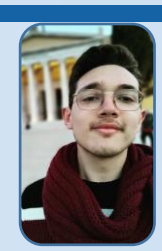
Valorization of waste bittern through the recovery of traces elements



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Desalination and Water Treatment

Concept

The purpose of this Ph.D. project is to analyze the possibility of recovering trace elements (TEs) from real salt bitterns. These will be carried out by adsorption on a bed of selective sorbents.
In order to achieve and ensure the highest recovery, an innovative separation unit will be developed by employing the technique of pH Swing Adsorption (pH-SA).
The idea is to promote the adsorption phase by using a basic environment to form complexes with the sorbent material thus trapping the elements of interest in the solid matrix. The desorption phase consists of an inversion of the pH of the system destroying all metal-sorbent bonds and thus releasing the metals of interest.
As a side project, bittern ultrafiltration as a technology for carotenoid separation will be investigated. The retentate stream, rich in organic compounds, will be further processed in order to optimize recovery with laboratory-scale processes.

Scientific Approch

For the recovery of trace elements, adsorption-desorption tests using real brines will be conducted. The adsorption capacity of the resins will be evaluated by analyzing the amount of minerals released from the resin during desorption step.
In addition, a sensitivity analysis will be performed to evaluate the behavior of the resin as the main operating factors (flow rate, concentration, pH) change.
Field measurements may also be carried out by investigating alternative methods for the determination of the above minerals. One of these could be the spectrophotometric analysis (UV – VIS) for the Boron and Cobalt detection.

For the side project, the recovery of carotenoids will be investigated using different organic solutions in which they are soluble. Different techniques (centrifugation, freeze-drying, sonification, …) will be used to optimize the main process parameters.

Research Objectives

By developing pHSA technology, it could be advantageous to recover TEs from brines using equipment with low specific energy consumption. This would make the technology applicable to many other treatment chains, reducing the approvals of critical raw material from sites with higher environmental impact.

An additional factor is added to the enhancement of sea bitterns: carotenoids. Their recovery would lead the bittern to become a source of raw material for other industries such as the pharmaceutical industry. To enable this, an optimized process scheme for their recovery will be proposed.