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Original Research

Analysis of Water Treatment by *Moringa oleifera* Bioflocculant Prepared Via Supercritical Fluid Extraction

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Abstract

In this study, we used supercritical fluid extraction to prepare *Moringa oleifera* as a bioflocculant and studied its efficacy in water treatment. Relative to the conventional solvent extraction method, supercritical fluid extraction produced 42% more bioflocculant and was a more efficient method with both time (about seven hours less) and cost savings (about USD30 less). The bioflocculant produced via supercritical fluid extraction was also smaller (18±5 µm) and more similar in size (Coefficient of Variation, CV = 28%) as opposed to conventional solvent extraction (23±8 µm, CV = 35%). It was able to reduce more than 95% of turbidity and up to 60% bacterial population. Its performance in reducing selected heavy metals from water samples was also generally better than aluminium sulfate or alum. Our study showed that with the exception of cost restrictions, *M. oleifera* bioflocculant produced via supercritical fluid extraction has the potential to replace alum in water treatment plants.

Keywords: *Moringa oleifera*; bioflocculant; water treatment; supercritical fluid extraction

Introduction

In a water treatment plant the flocculation step is the main process for turbidity removal. Currently, the flocculation step is carried out with various types of chemical flocculants, e.g., aluminium sulfate or its variants [1]. However, studies have suggested that there may be negative health implications of using alum, such as Alzheimer's disease [2]. Even though it is difficult to show a causal relationship through epidemiological studies, the long-term effects of aluminium cannot be dismissed, and there is a need to control exposure to aluminium in the general population [3]. Other than health implications, another disadvantage to using alum in a water treatment plant is the large sludge volume produced [4] and the high cost of disposing of alum sludge as scheduled waste.

With the growing global population, world water demand has increased seven-fold in the last century and is expected to increase further with the economic expansion of developing countries [1]. Existing freshwater resources need protection and

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