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Adsorption isotherms and kinetics of rare earth metals on multifunctional materials from various waste pomaces

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This contribution presents the preliminary results obtained using waste biomasses from the industrial food chain for the preparation of multifunctional materials possibly able to detect, bind and extract, efficiently and selectively, rare earth metal ions from aqueous solutions simulating real matrices. These metals belong to the list of "Critical Raw Materials", *i.e.* the group of materials whose recovery is considered strategic by the European Community[1]. The use of food-processing industry wastes as secondary raw materials offers a sustainable and environmentally friendly approach, that could also be useful for the rare earth metals recovery. In particular, the adsorption of neodymium and dysprosium ions in aqueous solution was studied at pH ~ 5 and t = 25°C using different waste biomasses, namely Bergamot Pomace (BP), Olive Pomace (OP) and Grape Pomace (GP), chemically pretreated at t = 30°C with H_2O and HNO_3 0.10 mol dm^{-3} [2,3]. The materials were characterized employing different analytical techniques; through the FT-IR ATR spectroscopy [2], it was possible to confirm the presence of functional groups capable of interacting with the above mentioned metals. To evaluate their adsorption capacity, batch experiments were carried out on different solutions containing the metal ions (M^{3+} = Nd^{3+}, Dy^{3+}). The concentration of each M^{3+} was determined by ICP-OES [4]. The results obtained from adsorption experiments show that Langmuir equation was the best isotherm fitting model for BP, OP and GP for the rare earth metals adsorption. The adsorption equilibrium was reached within 24 hours and the kinetic of adsorption was well described by the pseudo-second order model. Then the recovery of the metals adsorbed on the biomasses was carried out using HNO_3, but the reused materials show lower performance than the starting ones, exception done for BP, which showed great reutilization capacities [4].

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