Waste water treatment using fish by-products

C. Piccirillo,[1] S.I. Pereira,[1] A.P.G.C. Marques,[1] R.C. Pullar,[2] M.E. Pintado,[1] P.M.L. Castro[1]

[1]: CBQF/ESB, Universidade Católica Portuguesa, Porto, PORTUGAL.
[2]: CICECO, Universidade de Aveiro, Aveiro, PORTUGAL.

Introduction

Heavy metal pollution

- Heavy metal pollution is a problem of growing concern, as heavy metals are employed in several industries (i.e. electroplating, batteries production, mining, leather working).
- Heavy metals can be very harmful for both humans and environment.
- Effective methods for their removal from wastewaters have to be implemented.

Use of phosphates

- Phosphates-based compounds can be used for heavy metal removal.
- They form insoluble compounds with many heavy metals.
- Hydroxyapatite $Ca_{10}(PO_4)_6(OH)_2$ is the most effective remover.

Use of microorganisms

- Particular bacterial strains, resistant to heavy metals, can also be employed for heavy metal removal.
- Bacteria are more effective if immobilised on an appropriate matrix.

Work presented here

- Hydroxyapatite (HAp) of natural origin was used for removal of cadmium (II) and zinc (II).
- A bacterial strain is immobilised on HAp surface to improve the removal efficiency (synergistic action between HAp and bacteria).

Materials and Methods

- HAp was extracted from fish bones [1].
  - Atlantic cod fish (Gadus morhua) was used.
  - Bones were calcined at 600 ^{o}C, the powder was then pressed into pellets.
- *Microbacterium oxydans* (EC29) was immobilised on the pellet surface.
  - EC29 is resistant to heavy metals [2].
  - The immobilisation was performed with literature reportted method [3].

Results and Discussion

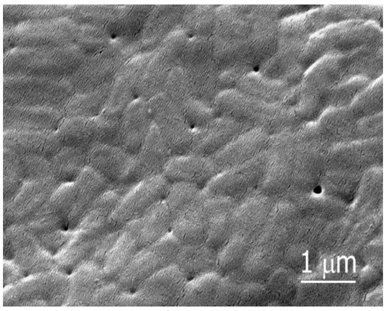

Figure 1. SEM micrograph of EC29 bacteria immobilised on HAp pellet.

- EC29 was successfully immobilised on HAp surface.
- A uniform film, with almost no discontinuity was obtained.

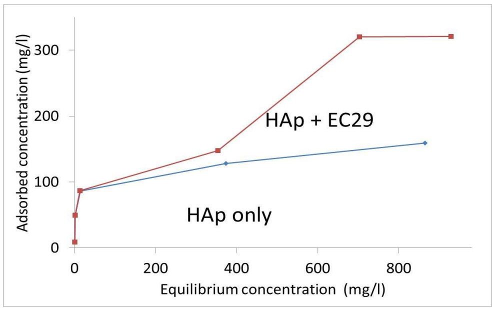

Figure 2. Adsorption isotherms for Zn (II) with HAp only and HAp with EC29 strain on its surface.

- The adsorption isotherms for both Zn (II) and Cd (II) showed improved efficiencies when EC29 was used.
- More than a two-fold increase was observed for the maximum adsorption capacity values.

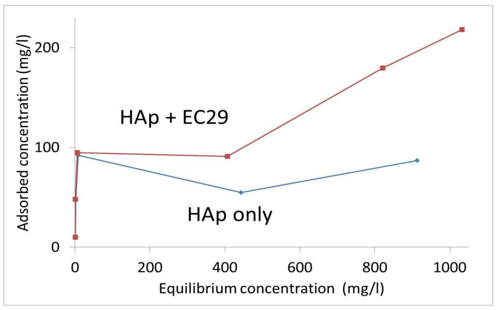

Figure 3. Adsorption isotherms for Cd (II) with HAp only and HAp with EC29 strain on its surface.

	Xm value (mg/g)
HAp only Zn (II)	7.93
HAp + EC29 Zn (II)	16.05
HAp only Cd (II)	4.05
HAp + EC29 Cd (II)	10.12

Conclusions – Future work

- HAp of natural source (cod fish bones) was successfully employed for removal of Zn (II) and Cd (II).
- The removal efficiency was improved with the use of a bacterial strain (*Microbacterium oxydans*), for a synergistic action between HAp and bacteria.
- More heavy metal resistant bacteria will be considered; samples containing both metals will also be tested.

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