

Harnessing Natural and Biowaste Adsorbents to Eliminate Contaminants of Emerging Concern in Water

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Introduction

- In the ongoing pursuit of environmental sustainability, addressing water quality emerges as a paramount challenge in the 21st century.
 - Conventional WWTP, while effective in treating conventional pollutants, are ill-equipped to eliminate contaminants of emerging concern.
 - Additional treatments are imperative, and among the explored avenues, natural and biowaste adsorbents stand out as a promising but relatively unexplored frontier
 - This exploration delves into the realm of biosorbents, including agro-industrial wastes, wood bark, different types of biomass, as potential agents to removal of contaminants of emerging concern from wastewater
- The aim of this study is to investigate three biosorbents: Chestnut Shells Wastes (CSW), Almond Shells Wastes (ASW) and Expanded Burnt Cork (EBC) as potential materials for the removal of emerging pollutants identified in WWTPs, as well as for their applications as part of nature-based strategies for wastewater treatment and regeneration

Materials & Methods



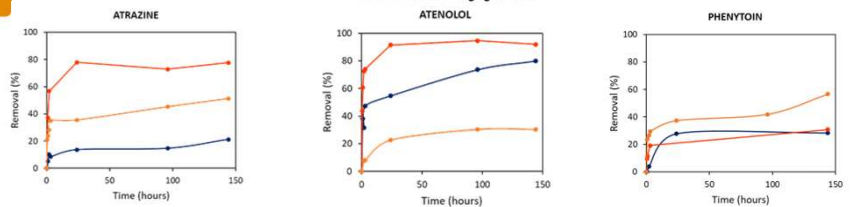
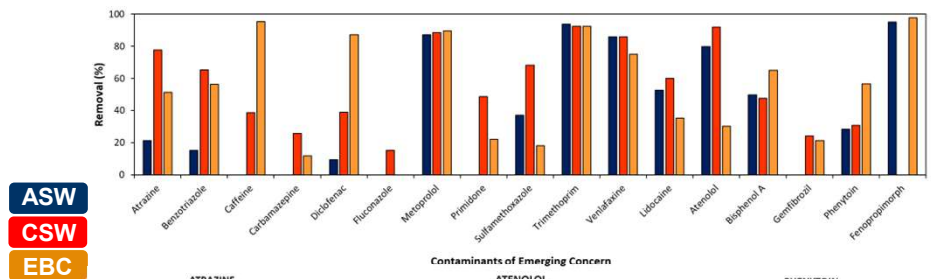
Results & Discussion

Chemical characterization

	Mass fraction (%), db				
	Ash	C	N	S	O*
CSW	1.00	49.10	0.32	0.02	49.56
ASW	0.84	50.24	0.18	0.01	48.73
EBC	1.29	70.78	0.48	0.02	27.43

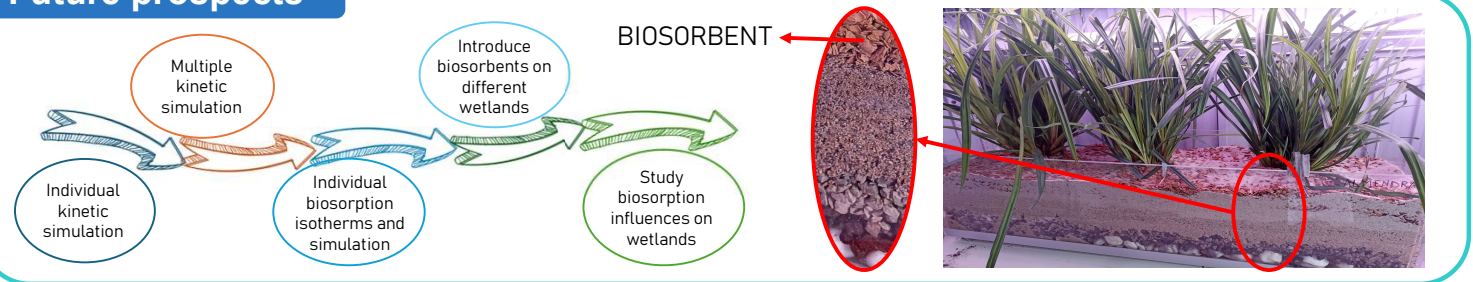
Functional group	wave number, cm ⁻¹	Materials		
		ASW	CSW	EBC
-OH	~ 3100 - 3500	++	+++	+
-CH	~ 2880 - 2975	+	+	++
C=O	~ 1740	++	++	+
C=C	~ 1650 - 1600	++	++	++
C-C	~ 1510	+	++	-
-CH	~ 1370 - 1470	+	+	++
C-O	~ 1230	++	++	+
C-O-C	~ 1120 - 1160	+++	++	-

Biosorption process



- ✓ ASW 12 of 17 POLLUTANTS UP TO 90% REMOVAL
- ✓ CSW 16 of 17 POLLUTANTS UP TO 90% REMOVAL
- ✓ EBC 16 of 17 POLLUTANTS UP TO 90% REMOVAL
- ✓ DIFFERENT BIOSORPTION BEHAVIOR IN ASW
- ✓ PRIMARY BIOSORPTION BEFORE 24 HOURS IN CSW
- ✓ HIGH BIOSORPTION OF CAFFEINE AND FENOPROPIMORF

Future prospects



Conclusions

- The biosorbents' characterization showed high carbon and oxygen content, with different functional groups like carboxylic and aromatic bonds.
- These groups facilitated chemical interactions like π - π interactions or hydrogen bonding, crucial for biosorbing emerging micropollutants
- The primary biosorption mechanism occurred within the initial 24 hours, reducing up to 80% the presence of some pollutants
- CSW and EBC remove 16 of 17 pollutants between 20 and 90%, and ASW 12 of 17
- The use of chestnut and almond waste as adsorbents show promise for enhancing the circular economy in the future.

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