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Data Article

Fluoride ion adsorption onto palm stone: Optimization through response surface methodology, isotherm, and adsorbent characteristics data

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ABSTRACT

In some part of the world, groundwater source can become unsafe for drinking due to the high concentration of fluoride ions [1]. The low cost and facile-produced adsorbent like palm stone could effectively removed fluoride ions through adsorption process. In this dataset, the influence of fluoride ion concentration, solution pH, adsorbent dosage, and contact time on fluoride ion adsorption by palm stones was tested by central composite design (CCD) under response surface methodology (RSM). The data stone carbonized adsorbent was prepared by a simple and facile method at relatively low temperature of 250 °C during 3 h. The adsorbent had the main functional groups of O–H, –OH, Si–H, C=O, N=O, C–C, C–OR, C–H, and C–Br on its surface. At the optimized conditions obtained by RSM, about 84.78% of fluoride ion was removed using the adsorbent. The Langmuir isotherm was suitable for correlation of equilibrium data (maximum adsorption capacity= 3.95 mg/g). Overall, the data offer a facile adsorbent to water and wastewater works which face to high level of fluoride water/ wastewater content.

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Specifications Table

Subject area	*Chemical engineering*
More specific subject area	*Environmental engineering*
Type of data	*Table, image, figure*
How data was acquired	*All adsorption tests were done in batch mode. Five level of each parameter was evaluated using RSM.* *The concentrations of fluoride in the samples were measured using a UV-visible spectrophotometer (HACH, USA, model CAM Spec M501) with a standard SPADNS reagent at 570 nm.* *A digital pH meter (Metrohm) was used for solution pH analyzing.* *The characteristics of the adsorbent were analyzed using FTIR (VERTEX 70/70 v), SEM (JSM- 5510, Jeol Ltd., Tokyo, Japan), XRD (Philips X'Pert, Netherlands) and pHzpc.*
Data format	*Analyzed*
Experimental factors	*Measuring of F concentrations under various levels of initial F concentration, solution pH, adsorbent dosage, and contact time to obtain optimal F removal from aqueous solution using an adsorbent provided from palm stone.*
Experimental features	Optimization of F adsorption onto palm stone adsorbent using RSM
Data source location	*Bushehr University of Medical Sciences, Bushehr, Iran, GPS: 28.9667°N, 50.8333°E*
Data accessibility	*Data represented with the article*

Value of the data

- This data offer a simple method for preparation of adsorbent from palm stones.
- This data article presents a user friendly- statistical method (RSM) to optimize fluoride ion removal from aqueous solution using adsorption process.
- The dataset will be useful for fluoride ion removal from waters and wastewaters.

1. Data

Table 1 in this data article contains data for independent variables and their coded levels to central composite design. Normal probability plot and residual versus fit plot for fluoride adsorption efficiency are depicted in Fig. 1. Central composite design 3-D surface plots which showing effect of various parameters on fluoride removal efficiency with the adsorbent are presented in Fig. 2. The data for model summary statistics and ANOVA for central composite design are listed in Tables 2 and 3. The FTIR spectra for fresh and used adsorbent in the F adsorption are also depicted in Fig. 3. The surface morphology (SEM) of the adsorbent was presented in Fig. 4. The XRD analysis was used to

Table 1
Independent variable and their coded levels to central composite design.

Code	Variable	-α	-1	0	1	+α
A	pH	3	5	7	9	11
B	Adsorbent dose (g/L)	1	2	3	4	5
C	Fluoride conc. (mg/L)	2	5	8	11	14
D	Time (min)	0	60	120	180	240