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Adsorption of bisphenol-A in aqueous solution using silica nanoparticles obtained from sugarcane ash

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Scientists around the world have searched minimize problems related to the incorrect disposal of solid wastes and water contamination. Brazil, for example, is the largest producer of sugarcane in the world, generates around 3-12 million of tons ash/year or more, and this waste can be transformed into value-added material. In this study, we tried to solve two problems at the same time, manufacturing an adsorbent material and applies it in the remediation of contaminated water with bisphenol-A (BPA), an endocrine disrupting compounds, which alters plasma sex hormone levels in fishes [1]. The silica nanoparticles were synthetized through the addition of silicate obtained from sugarcane ash in the solution of water/butyl alcohol (1:1) with 2.5% wt. of hexadecyltrimethylammonium bromide under constant stirring. Then, 0.5 mol L^{-1} H_2SO_4 solution was added to suspension until pH 4. The nanosilica formed was washed with distilled water, filtered and dried. The silica nanoparticles and BPA adsorbed on silica were characterized by different techniques. The maximum BPA adsorption capacity obtained was 80 mg g^{-1}. From TEM images (Fig. 1A-B) of the silica nanoparticles it is seen that all particles has less than 20 nm. Fig. 1C shows the infrared spectra of samples. The band at 1058 cm^{-1} is due to the Si–O–Si asymmetric stretching, the band at 965 cm^{-1} is due to Si-OH bending vibrational absorption, the bands at 799 and 446 cm^{-1} are due to the Si–O–Si symmetric stretching. The presence of other bands in the blue spectra are attributed of BPA adsorbed on silica nanoparticles, at 554 cm^{-1} is due to aromatic ring deformation vibration of di-substituted benzenes, at 834 cm^{-1} is assigned to C-H vibrations out of the plane and at 1512 cm^{-1} is due to aromatic C=C stretching vibration [2]. The results of characterization of the silica nanoparticles manufactured showed that the material presents potential to be employed as adsorbent for remediation of water contaminated with endocrine disrupting compounds.

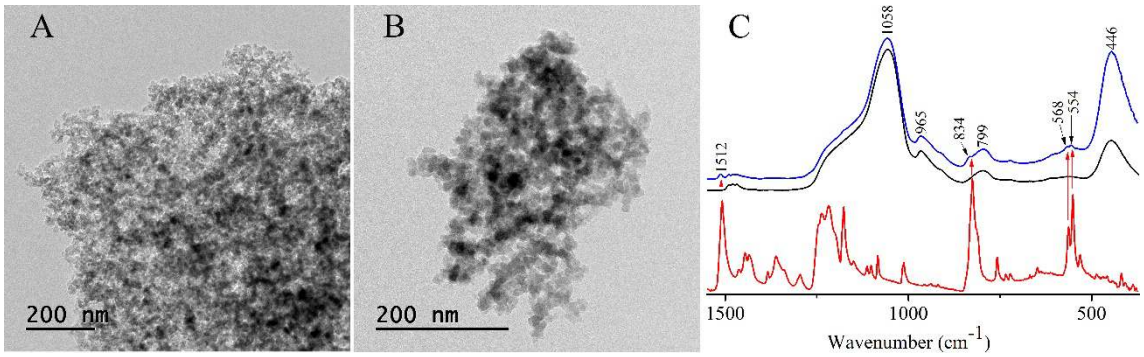

Figure 1. Transmission electron microscopy image of silica nanoparticles (A-B) and FTIR-ATR spectra of the bisphenol-A in red, silica nanoparticles in black and silica nanoparticles + bisphenol-A in blue (C).

References:

1. K. Ji, et al., Environ. Sci. Technol. 47 (2013) 8793.
2. L. Tang, et al., RSC Adv. 6 (2016) 25724.