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Data on the bisphenol A adsorption from aqueous solutions on PAC and MgO~PAC crystals

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ABSTRACT

The compounds of endocrine disrupting are one of the important pollutants in the environment. These pollutants, even at extremely low concentrations, have significant effects on humans, animals and the environment. The main goal of this work was to study the performance activated carbon coated with MgO in the bisphenol A adsorption from aqueous solutions. The leading variables investigated were initial concentration of bisphenol A (20–100 mg/L), PAC and MgO~PAC (2–6 g), contact time (10–60 min), and pH (3–11). The residue concentration of bisphenol A was measured by temperature High-Performance Liquid Chromatography. The maximum adsorption of bisphenol A over PAC and MgO~PAC crystals was 9.2 mg/g and 22.28 mg/g, respectively. Based on BET, the surface area of PAC and MgO~PAC crystals were found to be 450.3 m²/g and 378.21 m²/g, respectively. By increasing initial concentration of bisphenol A, the adsorption decreased. The study findings showed that the Langmuir model and the pseudo-second-order model were a fit model to the experimental data, respectively.

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Specifications table

Subject area	<i>Environmental Chemistry</i>
More specific subject area	<i>Adsorption</i>
Type of data	<i>Table, figure</i>
How data was acquired	<i>HPLC (Shimadzu Corp., Kyoto, Japan) consisting of a quaternary pump (LC-10ATvp), UV-vis detector (SPD-M10Avp), vacuum degasser and system controller (SCL-10Avp)</i>
Data format	<i>Raw, analyzed,</i>
Experimental factors	<i>The experiments of bisphenol A adsorption were done in batch conditions. The leading variables investigated were initial concentration of bisphenol A, PAC and MgO~PAC, contact time, and pH. the residue concentration of bisphenol A was measured by temperature High-Performance Liquid Chromatography</i>
Experimental features	<i>(I) Add magnesium nitrate hexahydrate [52.5 g] to a distilled water [1 L], (II) Add sodium hydroxide [3 mL, 1 N] to the solution prepared in the previous step, (III) Mix the solution prepared to create a mixture of gelatin homogeneous from magnesium hydroxide [5 min], (IV) Add PAC [50 g] and mix it [1 h], (V) After separating the produced precipitate, it dried in an oven [100 °C, 3 h], and (VI) To convert Mg(OH)₂ to MgO, it was calcinated [500 °C, 2 h].</i>
Data source location	<i>Khorramabad, Lorestan University of Medical Sciences, Iran</i>
Data accessibility	<i>Data are included in this article</i>

Value of the data

- The information obtained the data of this article showed that by the modification of conventional adsorbents can be their ability to adsorption various pollutants from aqueous solutions.
- The acquired data of this article can be used to complete the data on the adsorption of Phenolic compounds from wastewater and industrial effluents.
- The information of the isotherms and kinetics will be informative for predicting and modeling of the Phenolic compounds adsorption from aqueous solutions.

1. Data

Phenolic compounds are one of the most important environmental pollutants that have low biodegradability. These compounds have harmful effects on human, animal and environmental health. One of the common ways to remove these compounds is adsorption processes. So far, various adsorbents have been used to remove phenolic compounds from aqueous solutions. Therefore, in this study, adsorbents PAC and MgO~PAC crystals were selected to remove phenolic compounds.

2. Experimental design, materials, and methods

2.1. Materials

In this study, these chemicals were used magnesium nitrate, bisphenol A (C₁₅H₁₆O₂), sulfuric acid, acetic acid, power activated carbon (PAC), acetonitrile, dichloromethane, iron chloride tetrahydrate, iron chloride tetrahydrate, and alizarin red S. the all chemicals with high quality were purchased from the Sigma-Aldrich and Merck companies.

2.2. Preparation of MgO~PAC

Previous studies were used to modify power activated carbon (PAC) with manganese oxide (MgO) [1–3]. This method was used to modify: (I) Add magnesium nitrate hexahydrate [52.5 g] to a distilled water [1 L], (II) Add sodium hydroxide [3 mL, 1 N] to the solution prepared in the previous step, (III) Mix the solution prepared to create a mixture of gelatin homogeneous from magnesium hydroxide [5 min], (IV) Add PAC [50 g] and mix it [1 h], (V) After separating the produced precipitate, it dried in an oven [100 °C, 3 h], and (VI) To convert Mg(OH)₂ to MgO, it was calcinated [500 °C, 2 h]. After the above steps, the power activated carbon coated MgO was stored in a bottle for later use. After coated, MgO~PAC characterizations were determined.

2.3. Adsorbent characterization

The metal-organic frameworks of ZIF-8 and Uio-66 were determined by XRD, SEM. BET surface area and total pore volumes of the adsorbents were determined from N₂ adsorption isotherms at 77 K.

2.4. The experiments of bisphenol A adsorption

The adsorption of bisphenol A by PAC and MgO~PAC was investigated. The experiments of bisphenol A adsorption were conducted in batch conditions. The leading variables investigated were

Table 1

Empirical formulas of the applied isotherm models [18].

