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GREEN CARBONACEOUS ADSORBENTS DERIVED FROM THE PYROLYSIS OF WEEE PLASTICS

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PURPOSE OF THE ABSTRACT

GREEN CARBONACEOUS ADSORBENTS DERIVED FROM THE PYROLYSIS OF WEEE PLASTICS

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Abstract

In the last decades, waste of electric and electronic equipment (WEEE) has become a rapid growing waste stream, from which the recycling of many plastic parts is no feasible by mechanical methods and are commonly landfilled or incinerated. Thermal and chemical recycling is being regarded as a feasible alternative for such kind of complex polymeric waste streams. Among all the existing possibilities, pyrolysis, an already well-established process (TRL9), stands out for its capability of generating valuable products with high industrial interest. These products are divided into three different phases that determine their use: 1) Gas, composed of light hydrocarbons, hydrogen and carbon monoxide/dioxide, has the potential to be used as fuel. 2) Liquid, tars and oils, can be used as fuel or secondary raw material in the petrochemical industry, if their characteristics satisfy the environmental regulations. 3) Solid, a mixture of char and inorganics coming from the feed, could fulfil some applications of carbon, such as reducing agent, fuel or adsorbent.

In this study, three plastic rich samples (A, B and C) coming from different stages of a WEEE recycling industrial plant were pyrolyzed in order to determine the possible application of the pyrolysis solids as adsorbents of antibiotics in liquid phase. The hypothesis of the study was to produce a carbonaceous material from non-recyclable waste to be use as a green adsorbent of drug residues in water, an emerging concern in wastewater treatment plants. Pyrolysis parameters were 500 °C reaction temperature, 15 °C/min heating rate and 30 minutes dwell time. Under these conditions the solid yield ranged 20.8, 29.1 and 52.5 %wt. for A, B and C samples, respectively. The surface area of the obtained carbonaceous solids was 133.4, 89.1 and 36.7 m2/g for the samples A, B and C respectively, from which 90 % corresponded to micropores.

The green adsorbents were tested with six different antibiotics from the penicillin family (?-Lactam antibiotics). For the test, 0.5 g of adsorbent were added to 10 mL of water solution containing 10 µg of antibiotic and were stirred for 1 h at 140 rpm, with the intention of emulating the conditions of the agitation tanks where tertiary treatments are carried out in wastewater treatment plants. The adsorption efficiencies was in the range of 98-100 % for the adsorbent coming from sample C, 64-81 % for that of sample B and 10-48 % for the pyrolysis solid derived from sample A. These results show the enormous potential that pyrolysis solids coming from the pyrolysis of WEEE plastics can have as liquid phase drug adsorbents and open the door to future research in this area.

FIGURES

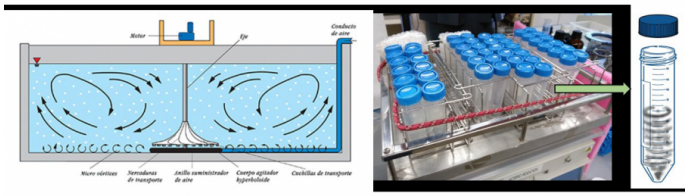

FIGURE 1

FIGURE 2

Figure 1

Simulation of an agitation tank in the laboratory

KEYWORDS

WEEE | pyrolysis | adsorbents | antibiotics

BIBLIOGRAPHY