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Microwave assisted accelerated fluoride adsorption by porous nanohydroxyapatite

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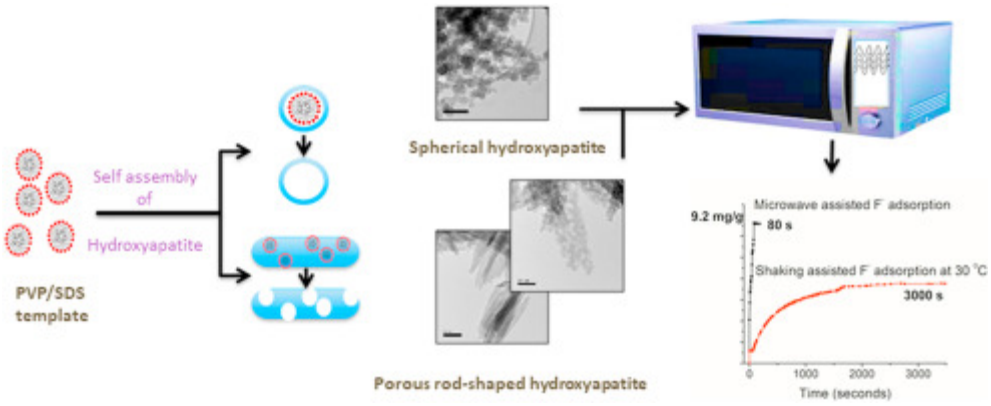
Abstract

Fluoride pollution of water is a matter of concern in many countries due to its association with chronic kidney failure. Therefore, it is important to develop fast and efficient methods for fluoride removal from drinking water using environmentally friendly materials. In this article, the synthesis, characterization and microwave assisted accelerated fluoride removal by porous nanohydroxyapatite (PHAP) are reported. The PHAP samples were synthesized using polyvinyl pyrrolidone and sodium dodecyl sulphate micellar system as the template. The prepared nanohydroxyapatite was characterized using TEM, SEM, FT-IR, TGA, XRD and BET. Investigation of the morphology of microcrystals using TEM showed the presence of spherical particles of 20–35 nm size and highly porous rod-shaped crystals with the aspect ratio of 2:13. The adsorption of F^- ions using PHAP was carried out under the influence of microwave radiations using concentrations comparable to existing F^- levels in natural water. The equilibrium is reached within 80 s and this is the fastest saturation time recorded for any

existing material. The kinetic experiments showed that the fluoride adsorption is an activated second order process. The equilibrium fluoride adsorption capacity of PHAP was found to be 9.19 mg g^{-1} at pH 6.5 for 80 s and this was proven to be a potential material to remove F^- ions rapidly from drinking water.

Graphical abstract



Keywords

Microwave
Porous nanohydroxyapatite
Template
Fluoride
Adsorption isotherm