



Biodegradability enhancement and detoxification of cork processing wastewater molecular size fractions by ozone



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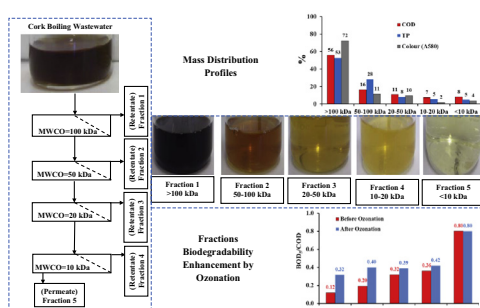
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HIGHLIGHTS

- The fraction with molecular size >100 kDa corresponds to 56% of the organic load.
- Molecular size of pollutants is a major constraint to biodegradability.
- Ozone efficiency for improving biodegradability increases with molecular size.
- To raise biodegradability by ozonation the best outcome was with compounds >20 kDa.

GRAPHICAL ABSTRACT



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ABSTRACT

Cork boiling wastewater pollutants were fractionated by sequential use of four ultrafiltration membranes and five fractions were obtained: four retentates (>100, 50–100, 20–50 and 10–20 kDa) and one permeate (<10 kDa); which were used to study the correlation of molecular size with biodegradability and toxicity before and after ozonation. The results show that molecular size is correlated with organic load and restrains biodegradability. The fraction with >100 kDa corresponds to 56% of the organic load and the one with <10 kDa only 8%. The biodegradability of fractions increased 182% with fractions molecular size reduction from >100 to <10 kDa and the chemical oxygen demand (COD) was from 3436 to 386 mg L⁻¹. For biodegradability enhancement the best outcome of ozonation was obtained with compounds having molecular size >20 kDa and range from 5% up to 175% for applied ozone doses to COD ratios between 0.15 and 0.38.

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1. Introduction

Cork is a natural, renewable and biodegradable material produced from the bark of the cork oak (*Quercus suber* L.). Close to 15% of the overall production is used to manufacture stoppers, the most valuable product of cork industry (Pereira, 2007). The

acceptance of cork products can be improved if cork production and transformation are perceived as highly environmentally sustainable activities and this way contribute to the preservation of more than 2.2 million hectares of natural forest ecosystem in Mediterranean countries (APCOR, 2012). After extraction, the corkwood is dried and subsequently immersed in boiling water for 1 h. This first stage of the cork industrial processing, focused on the cleaning, disinfection and moistening of the raw material, raises some environmental concerns due to the high specific water consumption and organic load of biorecalcitrant nature of the effluent. In high quality products, it is crucial to ensure the absence of organic contaminants in corkwood, therefore the reuse of process hot

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