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Procedure for Large-Scale Production of Apatite-Based Adsorbent Material for Arsenic Removal †

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Abstract: Nowadays, water purification technologies are based on nano-scaled adsorbents, such as metal or polymeric nanoadsorbents, metal organic frameworks, metal oxide nanoparticles, and carbonated nanomaterials, which have shown exceptional results in water decontamination. Adsorption is one of the most environmentally friendly and efficient methods used for pollutant removal from aquatic environments due to the large specific surface area of nanoadsorbents, which creates multiple adsorption sites. Therefore, we developed a synthesis method for the large-scale production of an apatitic adsorbent, which we will further use in a water treatment system.

Keywords: apatitic material; adsorbent; large-scale production; arsenic removal; environmental protection

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1. Introduction

With the great industrial revolution, pollution, whether we are talking about water, soil, or air pollution, has gained an exponential increase. Adsorption is one of the most environmentally friendly and efficient methods of removing pollutants from aquatic environments due to the large specific surface area of nanoadsorbents, which creates more adsorption sites. Moreover, by controlling the synthesis parameters, adsorbents with controllable morphology, high mechanical and thermal stability, and, most importantly, ecological character can be obtained [1].

2. Materials and Methods

In this study, we prepared an apatitic material-based adsorbent at a large scale based on a protocol previously presented by our group [2,3] in two reactors of 20 L volume each (Figure 1), using $Ca(NO_3)_2 \times 4H_2O$ and $(NH_4)_2HPO_4$. Both of the reactors were maintained at 80 °C and continuously stirred for 3h. The obtained material was characterized via X-ray diffraction to confirm the synthesis.

Figure 1. The 20 L reactor used for the synthesis.

3. Results

The obtained powder was further conditioned using PVA (JP-24, J-Poval) and calcinated at 600 °C.

4. Conclusions

The efficiency of the material was evaluated for arsenic removal in a synthetic water matrix using column experiments.

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