REMOVAL OF ESTROGENS FROM WATER USING ACTIVATED CARBON OBTAINED FROM OLIVE STONES

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INTRODUCTION

Micropollutants are natural or synthetic substances that are continuously released to aquatic environments that, even present at very low concentrations, such as µg/L or ng/L, can present adverse effects to the environment [1]. Micropollutants include a huge range of compounds such as pharmaceuticals, hormones, cosmetics, disinfectants, pesticides, among others [2]. Estrogens are hormones that can be found naturally in fish, reptiles, birds, and mammals. The main therapeutic molecules of estrogens are 17β-Estradiol, Estriol and synthetic 17α-Ethinylestradiol normally used as contraceptives [3]. When present in water bodies, they can represent an environmental and health problem since traditional sewage and drinking water treatment plants are not able to remove or degrade this pharmaceutical compounds.

This work will present some experimental studies for the removal of estrogens by adsorption using biomass-based materials, namely different types of activated carbon, obtained using olive stones as carbon source.

METHODOLOGY

Five different activated carbon materials were obtained from olive stones, namely the original granulated olive stones, chemical activation with acid or base, carbonization and pyrolysis (Figure 1). Then some physicochemical properties were measured as frequency distribution of olive stone particle size, carbonization yield, FTIR of adsorbents end pH_{PZC} .

RESULTS

The olive stone particles, after grinding, had a predominant diameter of 188 mm (Figure 2), and we obtained a mean sauter diameter of 162.4.The moisture in the olive stone was 12.13% ± 0.08 and the ash content was 1.09 ±0.08. From Table 1, the production method of carbons significantly influences the carbonization yield, with the method with the highest yield being the one carried out by acid activation (57.45%). The adsorbents production method also influences the pH_{PZC} of the adsorbents, being more expressive by the acid activation with the lowest pH_{PZC} (3.84).

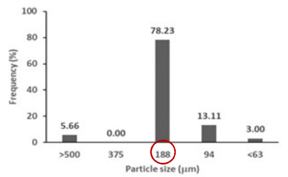

Fig. 2. Frequency distribution of olive stone particle size

Table 1. Carbonization yield (Y) and pH_{PZC} of different adsorbents

Adsorbent	Yield(%)	pH_{PZC}
OS	nd	5.43 ± 0.13
CC	26.86 ± 0.85	8.46 ± 0.03
CP	23.03 ± 1.81	8.64 ± 0.02
CA	57.45 ± 2.88	3.84 ± 0.05
CB	33.86 ± 1.71	8.92 ± 0.04

OS: ground olive stone; **CC**: carbonized olive stone; **CP**: pyrolysis olive stone; **CA**: acid-activated olive stone and **CB**: base-activated olive stone.

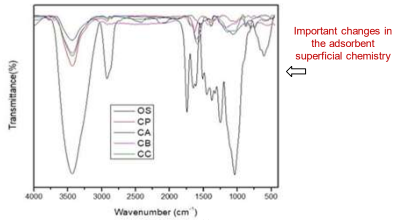

Fig. 3. FTIR analysis of the 5 different adsorbents

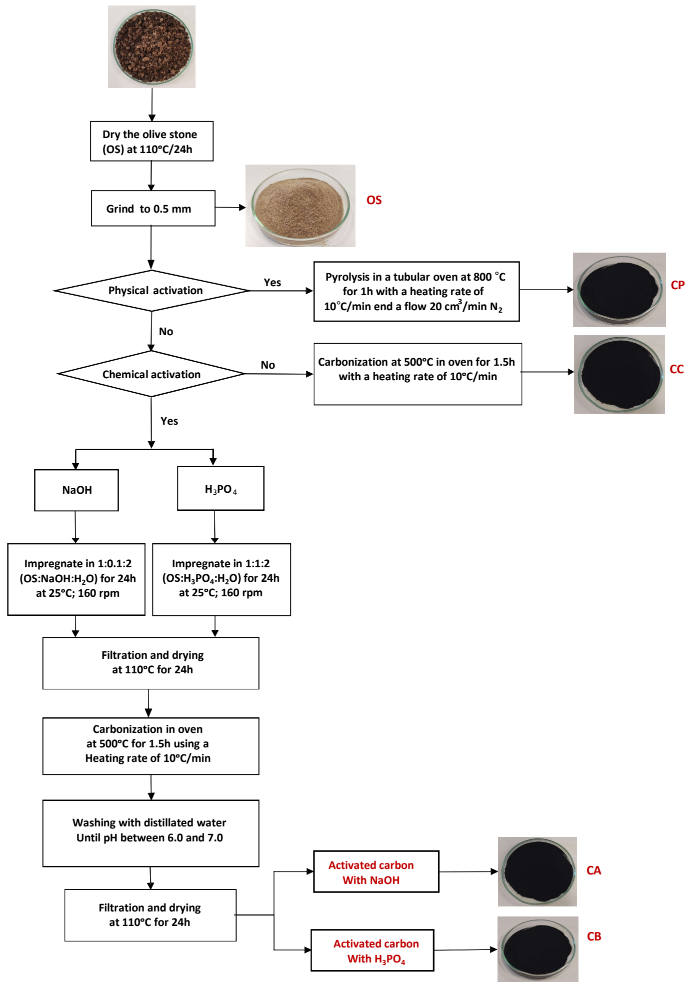

Fig. 1. Adsorbent production flowchart

CONCLUSIONS & ONGOING WORK

Five different types of biomass-based adsorbent were prepared and some of the main physicochemical parameters were measured. The raw material obtained from olive stones has a particle size average of 188 µm. The obtained yield was 35.3% (in mass) and depednding of the activation method, the obtained OSAC show different Zero Charge pH values. The superface chemical analysis of the five adsorbents using FTIR also show important variation with the type of adsorbent activation method. Equilibrium adsorption isotherms and the adsorption kinetics for the removal of estrogens from water are current in study.

References

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Acknowledgments

The authors are grateful to the Foundation for Science and Technology (FCT, Portugal) for financial support through national funds FCT/MCTES (PIDDAC) to CIMO (UIDB/00690/2020 and UIDP/00690/2020) and SusTEC (LA/P/0007/2021). J.L. Diaz De Tuesta acknowledges the financial support of “Comunidad de Madrid” (Spain) for the individual research grant 2020-T2/AMB-19836.

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