Heavy metals removal by flax fibers to a further use in urban runoff management systems

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CONTEXT

- **Stormwater management** is currently of a big issue in urban areas.
- With the **increasing urbanisation,** stormwater runoff volume became very important.
- **Traditional systems** can **no more handle** the large amounts of water volumes generated by stormwater.

- **Furthermore,** stormwater runoff gets loaded of various **pollutants**:
  - ✓ Heavy metals (Pb, Cr, As, Hg, Cu, Fe, Zn…)
  - ✓ Nutrients
  - ✓ Polycyclic aromatic hydrocarbons
  - ✓ Petrolium hydrocarbons
  - ✓ Suspended solids

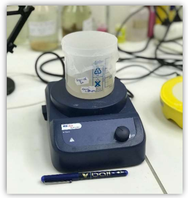
- **Therefore, New techniques** have emerged in order to manage stormwater to the source of pollution, as vegetative swales and Bioretention or biofiltration systems. This study is a preliminary one of the implementation of a filtration system composed of granular material and **flax** geotextiles.

EXPERIMENTAL APPROACH

- This study consists of the use of **flax fibers** as biosorbent to remove zinc, copper and lead ions from artificial contaminated aqueous solutions, in **two** types of systems **monometal** and **ternary metal ions systems**.

Flax plant

Flax fibers cut into small pieces 0.2 – 2 mm



A batch trial on magnetic agitator

- The objectives are to evaluate the adsorption capacity of this biosorbent and also investigate the competition phenomenon which may take place when metals are added simultaneously.

- The **experimental approach** consists of carrying **batch experiments** under **magnetic agitation** at different concentrations of heavy metals, different contact times, different values of pH, and different concentrations of biosorbent. The solutions are **filtrated** and **acidified**, and the samples concentrations **analysed** by **ICP-AES machine** at COBRA laboratory.

PRELIMINARY RESULTS

- The **biosorption kinetic** of the three metals showed a favourable adsorption onto flax fibers.

- The **biosorption kinetic** was also very quick for the three ions in both systems, and reached equilibirum at a contact time of 60 min.

- **Heavy metal removal** was generally higher in the monometal system than in the ternary system.

- **Zn removal** was significantly higher in the **monometal** solution (81.8% and 62.0% respectively).

- **Cu removal** was 75.4% and 80.1% respectively in the ternary and monometal ion solution.

- However, **lead** showed quite **the same heavy metal removal** in the two tested conditions and was about 94%.

- These **kinetic data** were afterwards fitted to the **pseudo-first order** and **pseudo second-order kinetic models**, and **intraparticle diffusion model** for further description of the biosorption process onto flax fibers.

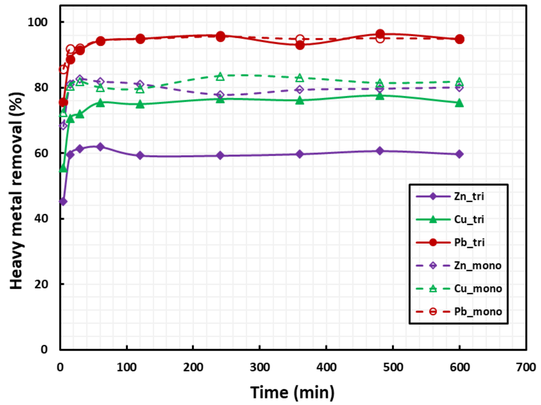


Figure 1. Kinetics of zinc, copper and lead biosorption onto flax fibers, at a metal concentration of 0.045 mmol.L^{-1} pH about 6.4 and biosorbent concentration of 2 g.L^{-1}.

CONCLUSION

- Flax fibers have been shown a very good biosorbent to remove zinc, copper and lead.
- Biosorption kinetics showed a quite quick saturation of biosorbent sites.
- Biosorption was shown more efficient in the monometal ion solution than in the thernary metal solution.
- Zinc was the most affected ion by the presence of other ions.
- Lead was the most retained ion and the less affected by competition.

ACKNOWLEDGEMENT

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