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Adsorption of Sudan IV from oily wastewater by using modified activated carbon materials

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A commercial activated carbon (AC: Norit ROX 0.8, D = 0.8 mm) was modified by chemical and thermal processes, following the procedures described elsewhere [1]. The materials were tested as adsorbents for the removal of a lipophilic pollutant, Sudan IV (S-IV), using a biphasic medium (water/cyclohexane) in order to simulate contaminated petroleum mixtures with water [2]. The AC was modified in successive steps considering: (1) grinding and sieving (< 250 µm) and (2) treatment with nitric acid, followed by hydrotreatment with urea and thermal treatment at 800 °C under inert atmosphere, resulting in the adsorbents PAC and PACNAUT, respectively. Adsorption experiments were performed in a 500 mL batch glass reactor, using 2.5 g of adsorbent per litre of organic phase, 2.5 g/L OP. Fig. 1A shows results with different particle size (pₐ), initial S-IV concentration (Cₛ₋IV,₀) and AC modifications. As expected, it can be observed that adsorption is faster when pₐ is smaller. However, the powdered activated carbon (PAC) is not able to adsorb all S-IV in high initial concentration (500 mg/L). This target was achieved with PACNAUT (adsorption of S-IV was 90 % at 1 h and 2.5 g/LOP of adsorbent, higher than the removal observed by other authors [2] at the same time and 4 g/LOP of material). The adsorption kinetics was fitted by a pseudo-second-order model to the data obtained with 500 mg/L of Cₛ₋IV,₀ (Fig. 1B). PACNAUT has higher adsorption capacity (qₑ) and rate constant (kₛ).

Fig. 1. Removal of S-IV in runs performed with different pₐ, Cₛ₋IV,₀ and adsorbents (A) and kinetic model fitted for the experiments carried out with PAC and PACNAUT materials at Cₛ₋IV,₀ = 500 mg/L (B).

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