while promoting sustainable agricultural waste valorization.

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