An eco-friendly sorbent for removing heavy metals from water

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1. Introduction – Among manganese oxides naturally present in the environment, birnessite is particularly interesting because of its very open and "malleable" lamellar structure. Thus, it has great sorption and cation exchange capacities [1] that are why this compound is interesting to develop decontamination processes. But, birnessite is a complex material because of a multitude of parameters (Mn (III)/Mn (IV), cation ...) [1] that can affect its reactivity. Thus, it is imperative to perfectly control the material to optimize the sorption processes,
For that, we have chosen to synthesize birnessite by electrochemistry because this method, in addition to being reproducible and inexpensive, allows to obtain in mild conditions adhering films of pure compounds, well crystallized and very homogeneous [2].

2. Experimental - Firstly, we studied the influence of many parameters during electrodeposition that can play directly on the material and its reactivity. Then, the interactions were made with particularly toxic heavy metals such as cadmium, lead, nickel and copper in order to test the sorption capacities of the materials obtained.

3. Results and discussion - The results show that our thin nanostructured films have significant adsorption capacities and higher than the values reported in the literature for birnessite powder [3] which can be explained by the very well nanostructured surface and the high average oxidation state of Mn. Moreover, the total absence of modification after interaction, as illustrated by the Scanning Electron Microscopic observations (SEM), is very encouraging for the intended applications.

4. Conclusion – To conclude, these eco-friendly thin films of birnessite are the real asset to develop innovative devices due to the lack of filtration steps, and therefore clogging problem (energy-consuming), as met with powder.

5. References

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