

Hydro Nation Scholarship

Can Low Cost Biosorbent Technology be used to Efficiently Remove Steroid Hormones and Pharmaceutical Residues from Wastewater Effluents?

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INTRODUCTION

The adverse effects of

EDCs & pharmaceuticals

- Environmental persistence of endocrine disrupting chemicals (EDCs) and other pharmaceutical residues in water bodies has garnered global attention due to their possible disruptive effects.
- Even at nanogram levels these compounds might increase the risk of cancer, decrease egg and sperm production, reduce gamete quality and elicit negative effects on progeny.

Assessment of current treatment processes

Treatment process	Advantages	Disadvantages
Coagulation (iron or aluminium salts)	no EDCs removal	expensive
Filtration processes (UF, MF, NF),	relatively high EDCs removal	expensive & require a significant maintenance.
Advanced oxidation processes	a high removal of recalcitrant compounds	release many by-products, which estrogenic activities could be higher than their precursors.
Membrane bioreactor	(adsorption & biodegradation processes) a good compromise	

- Therefore, the low cost biosorbent materials with little processing, which not only sorb organic pollutants but also form a platform for enhancing microbial degradation of the pollutant would be more applicable for the removal of EDCs and other pharmaceutical residues, particularly in smaller wastewater treatment systems in rural or semi-rural areas with relatively low effluent flows.

METHODS

- E-SCREEN cell proliferation bioassay to determine toxicity properties and assess removing effectiveness
- Derivatisation GC-MS & LC-MS. to establish a suitably rapid measuring method for target chemicals
- Sorbent characterisation & kinetics & mechanisms
- Optimised biosorbent treatment experiments for real wastewater effluents



RESULTS

- Simple/rapid methods developed for EDCs determination at both sorption modelling level ($\mu\text{g/L}$) and environmental concentrations (ng/L).
- Sorption kinetics and mechanisms of biosorbents for EDCs under controlled (batch and continual flow) conditions.
- Toxicity/oestrogenic properties of any by-products from the treatment process determined by the E-SCREEN bioassay (MCF7-BOS Cell proliferation assay).
- Optimised treatment system for effective removal of EDCs from wastewater outflow.



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