WASTE UTILIZATION FROM FOOD PRODUCTION AND PROCESSING AS BIOSORBENT FOR TREATMENT OF WATERS POLLUTED WITH HEAVY METALS

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Introduction

Increased agricultural production, food production and processing lead to the large amounts of organic solid wastes and residues which require adequate disposal. Instead, the organic solid wastes should be evaluated in terms of sustainability. Recently, there is a growing interest in designing the low-cost, non-hazardous and easily accessible materials as sorbents in removal of various harmful substances from wastewater. Finding proper low-cost sorbent with good sorption properties is quite challenging.

Experimental part

In this research the several solid organic wastes (Fig. 1) were collected from local food producers in order to estimate their sorption efficiency in lead (Pb) and zinc (Zn) removal from aqueous solutions.

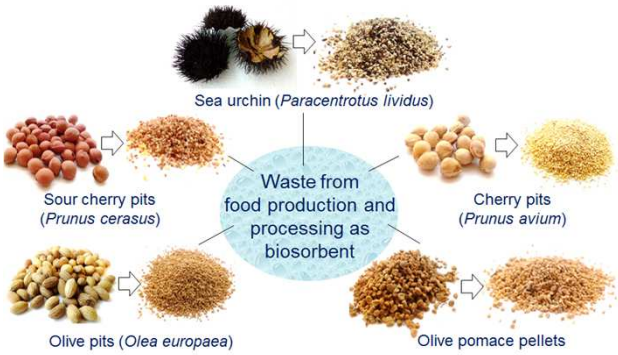

Figure 1. Different biosorbents from food production and processing.

The experiments were performed in batch mode by mixing of 1 g of each biosorbent with 100 mL of Pb or Zn solution in laboratory shaker at 250 rpm, for 24 h at ambient temperature.

The experiments were monitored by determination of equilibrium Pb and Zn concentrations and pH in supernatants.

Results & Discussion

The sorption results of Pb and Zn onto different biosorbents are shown in Figures 2 and 3. According to the results obtained (Fig. 2), the decrease in initial (c_o) Pb and Zn concentration has been obtained for all tested biosorbents. The sorption efficiency (Fig. 3) for Pb is in the range ≈ 13 - 36% and follows olive pomace pellets < sea urchin < cherry pits < olive pits < sour cherry pits, while for Zn is in the range ≈ 17 - 38% and follows olive pits < olive pomace pellets < sour cherry pits < cherry pits < sea urchin. Thus, the best removal of Pb is achieved on the sour cherry pits, while of Zn onto cherry pits and sea urchin.

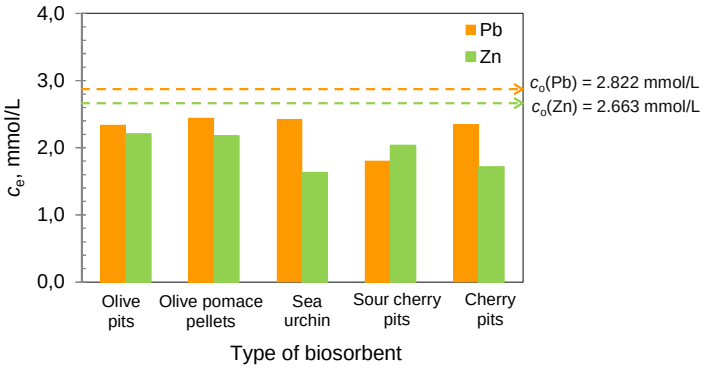

Figure 2. The equilibrium concentrations of Pb and Zn after sorption onto different biosorbents.

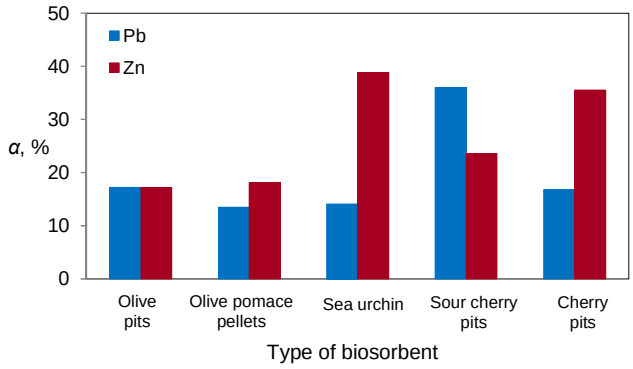

Figure 3. The removal efficiency of different biosorbents for Pb and Zn.

The sorption process was also monitored by analysis of equilibrium pH (pH_e) in Fig. 4, since pH is very important parameter that can change the surface properties of biosorbents, cause the formation of sorbate-hydroxy species and thus affecting biosorbent selectivity and removal efficiency.

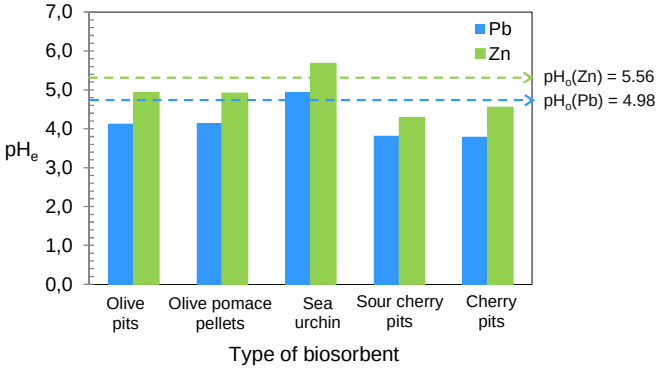

Figure 4. The equilibrium pH values after sorption of Pb and Zn onto different biosorbents.

Regarding the pH_e values (Fig. 4), there is no significant changes compared with initial (pH_o) values of Pb and Zn solutions. The most important, all values are in a slightly acidic area in which Pb and Zn precipitation doesn't occur.

Conclusion

These preliminary results demonstrate the solid waste and residues from food production and processing as potential biosorbents for cost-effective treatment of wastewaters contaminated with Pb and Zn.

In order to increase removal efficiency it is necessary to perform multistep sorption or biosorbents surface modification.

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