Title : Green Technology–Derived Extracts from Spirulina for Foot Deodorant Spray Development.

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ABSTRACT

Foot odor is caused by the growth of bacteria on the skin that produce volatile compounds responsible for unpleasant odors. This study aimed to investigate the extraction and bioactivity of active compounds from *Spirulina* using environmentally friendly extraction approaches. Three extraction methods with ethanol used as the solvent were compared, i.e. microwave-assisted extraction (MAE), ultrasonic-assisted extraction (UAE), and maceration. The extracts were evaluated for percentage yield, total phenolic content (TPC), antioxidant activity using the DPPH assay, and antibacterial activity against three bacterial isolates. Statistical analysis was performed using one-way ANOVA. The results showed that extraction methods significantly affected extraction yield ($p < 0.05$). Microwave-assisted extraction provided the highest yield (22.55 ± 1.67%), followed by maceration (17.44 ± 1.14%) and ultrasonic-assisted extraction (16.21 ± 3.67%). In contrast, TPC values were not significantly different among extraction methods ($p > 0.05$), ranging from 0.62 to 0.85 mg GAE/g extract. Regarding antioxidant activity, UAE exhibited the lowest IC_{50} value, indicating the strongest antioxidant capacity. Antibacterial activity, evaluated at a minimum inhibitory concentration (MIC) of 500 µg/mL, showed that MAE demonstrated the highest inhibitory efficiency, with an average inhibition rate of 94.2%. The development of a foot deodorizing spray is

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currently under investigation. The formulation incorporates *Spirulina* extract combined with cell-free supernatant from *Lactobacillus plantarum* to enhance the inhibition of odor-causing microorganisms.

Keywords: Microwave-assisted extraction, Green extraction, Antioxidant activity, Antibacterial activity

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