Effect of dual anthropogenic stresses on exopolysaccharide production by aerobic granular sludge

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Introduction

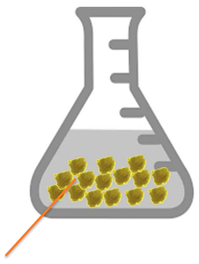
Industrial wastewater streams are difficult to manage due to their complexity, often containing several organic and inorganic compounds, such as toxic/recalcitrant organics, ammonium and inorganic salts.

Aerobic granular sludge (AGS) technology has been widely investigated for the treatment of urban and industrial wastewater and its implementation at full-scale is growing worldwide. AGS is a special type of biofilm, formed via self-aggregation of microorganisms in an extracellular polymeric substances (EPS) matrix. EPS produced by microorganisms are crucial not only for granules formation and stability but also to protect cells against harsh conditions in the living environment which often occur in industrial wastewater streams.

In this study, the combined effect of different anthropogenic substances on the EPS production by AGS was evaluated.

Methods

Short-term batch assays



AGS in synthetic wastewater
* different levels of salt (0-30 mg L^{-1})
* pharmaceutical (diclofenac (DCF) or carbamazepine (CBZ) at 8 mg L^{-1}).

- EPS production and its biochemical characterization
- Pharmaceutical biosorption
- *psi* and *alg* gene expression for exopolysaccharide production

Results & Conclusions

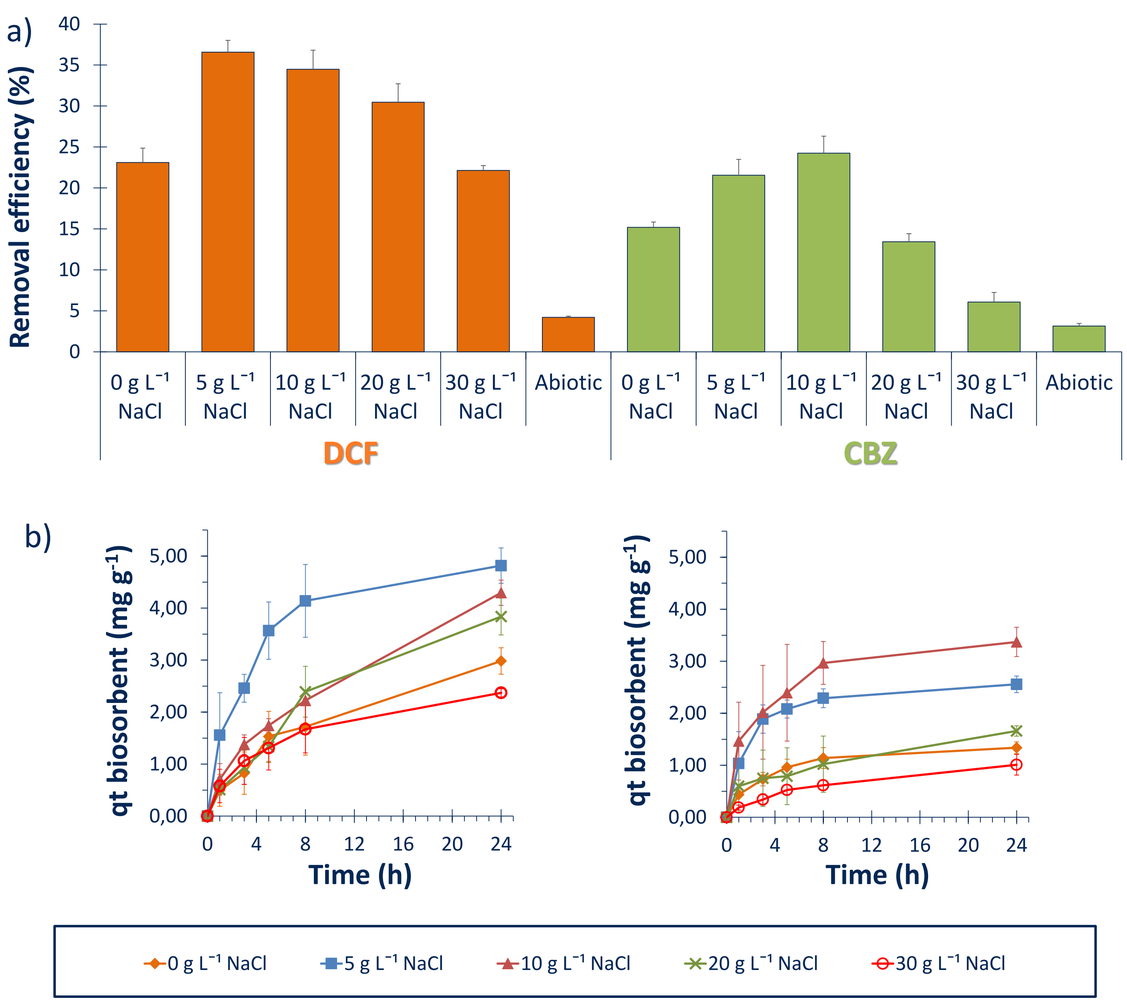


Figure 1 – Removal efficiency (%) (a) and biosorption isotherms (b) of diclofenac and carbamazepine pharmaceuticals onto AGS at different salinity levels.

