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Adsorptive removal of oxytetracycline from aqueous solution by natural zeolites

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ABSTRACT

The persistent existence of antibiotics in sewage wastewater treatment plants in all parts of the world currently has emerged as a serious concern regarding public health and ecology balance. In this study, natural zeolites were employed as adsorbents to remove oxytetracycline (OTC) from aqueous solution. Natural zeolites from different sources labelled as NZ01, NZ02 and NZ03 were characterized using Fourier transform infrared (FTIR) spectroscopy, cation exchange capacity (CEC), x-ray fluorescence (XRF) spectroscopy and x-ray diffraction (XRD) spectrometry followed by evaluation towards OTC removal from aqeous solution. The OTC removal performance by adsorptive flocculation-coagulation was conducted in Jar Test equipment for the system containing natural zeolites, alum and kaolin. The maximum adsorption capacity of OTC was 29µmol/g with the initial OTC concentration of 100µM observed for the NZ02. This may be due to it has the largest surface area (36.646 m^2/g) among the three natural zeolites. The optimum pH was determined to be in the range of 7 to 8. Adsorption data analysis indicated that the process was best fitted to the pseudo-first order and Langmuir isotherm models.

| Natural zeolites| Adsorptive flocculation-coagulation | Antibiotics | Aqueous solution |

Supramolecular Hydrogen Bonding Interactions of Self-Assembled Mixed-Hydrophobic/Hydrophilic Benzene-1,3,5-Tricarboxamides for Sensing Nitrobenzene

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ABSTRACT

Supramolecular self-assembly of weak non-covalent hydrogen, metal-metal, and π–π interactions have been developed for molecular recognition due to its easy to control and tune precisely. Moreover, nitrobenzene (NB) have been reported to penetrate skins rapidly, cause formation of methemoglobin on acute exposure, and used as explosive compounds in the bomb for terrorist activities. In recent years, benzene-1,3,5-tricarboxamides (BTAs) self-assembled to form nanofiber; however, there is no report on the use of its hydrogen bondings for sensing this hazardous NB. Herein we report, self-assemblies via hydrogen bonding interactions as a chemosensor of NB by using mixed-hydrophobic/hydrophilic version of BTAs. Hydrophobic BTA as a white powder solid showed self-assembly with a tape-like morphology, while hydrophilic BTA as an oily liquid formed less order characteristic of self-assemblies, thus suggesting the competitive intramolecular hydrogen bonding with amphiphilic properties of their alkyl chains or 'back-folding'. Both chemosensors BTAs, showed disappearances of N–H vibrational peaks at 3233 and 1540 cm^{-1} and appearance of a new peak at 1478 cm^{-1} for nitroso (N–N=O) upon addition of NB. These sensing capabilities was found to strongly depend on the anisotropic behavior of the self-assembled BTAs where highly ordered hydrophobic BTA with more rigid side chain has better N–N=O formation compared to hydrophilic BTA. Interestingly, mixing of both BTAs at equal molar ratio give a stable suspension indicating the formation of organogel with tape-like morphology due to 'self-sorting' in their assemblies. Furthermore, the mixed-hydrophobic/hydrophilic BTAs organogel turned to liquid upon addition of NB, suggesting improvement of sensing capability and breaking of hydrogen bonding or disassembly. The optimization of sensing capability parameters will be discussed in details later.

| Benzene-1,3,5-tricarboxamides | Supramolecules chemosensor | Hydrogen bonding | Nitrobenzene detection | Self-sorting |