



## Cadmium precipitation by sulfite reaction chain under UV irradiation

Tayebeh Rasolevandi<sup>a</sup>, Hossein Azarpira<sup>b</sup>, Amir Hossein Mahvi<sup>a,c,\*</sup>

<sup>a</sup>School of Public Health, Tehran University of Medical Sciences, Tehran, Iran, emails: ahmahvi@yahoo.com/ahmahvi95@gmail.com (A.H. Mahvi), tayebe\_r66@yahoo.com (T. Rasolevandi)

<sup>b</sup>Department of Environmental Health Engineering, Social Determinants of Health Research Center, Saveh University of Medical Sciences, Saveh, Iran, email: hazarpira912@gmail.com

<sup>c</sup>Center for Solid Waste Research (CSWR), Institute for Environmental Research (IER), Tehran University of Medical Sciences, Tehran, Iran

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### ABSTRACT

Heavy metals in groundwater are potentially concerned because of their persistent toxicity, transformation to more toxic compounds, possibility of condensation, entry into the food chain. In this study removal of cadmium based on complexation in a UV/sulfite, and adsorption into  $\text{MnO}_2$  was investigated. Herein, cadmium was removed completely in the optimal condition  $\text{Na}_2\text{SO}_3 = 0.3$  mM, about 20 min reaction time (synthetic sample), pH 6, and 50 mg L<sup>-1</sup>. Afterwards, the real sample was examined and anions increased with time to reach the standard from 20 to 30 min. In the first stage, the sulfite–sulfate cycle and reaction with cadmium and then both substances were removed from the solution by forming a complex. Advantage of this method against others includes less time, higher efficiency, less use of reactive materials, and removal of both Cd and sulfite. The amount of energy consumed decreased from 17.73 to 4.37 kWh m<sup>-3</sup>,  $K_{\text{obs}}$  (min<sup>-1</sup>) 0.0915 to 0.1734 and  $r_{\text{obs}}$  (mg L<sup>-1</sup> min<sup>-1</sup>) increased from 3.57 to 43.35 with an increase in Cd concentration from 50 to 250 mg L<sup>-1</sup>. Presence of anions, such as nitrate and sulfate, increased the cadmium removal efficacy. Nitrate reacted with  $e_{\text{aq}}^-$  and with sulfite radicals and did not allow the formation of complexes; meanwhile, cadmium banding with sulfate helped its direct removal.

*Keywords:* Cadmium; Concern; Reduction; Radicals; Precipitation; Real sample

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\* Corresponding author.