



Contribution ID: 151

Type: Poster

Application of Ionizing Radiation for Treatment and Valorization of Cork Wastewater

Wednesday, 26 April 2017 14:15 (2 hours)

The wastewater produced from cork industry has a high concentration of undesirable cork extracts such as phenolic acids, tannins and 2,4,6-trichloroanisol. These compounds are difficult to degrade by conventional treatments, which make this water a toxic and recalcitrant effluent that constitute a risk for the ecosystem and require treatment before being discharged into the environment. This work represents a comprehensive study of the use of gamma radiation as an advanced oxidation process for wastewater treatment. This work was carried out aiming to degrade recalcitrant compounds, although it was also assessed the potential valorization of the cork industry wastewater through the selected recovery of the valued antioxidants. The irradiations were performed at room temperature in a Co-60 chamber at the absorbed doses: 20, 50 and 100 kGy and dose rate range of 1.6-2.4 kGyh⁻¹. pH, COD, BOD and TSS were determined according to the Standard Methods for the Examination of Water and Wastewater. Total Phenolic content (TP) was quantified by Folin-Ciocalteu method. The antioxidant activity was measured by DPPH radical scavenging activity, reducing power and inhibition of β -carotene bleaching. The identification of the phenolic compounds and its radiolytic products was carried out by HPLC-DAD-ESI/MS. To test the hypothesis that the radiolytic effect of gamma radiation could promote the biodegradability of phenolic acids products, microbial culture growth experiments were performed using a microbial population of four bacterial strains naturally present in cork wastewater sedimentation tank samples. Recovery studies of antioxidant compounds present in cork wastewater were carried out at adsorption/desorption experiments using a synthesized mesoporous carbon. The toxicity of irradiated cork wastewater and its radiolytic products was evaluated by cellular growth inhibition method using different prokaryotic and eukaryotic cells.

Cork wastewater indicated a low pH of 5.14, a high value of COD (2903 mgO₂L⁻¹) and a low biodegradability (BOD₅/COD=0.136), that can be explained by the presence of hardly biodegradable natural compounds. The TSS and TP values are 134 mgL⁻¹ and 680 mg gallic acid L⁻¹, respectively. The most abundant phenolic compounds identified were: gallic, protocatechuic, vanillic and syringic acids, that presented high antioxidant activity. After irradiation, the results suggested that gamma radiation is a potential technology for wastewater treatment. The BOD and TSS values are greatly reduced ($\geq 45\%$) at 100kGy. TP and antioxidant activity increase around 33% which opens the possibility of recovery of the added value compounds to be utilized in other industries. Concerning adsorption/desorption studies it was achieved a 40% recovery of vanillic and syringic acids using the activated carbon. Non-treated cork wastewater seems to be non-toxic for the majority of the studied cells. Gamma radiation treatment affected the toxicity of cork compounds for prokaryotic and eukaryotic cells, which could be related to a cytotoxicity effect of radiolytic products of cork compounds. Further studies are being carried out to understand these radiolytic mechanisms and alternative adsorbents will be tested for selective extraction of the valuable antioxidants.

Country/Organization invited to participate

Portugal

Primary author: Ms MADUREIRA, Joana (Instituto Superior Técnico, Portugal)

Co-authors: Ms PIMENTA, Andreia (Instituto Superior Técnico, Portugal); Ms MARGAÇA, Fernanda (Instituto Superior Técnico, Portugal); Ms MELO, Rita (Instituto Superior Técnico, Portugal); Ms CABO VERDE, Sandra (Instituto Superior Técnico, Portugal)

Presenter: Ms CABO VERDE, Sandra (Instituto Superior Técnico, Portugal)

Session Classification: P-A1

Track Classification: MITIGATING THE IMPACT OF CLIMATE CHANGE