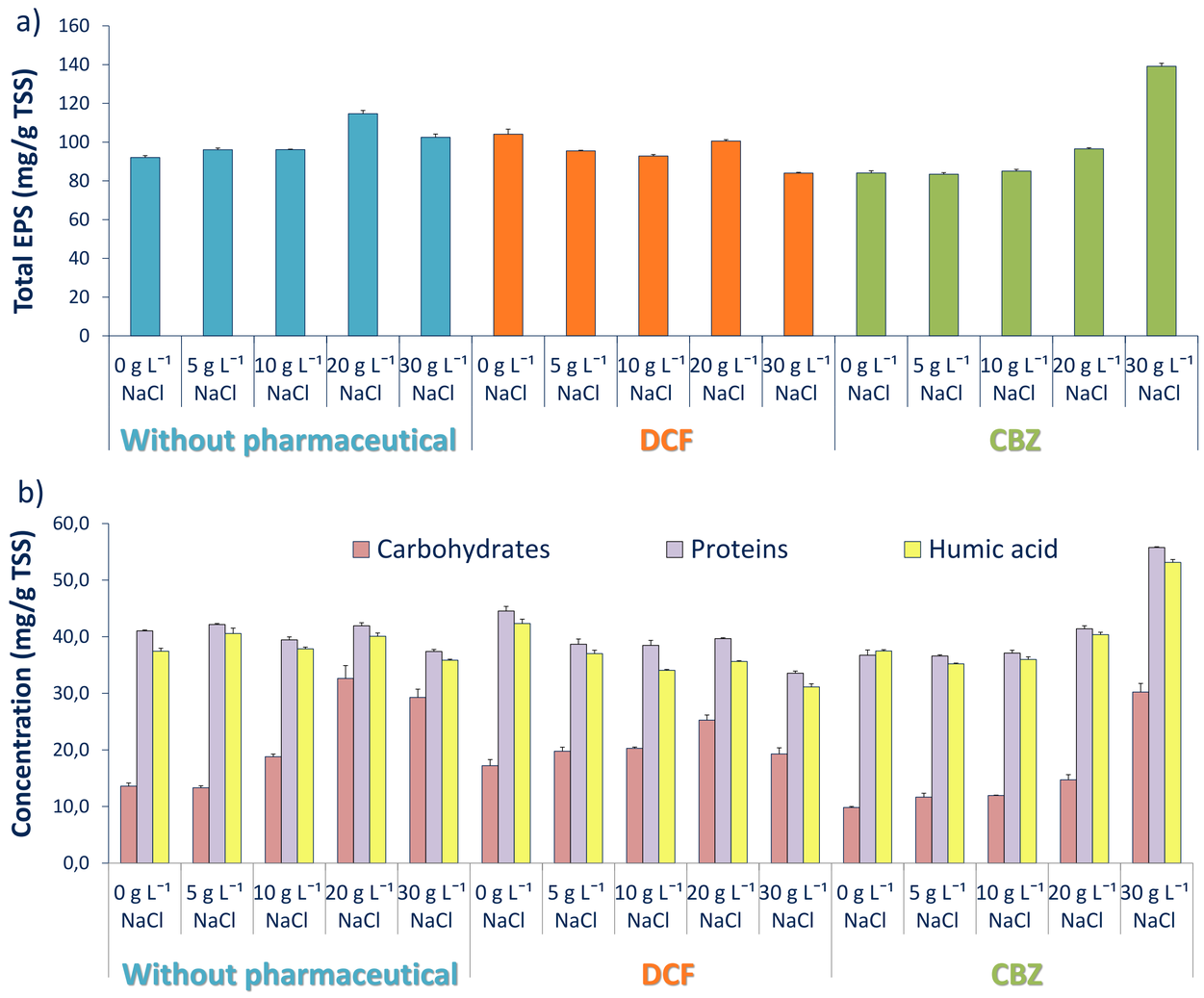


Figure 2 – Short-term exposure effects on EPS production and composition.

- ❑ DCF biosorption capacity was higher than that of CBZ at each salinity level.
- ❑ High biosorption capacity was observed at salinity levels of 5 and 10 mg L^{-1}.
- ❑ Further increase of the salt concentration did not benefit the biosorption.
- ❑ In general, sorption occurred quickly and almost achieved the maximum sorption capacity after 8 h.

- ❑ Overall total EPS content after short-term exposure were similar, except when CBZ and 30 mg L^{-1} of NaCl were simultaneously present.
- ❑ The EPS was mainly composed by proteins and humic acids in each stress condition applied.
- ❑ The carbohydrates content in EPS increased with the salinity level.

- AGS showed better performance to biosorb DCF than CBZ and the salinity level influenced the process.
- The impact of the stressful situations on the levels of transcripts involved in EPS production is under evaluation.
- These data could help to understand the role of EPS on the AGS stress response upon its exposure to anthropogenic sources.

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