Isotherm models	Formula	Plot
Langmuir	$C_e/q_e = 1/K_L + (a_L \times C_e/K_L)$	$\frac{C_e}{q_e}$ Vs. C_e
Freundlich	$\text{Log } q_e = \log K_F + (n_F \times \log C_e)$	$\text{Log } q_e$ Vs. $\log C_e$

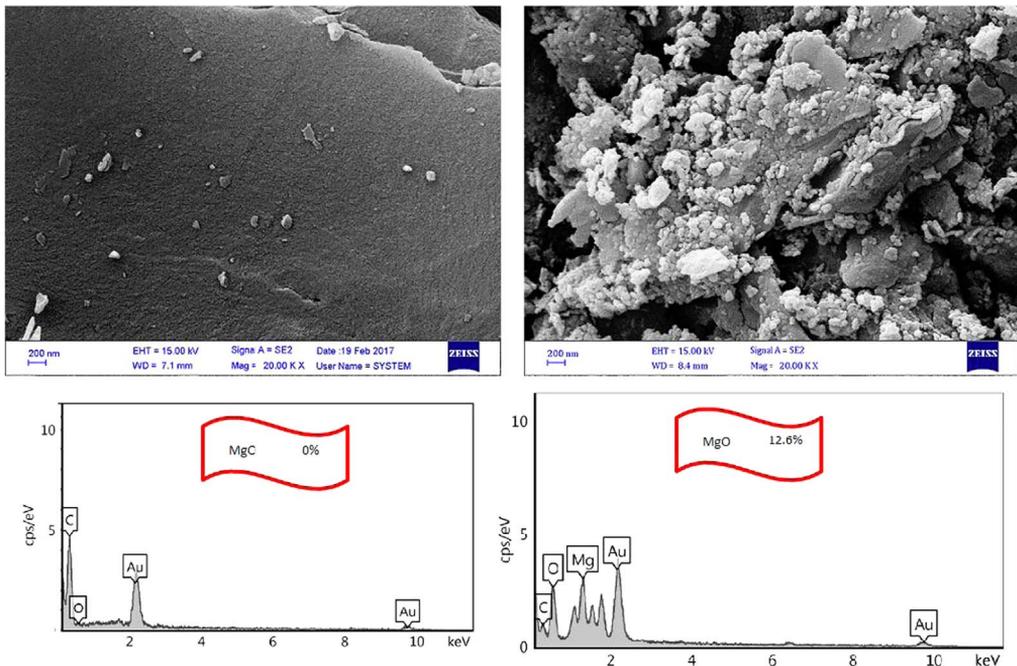


Fig. 1. The spectra of XRD and the images of SEM of PAC and MgO~PAC crystal.

initial concentration of bisphenol A (20–100 mg/L), PAC and MgO~PAC (2–6 g), contact time, and pH (3–11). At the end of the adsorption process, the residue concentration of bisphenol A was measured by temperature High-Performance Liquid Chromatography (HPLC) [1,4–22]. Finally, Eq. (1) was used to determine the removal efficiency of bisphenol A on ZIF-8 and Uio-66:

$$\text{Removal efficiency, \%} = \frac{(C_0 - C_t)}{C_0} \quad (1)$$

where, C_0 and C_e are the initial and final bisphenol A concentrations in solution (mg/l), respectively. To determine the pH_{zpc} of adsorbents, the steps were carried out as follows: (i) Preparation of potassium nitrate solution [50 mL, 0.01 M], (ii) Preparation of potassium nitrate solutions with a pH 2–12, (iii) Add adsorbents to it [0.2 g/l], (vi) Stirring the mixture for 24 h, (v) pH measurement after this time, and finally (iv) plot initial pH Vs. final pH. The relationships shown in Table 1 were used to calculate isotherms and kinetics of bisphenol A adsorption on ZIF-8 and Uio-66. Fig. 1 shows XRD spectra and SEM image of PAC and MgO~PAC. According to BET, the specific surface area PAC and MgO~PAC were $450.3 \text{ m}^2/\text{g}$ and $378.21 \text{ m}^2/\text{g}$, respectively. Also, total-pore volume and average-pore diameter of PAC and MgO~PAC were $0.553 \text{ cm}^3/\text{g}$ and $0.455 \text{ cm}^3/\text{g}$ and 5.1 nm , 4.7 nm , respectively. In Fig. 2, pH_{zpc} are presented for PAC and MgO~PAC. Fig. 3 shows the effect of solution pH on bisphenol A with PAC and MgO~PAC crystals. Fig. 4 presents the effect of adsorbent dose of PAC and MgO~PAC crystal on bisphenol A adsorption. Fig. 5 shows the effect of initial concentration of bisphenol A with PAC and PAC~MgO crystals. Fig. 6 presents the effect of contact time on bisphenol A with PAC and MgO~PAC crystals. Constants of kinetic models for the adsorption of bisphenol A onto PAC and MgO~PAC crystals are shown in Table 2. Constants of isotherm models for the adsorption of bisphenol A onto PAC and MgO~PAC crystals are shown in Table 3.

