

Evaluation of the Effectiveness of the Brown Alga, *Sargassum vulgare* Extract in Improving Wastewater Quality: An Eco-Friendly Approach

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Abstract

This study assesses the potential of *Sargassum vulgare* algal extract in wastewater treatment, covering its phytochemical constitution, antioxidant capabilities, and its effects on wastewater's physical and microbiological parameters. Phytochemical examination confirmed the presence of alkaloids, terpenoids, flavonoids, and other compounds critical for effective wastewater treatment. The algal extract notably reduced electrical conductivity (EC) from 7.70 to 0.16 mS/cm, total suspended solids (TSS) from 167 to 14 mg/L, and total dissolved solids (TDS) from 3,816 to 60 mg/L, thus adhering to EPA and MoE's environmental standards. Significant microbial reductions were observed, including decreases in fecal coliforms, *Salmonella* spp., *Staphylococcus* spp., and other pathogens. The study demonstrated enhanced microbial suppression with higher concentrations (160 mg/mL) and longer incubation times (72 hours). These findings underscore the algal extract's promise as a sustainable, efficient alternative in wastewater management practices.

Keywords: Antioxidant activity; Bioactive compounds; Microbial reduction; *Sargassum vulgare*; Wastewater treatment; Water quality improvement.