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The potential of photocatalysis aided by Layered Double Hydroxides for the removal of 4-chloro-L-phenylalanine from water

M.I. Roque [a], M.M. Pereira [a], F. Ghribi [b,c], J. Gomes [a], L. Durães [a], R.C. Martins [a]

[a] University of Coimbra, CERES, Department of Chemical Engineering, 3030-790 Coimbra, Portugal
[b] Centre de Recherche Scientifique et Technique en Analyses Physico-chimiques (CRAPC). Zone Industrielle, BP 384 Bou-Ismail, Tipaza, Algeria
[c] Unité de Recherche en Analyses Physico-Chimiques des Milieux Fluides et Sols (URAPC-MFS), 11, Chemin Doudou Mokhtar, Ben Aknoun – Alger, Algeria

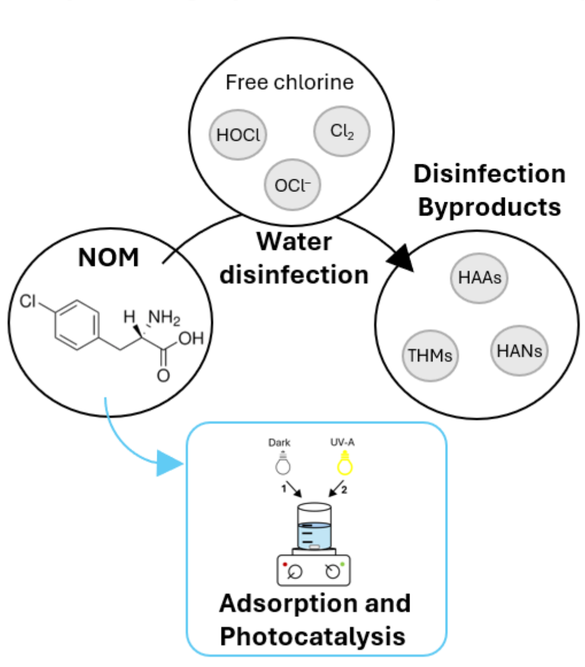
INTRODUCTION & AIM

- Disinfection byproducts (DBPs) result from water disinfection, by the reaction of disinfectants (mainly free chlorine) with natural organic matter (NOM).
- DBPs may have a serious impact in human health leading to the development of several diseases[1].
- Chlorophenylalanine is a well-known precursor of the most found DBPs in water (THMs – trihalomethanes, HAAs – haloacetic acids and HANs – haloacetonitriles).

Treatment alternatives

1. Remove NOM that leads to the formation of DBPs at the early stages of the water treatment process (preferred option);
2. Change the disinfectant used;
3. Remove the DBPs formed at the end of the water treatment process[2,3].

The aim of this work was to degrade 4-chloro-L-phenylalanine (Cl-phe) from water, by adsorption and photocatalysis using layered double hydroxides (LDHs).

