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Iron oxide for arsenic removal in water: synthesis and characterization

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Iron oxide materials are widely known as effective for arsenic removal in drinking water. Among the 16 known iron oxides akaganéite, goethite, schwermannite, ferrihidrite and magnetite has been reported as good arsenic adsorbents. Some of those materials are found naturally, others have to be synthetized. This study presents two low-cost synthetic routes to produced effective iron oxide crystal phases for arsenic removal. Iron wool was used as starting material in both cases. In the first case 1g of iron wool was placed in bottles with 1 L of water and exposed to direct sun light for 6-8 hours. PXRD confirmed the presence of lepidocrocite in the material produced. However, the Raman spectrum, presumably due to a higher temperature during the analyses, shows the presence of maghemite. The arsenic adsorption capacity of the powder produced was evaluated trough isotherms. The powder (0.1000g to 0,3000g) was placed into contact with a 400 µgAs/L solution for 24h.The results showed trough the Langmuir model a high adsorption capacity of 3333 µgAS/g. Considering such results, during the second synthesis route the influence of sunlight, temperature and dissolved oxygen in the water were evaluated. During that set of experiments it was showed that with no sunlight, injecting oxygen and a 40°C water temperature a powder is produced. The PXRD showed that during these conditions a mixture of crystalline phases of lepidocrocite, ferrihidrite and magnetite was obtained. Further characterization and evaluation of the arsenic removal capacity of this material are in progress.

Keywords: Iron oxide, arsenic removal, drinking water