

Optimization of uranium biosorption in solutions by *Sargassum boveanum* using RSM method

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Abstract. The potential use of *Sargassum boveanum* algae for the removal of uranium from aqueous solution has been studied by varying three independent parameters (pH, initial uranium ion concentration, *S. boveanum* dosage) using a central composite design (CCD) under response surface methodology (RSM). Batch mode experiments were performed in 20 experimental runs to determine the maximum metal adsorption capacity. In CCD design, the quantitative relationship between different levels of these parameters and heavy metal uptake (q) were used to work out the optimized levels of these parameters. The analysis of variance (ANOVA) of the proposed quadratic model revealed that this model was highly significant ($R^2 = 0.9940$). The best set required 2.81 as initial pH (on the base of design of experiments method), 1.01 g/L *S. boveanum* and 418.92 mg/L uranium ion concentration within 180 min of contact time to show an optimum uranium uptake of 255 mg/g biomass. The biosorption process was also evaluated by Langmuir, Freundlich, Temkin and Dubinin-Radushkevich isotherm models represented that the experimental data fitted to the Langmuir isotherm model of a suitable degree and showed the maximum uptake capacity of 500 mg/g. FTIR and scanning electron microscopy were used to characterize the biosorbent and implied that the functional groups (carboxyl, sulfate, carbonyl and amine) were responsible for the biosorption of uranium from aqueous solution. In conclusion, the present study showed that *S. boveanum* could be a promising biosorbent for the removal of uranium pollutants from aqueous solutions.

Keywords: biosorption; uranium; *Sargassum boveanum*; environmental remediation; wastewater treatment

1. Introduction

One of the most important concerns of the global community is to preserve the environment. The production of waste and disposal in the water has become one of the most important concerns (Varjani *et al.* 2018). Human activities have influenced the environment by producing a huge amount of toxic liquids containing heavy metals, metalloids, radionuclides, and various organic pollutants. Preventing or limiting toxic emissions to the environment is one of the main purposes

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