Facile synthesis of mesoporous carbon aerogel for the removal of ibuprofen from aqueous solution by central composite experimental design (CCD)

Sara Abolhasani[1], Tahereh RohaniBastami[2], Ali Ahmad pour[3,*]

[1] Department of Chemical Engineering, Faculty of Engineering
[2]Department of Chemical Engineering, Faculty of Engineering
[3,*] Department of Chemical Engineering, Faculty of Engineering, Ferdowsi University of Mashhad, Mashhad, Iran;
*Email: ahmadpour@um.ac.ir,

Abstract:

In this paper, carbon aerogel as a nanostructure adsorbent was prepared from mixed resorcinol and formaldehyde precursors by the ambient pressure drying. Synthesis of carbon aerogel is performed in four main steps: preparation of wet gel, aging, wet gel drying and pyrolysis. The cheap precursors in this synthesis were significant and economical for the mass production. The prepared carbon aerogel was characterized by surface area measurement, field emission scanning electron microscopy (FESEM), X-ray diffraction (XRD), energy dispersive X-ray (EDX) analysis and Fourier transform infrared (FTIR) spectroscopy. According to the surface area analysis, the carbon aerogel has a high surface area of 790 m^2g^{-1}, a total pore volume of 1.47 cm^3g^{-1} and a mean pore diameter of 7.48 nm. According to the FESEM images, a uniform particle size distribution with a diameter of less than 50 nm was observed. Adsorption investigation of ibuprofen from aqueous solution was performed by the carbon aerogel. Design Expert with a coherent program was used for the adsorption process optimization. The main objective of this study was to evaluate operational variables such as contact time, adsorbent dosage, pH, and interaction of these variables in the adsorption process. According to the kinetic study, the compatibility of experimental data with the pseudo-second-order model represents the heterogeneous chemical adsorption on the adsorbent surface. The results of Freundlich isotherm demonstrate the multilayer adsorption with a heterogeneous system for adsorption process.

Keywords: Carbon aerogel; Mesopore; Ibuprofen; Adsorption; Experimental design

References:

[1] S. Álvarez-Torrellas et al., Chem. Eng. J. 347 (2018) 595–606.
[2] J.Q. Xiong et al., Trends Biotechnol. 36 (2018) 30–44.
[3] R.R. Zepon Tarpani et al., J. Environ. Manage. 215 (2018) 258–272.
[4] J. Garcia-Ivars et al., Water Res. 125 (2017) 360–373.
[5] C. Gadipelly et al., Ind. Eng. Chem. Res. 53 (2014) 11571–11592.
[6] J. Akhtar et al., Desalin. Water Treat. 57 (2016) 12842–12860.
[7] H. Maleki et al., Chem. Eng. J. 300 (2016) 98–118.
[8] T. Rohani et al., 51 (2017) 244–254.
[9] T. Ren et al., J. Mater. Sci. Res. 3 (2014) 74–81.
[10] J.P.C. Kleijnen., Int. Ser. Oper. Res. Manag. Sci. 216 (2015) 81–104.
[11] E. Hu et al., J. Clean. Prod. 112 (2016) 4710–4718.