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MDPI

Supplementary Material

Competitive Removal of Antimony and Humic Acid by Ferric Chloride: Optimization of Coagulation Process Using Response Surface Methodology

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S1. Design Procedure and Statistical Analysis

The BBD presented 17 different randomized combinations of experiments to minimize effects of uncontrolled factors on removal responses, with the central point of the model repeated five times to quantify the error. The removal responses of Sb(III) and TOC were modelled as an empirical second order polynomial equation in the form shown in Equation (S1):

$$Y = f(x) = \beta_0 + \sum_{i=1}^{k}(\beta_i x_i) + \sum_{i=1}^{k} x \sum_{j=i+1}^{k} (\beta_{ij} x_i x_j) + \sum_{i=1}^{k}(\beta_{ii} x_i^2) \quad \text{(S1)}$$

Where Y was the predicted response (Sb(III) removal) as well as (TOC removal); βo was the model coefficient; βi, βii, and βij were linear, square, and interactive effects, respectively, of various independent variables; k was the number of factors; xi and xj were coded values of factors that influenced the predicted response Y. Regression analysis was done for experimental data using Design Expert software. The statistical significance of the model was determined using analysis of variance (ANOVA) in Design Expert, which was also utilized to visualize the 3D response surface and 2D contour plot for experimental data validation by comparing it to predicted values. Moreover, the model was used to optimize simultaneous removal responses of Sb(III) and TOC by using FC as a coagulant.

Table S1. Experimental data points and results of Sb(III) and TOC removal in Box-Behnken experimental design.

Run	Initial Sb concentration (μg/L)	Initial HA concentration (mgC/L)	FC dosage (mg/L)	Sb(III) removal (%)	TOC removal (%)
1	100	6	20	45.85	35.67
2	1000	6	20	51.06	44.83
3	1000	2	60	93.85	72.5
4	550	10	20	31.06	35.42
5	550	6	60	80.97	54.12
6	550	6	60	80.69	54.37
7	100	6	100	88.02	78.08
8	550	6	60	81.11	53.08
9	550	10	100	85.55	81.8
10	550	2	20	62.7	66.95
11	550	6	60	80.72	54.6
12	550	2	100	92.51	78.8
13	1000	10	60	78.21	46.1
14	100	10	60	70.55	58.2
15	550	6	60	80.75	55.1
16	100	2	60	91.06	67.25
17	1000	6	100	87.27	54.33