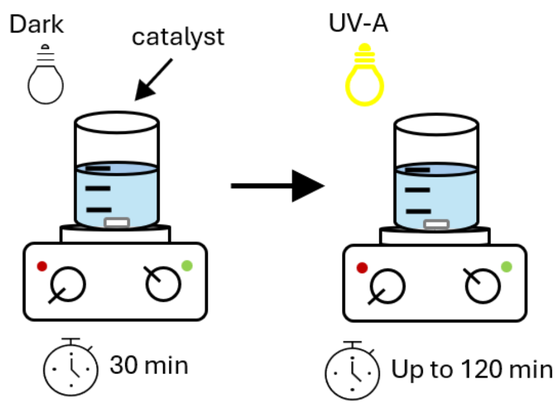


METHOD

Removal of NOM

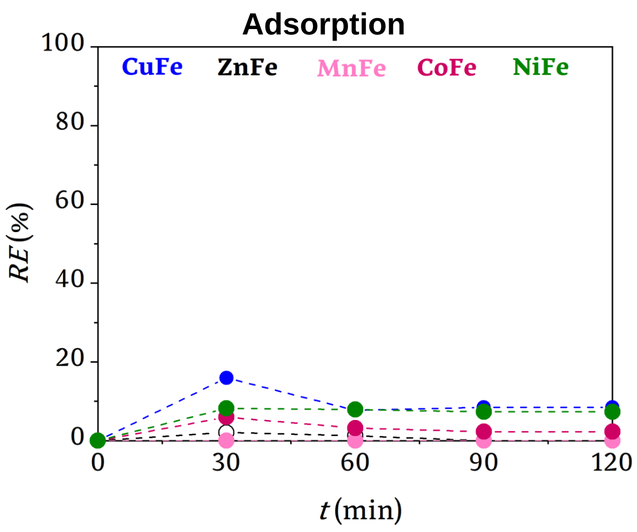
- NOM: 4-chloro-L-phenylalanine (Cl-phe) (10 mg L^{-1});
- Removal techniques: adsorption & photocatalysis (200 mg L^{-1} load);
- Adsorbents/Catalysts: NiFe, ZnFe, CoFe, MnFe and Cu-Fe layered double hydroxides (LDH) obtained by co-precipitation (calcination at 600 ºC); TiO_2;
- Quantification: HPLC-UV Vis with detection at 225 nm.

Tests Methodology



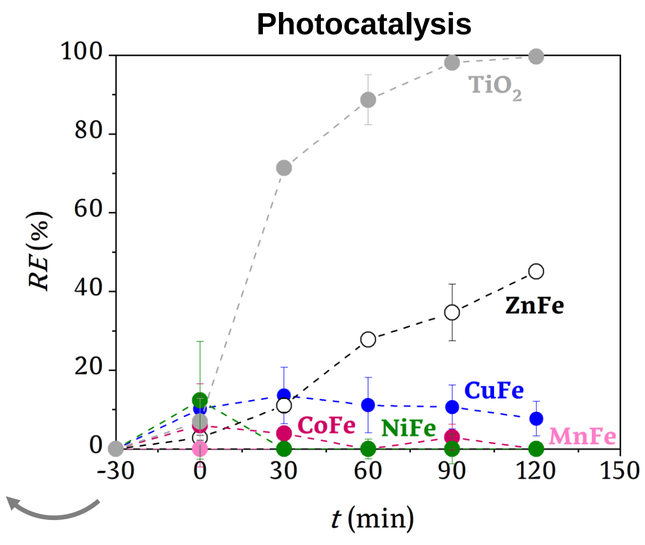
RESULTS & CONCLUSIONS

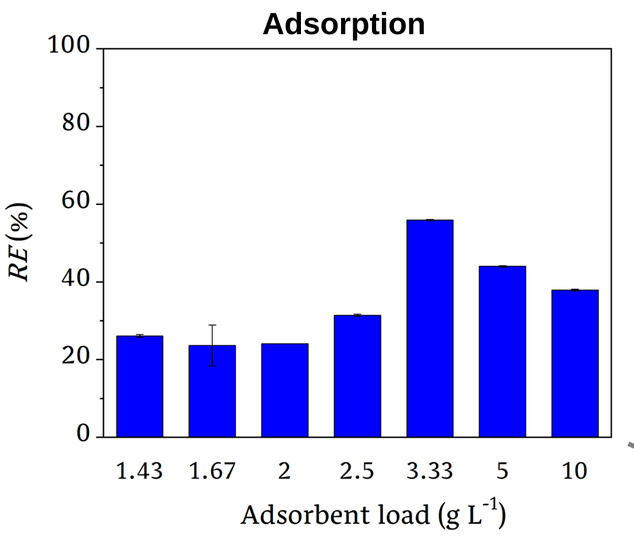
Removal of Cl-phe by the LDHs



The adsorption by the LDH catalysts achieves a maximum at 30 min.

- NiFe and CoFe acted mainly as adsorbents (**12%** and **6%** removals, respectively)
- ZnFe and TiO_2 led to photodegradation of Cl-phe under UV-A light (**45%** and **100%** removal)
- MnFe did not adsorb or degrade Cl-phe
- CuFe led to similar removals during adsorption and photocatalysis (**10-14%**)





CuFe LDH was tested towards the Cl-phe, in **adsorption** with varying loads for **24 h**. This test showed an ability to remove **56%** of the Cl-phe (**10 mg/L**), for a load of 3.33 g L^{-1}.

Most of the developed LDH catalysts showed a removal potential towards Cl-phe, either by adsorption (NiFe, CoFe, CuFe) or by photocatalysis with UV-A light (ZnFe, CuFe).

Future studies will consider changes in the shift to solar light and use of other advanced oxidation processes – Fenton and photo-Fenton.

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