Removal of emerging pollutants with Cyclodextrins-clay composites

Emerging pollutants in aquatic ecosystems

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Summary

It is recognized that a large variety of the organic compounds contaminating the environment can form inclusion complexes with cyclodextrins resulting in enhanced solubility as mentioned in a recent review on cyclodextrins for environmental biotechnologies [x]. Micelle-clay composites have been used for environmental remediation and for the removal of organic pollutants from water [2-5]. In this research we explore the use of cyclodextrins, known to for inclusion complexes and layers onto negatively charged surfaces when combined with cationic surfactants [6-7], to form a composite with clays using similar protocol to the described for micelle-clay composite preparation by Gonzalez-Perez and Macia [8] for the removal of bacteria from water.

(a) Purpose or objectives and status of study or research hypothesis

We work to develop clay-based filters for the removal of key pollutants of emerging concern. We use clay-based composites will be characterization at the Molecular-Scale Biophysics Research Infrastructure (MOSBRI) under the project (MOSBRI 2022-110). This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 101004806. The cyclodextrin-clay composite was prepared according to a protocol described elsewhere for pure micelle-clay composites [5,8]. Concept idea is show by the side.

(b) Key issue(s) or problem(s) addressed

Many pollutants of emerging concern are electrically neutral and cannot be absorbed directly in clays without modification. We developed modified clays using cyclodextrins (known to be able to form inclusion complexes with some key pollutants like bisphenol A) for the removal of pollutants from water [1]. We aim to develop cost-effective filters easy to recycle ensuring sustainability.

(c) Methodology or approach used

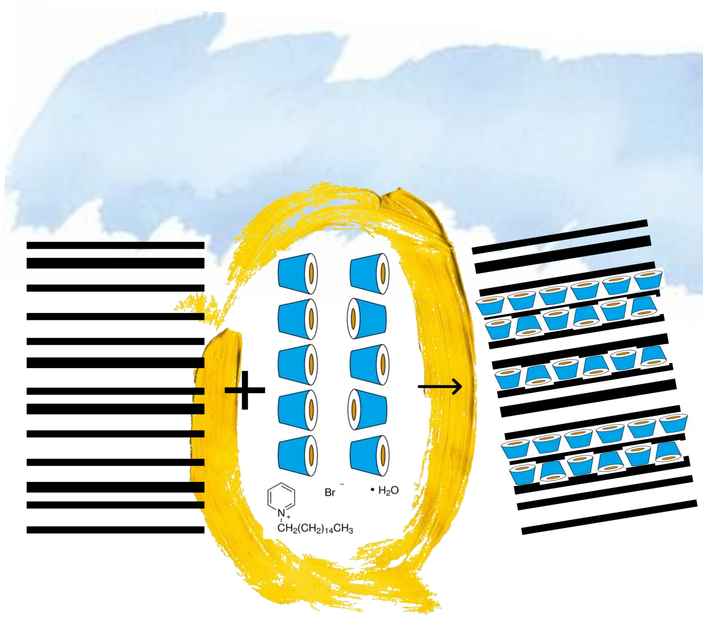
The clay is being modified at different concentrations of cyclodextrins and cationic surfactant that become integral part of the clay by cationic exchange. The modified clay and removal efficiency is being characterized by different techniques (SAXS, FTIR and UV). The preliminary test for the removal efficiency was investigated in cooperation with our partners at the University using Erythromycin and Bisphenol A as a test model pollutant. SAXS characterization of pure micelle-clay composite is show as example of the characterization techniques used in this work.

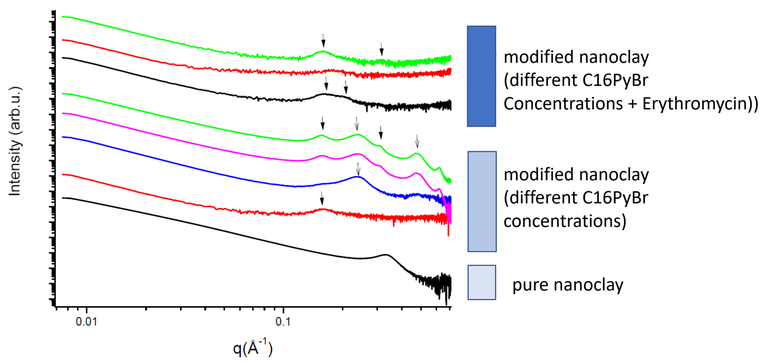
(d) Results and conclusions derived from the project

The modified clay is being characterized under the project MOSBRI 2022-110. SAXS experiments will be provided to confirm the optimal cyclodextrin-surfactant concentration to ensure a functional clay modification for the removal of Bisphenol A. Complementary studies are being done using different techniques (FTIR and UV) to assess the removal efficiency of different samples under investigation. The removal capacity of the composite for the model pollutants was superior for the cyclodextrin-clay composite compared with the micelle-clay composite investigated previously.

(e) Policy implications of the project relevant to the selected conference theme, theory and/or practice

We aim to provide a cost-effective filter that can be reused may times for the removal of small amounts emerging pollutants to maintain clean water bodies and in particular drinking water. If regulation requires the removal of some pollutants of emerging concern, solutions will be available at a reasonable price. The preliminary results are shown to be promising and more systematic work needs to be done to develop a functional filter.





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