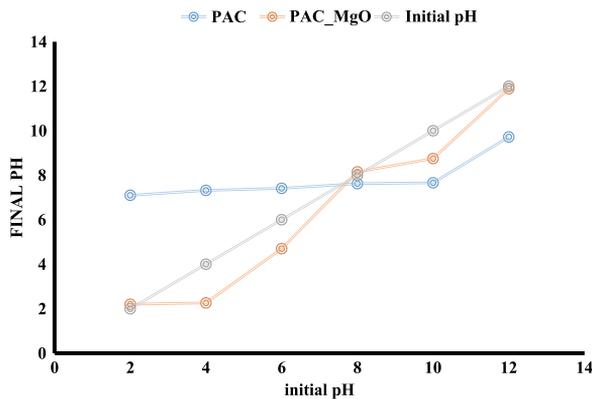


Fig. 2. Determination of pH_{zpc} for PAC and MgO~PAC.

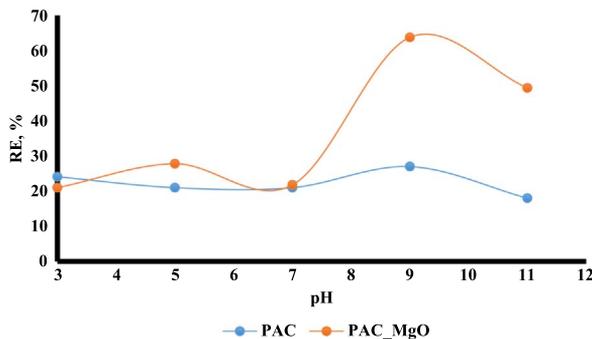


Fig. 3. The effect of solution pH on bisphenol A adsorption with PAC and MgO~PAC crystals.

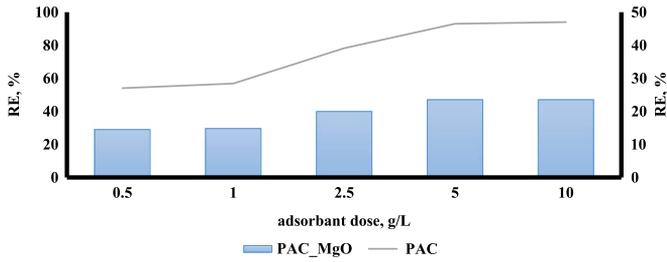


Fig. 4. The effect of adsorbent dose of PAC and MgO~PAC crystal on bisphenol A adsorption.

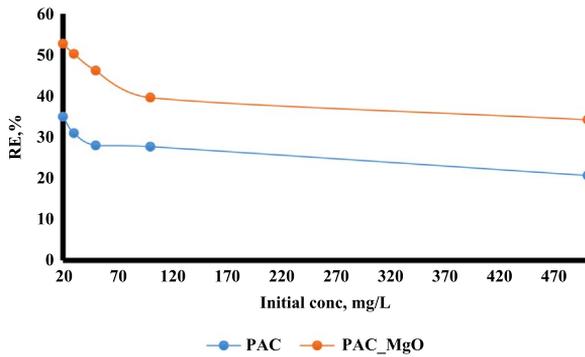


Fig. 5. The effect of initial concentration of bisphenol A with PAC and PAC~MgO crystals.

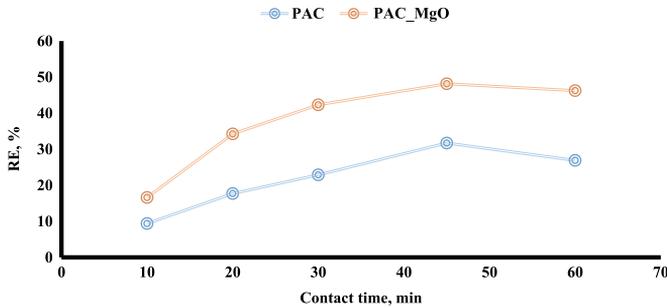


Fig. 6. The effect of contact time on bisphenol A adsorption with PAC and PAC~MgO crystals.

Table 2

Constants of kinetic models for the adsorption of bisphenol A onto PAC and MgO~PAC crystals.

Adsorbents	q_e [mg/g]	Pseudo-first-order			Pseudo-second-order		
		q_{cal}	K_1 [1/min]	R^2	q_{cal}	K_2 [1/min]	R^2
PAC	5.068	3.27	0.0333	0.93	5.49	0.0157	0.994
MgO~PAC	14.03	5.21	0.044	0.862	17.89	0.0123	0.987

Table 3

Constants of isotherm models for the adsorption of bisphenol A onto PAC and MgO~PAC crystals.

Adsorbents	Langmuir				Freundlich		
	q_m [mg/g]	b [L/mg]	R^2	R_L	K_F	n	R^2
PAC	9.2	0.124	0.927	0.074	7.05	0.66	0.849
MgO~PAC	22.28	0.268	0.991	0.036	2.43	0.62	0.989

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Transparency document. Supplementary material

Transparency document associated with this article can be found in the online version at <https://doi.org/10.1016/j.dib.2018.10.033>.

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