22nd Iranian Chemistry Conference, 23-25 August, 2023
University of Kurdistan

Adsorptive removal of tetracycline from water using MOF-808 nanoadsorbent

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Environmental pollution by antibiotics has severely affected human health and development [1]. This paper presents synthesis of MOF-808 and its adsorptive performance for tetracycline (TC) removal. MOF-808 were synthesized by the solvothermal method. We designed MOF-808, BTC (0.056 g), and ZrOCl2·8H2O (0.257g,) in a solvent mixture of DMF/formic acid (12mL/12 mL) were placed in a screw-cap jar, which was subsequently heated at 120 ◦C for 48 h [2] and The centrifugation activation method were employed. The featured powder X-ray diffraction (PXRD) peaks at 2θ values of 4.3, 8.3, and 8.69 can be easily identified in the obtained powders, indicating (111), (311), and (222) crystal planes, respectively [3]. The FTIR spectrum of the synthesized MOF-808 sample indicates peaks at 710 and 758 cm^{-1} were assigned to the C–C bond of the benzene ring. Furthermore, the peaks at 1570 and 1400 cm^{-1} are assigned to asymmetric and symmetric stretches of coordinating carboxylates (C=O), respectively, indicating Zr^{4+} and BTC coordination [4]. Specifc surface area of the materials was measured at $-196\ ^{\circ}C$ and the calculated BET surface area of the sample is around 589 m^2g^{-1}. A SEM image of MOF-808 showed that the MOF-808 has a regular ochtahedral structure with particle size of about 500 nm. To obtain the adsorptive performance of MOF-808 adsorption, kinetic adsorption and isotherm experiments were employed. To quantify the adsorption equilibrium time, kinetic experiment was done and the high correlation coefficient ($R^2 = 0.99887$) indicates that besides physisorption, chemisorption also plays a crucial role in terms of the interactions that occur between TC and MOF-808. To find the maximum adsorption capacity of TC in MOF-808, adsorption experiments were performed for 4 h (equilibrium time) and showed that the uptake of TC by MOF-808 followed a Langmuir adsorption model ($R^2 = 0.89368$). The maximum adsorption capacity of TC in MOF-808 is about 254.94 $mg.g^{-1}$, which indicates a great adsorption performance of MOF-808.

References

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