Process development for the adsorption/desorption of pharmaceuticals and other organic pollutants from industrial wastewater

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Water contamination caused by hazardous organic compounds, represents a serious environmental problem that requires urgent actions. As first, the development of robust, efficient, economically viable and environmentally friendly water treatments should be considered. Due to the simple design, low cost, and easy operation towards noxious pollutants, adsorption can be considered a method of choice [1]. Moreover, activated carbon (AC) has been globally recognized as the oldest, widely used and most popular adsorbent in water and wastewater treatments [2]. The investigation carried out in this doctoral thesis aimed to evaluate the potential application of specific AC as an adsorbent in highly polluted wastewater with polyphenols (PP) and other corkwood extracts, phenolic compounds (PC) and pharmaceuticals, as well as residual veterinary antibiotics in low concentrations.

Specific treatments involving purification/removal, recovery of substances and desorption studies from wastewater were designed. This project comprised three main fields: i) Treatment of cork industrial wastewater (CW) with high chemical oxygen demands (COD) and PP content. A novel flocculation/adsorption method for CW purification and microwave efficient regenerated of spent AC (Figure 1 (a)) have been described [3]. ii) Treatment of aqueous solutions with high concentration X-ray contrast agent Iopamidol (IOP). An efficient adsorption/desorption process of IOP, and recycling of the adsorbent AC via methanol or ethanol elution in a semi-continuous flow mode (Figure 1 (b)) have been reported [4]. iii) Treatment of PC at high concentrations. Different solvents for desorption of 4-nitrophenol were carried out in batch (Figure 1 (c)) and semi-continuous flow modes, which suggested the desorption feasibility and mechanism. In summary, AC used in this study exhibited excellent results for the high concentration organic removal and the efficient recovery from aqueous solution or wastewater.

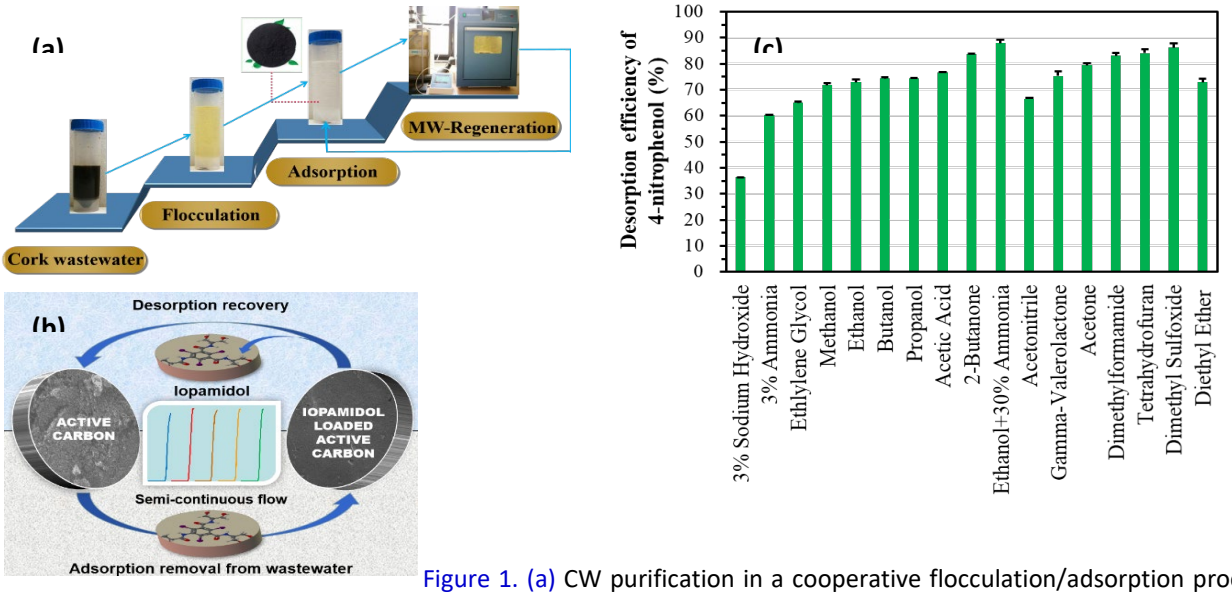

Figure 1. (a) CW purification in a cooperative flocculation/adsorption process with microwave-regenerated AC; (b) Adsorptive recovery of IOP from aqueous solution and reuse of AC; (c) Desorption of 4-nitrophenol from spent AC with solvents.

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