Surfactant mediated synthesis of silica nanoparticles using sugarcane ash waste as renewable source

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Green silica from renewable source can be used in very different materials, since addictive for construction materials or polymers to traditional products as glass, silicone rubber as well as source for silicon. Brazil is the world's largest producer of sugarcane and generates huge amounts of sugarcane ash waste (SAW) which is a rich source of silica. This work investigates a method to produce pure silica nanoparticles from SAW. Initially, sodium silicate was obtained from sugarcane ash waste adapting the methodology published by Alves, *et al.*, 2017. Subsequently, sodium silicate was added to a mixture of water/butyl alcohol (1:1) with 2.5% wt. of hexadecyltrimethylammonium bromide under constant stirring at 60 °C. Then, 0.5 mol L^{-1} sulfuric acid solution was added slowly to suspension until pH 4 and the resulting gel was aged at 60 °C for 8 h. The aged nanosilica gel was washed with distilled water, filtered and oven dried at 120 °C. The silica nanoparticles were characterized by different techniques. In the Figure 1 can be observed energy dispersive spectra (EDS) and transmission electron microscopy (TEM) images of sugarcane ash waste (A and B) and of silica nanoparticles (C and D). EDS of SAW shows the presence of several different elements (being Si, Fe, Al, P, Cl and S more abundant) and only Si and O were observed after synthesis procedure (Cu signal comes from TEM grid). Transmission electron microscopy image of samples exhibit a drastic alterations of the material size ranging from several micrometers (Fig. 1C) to less than 20 nm (Fig. 1D). The results indicate that was possible to obtain pure silica in a nano- size from waste material to reduce disposal and pollution problems.

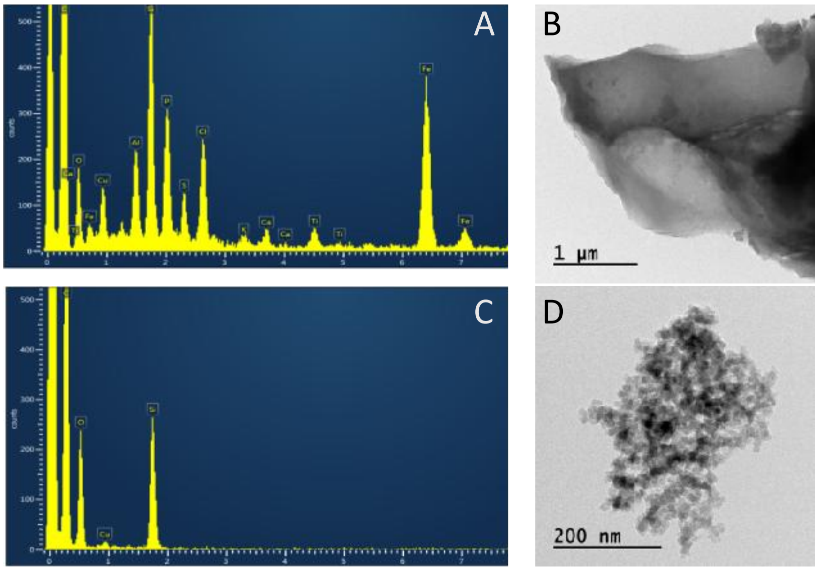

Figure 1. Sugarcane ash waste EDS (A) and TEM image (B) and silica nanoparticles EDS (C) and TEM image (D)

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