

# The Potential of Tuna Bone Char as a Sorbent Material for Pharmaceuticals Removal from Wastewaters

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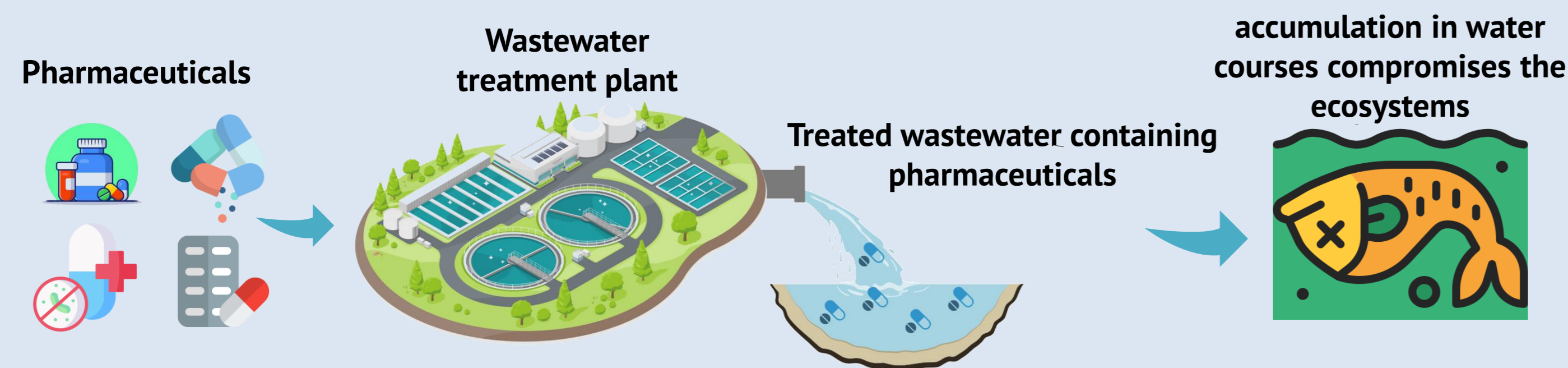
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## Introduction



The limited capacity of WWTPs to remove pharmaceutical residues from the wastewater results in their continuous accumulation in water bodies!

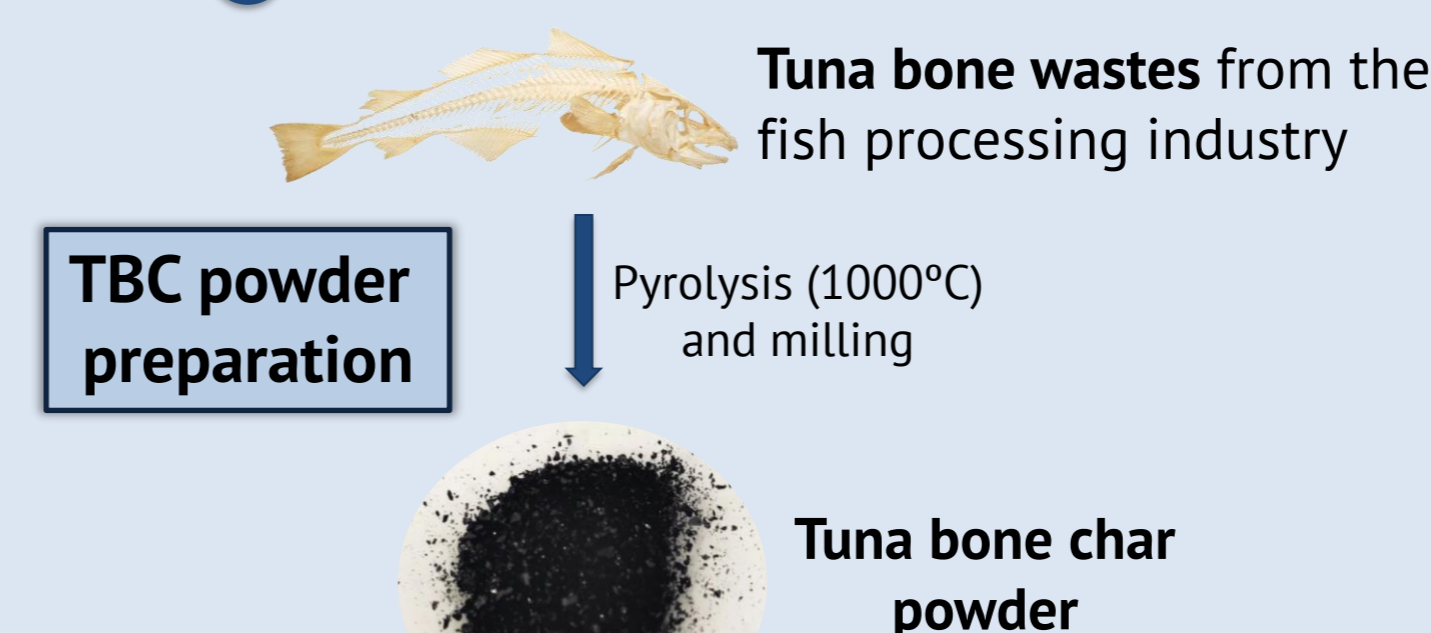


Objective

Evaluate the potential of a food waste-derived adsorbent material (tuna bone char, TBC) for the adsorption of tramadol and venlafaxine in saline and non-saline wastewaters.

## Material & Methods

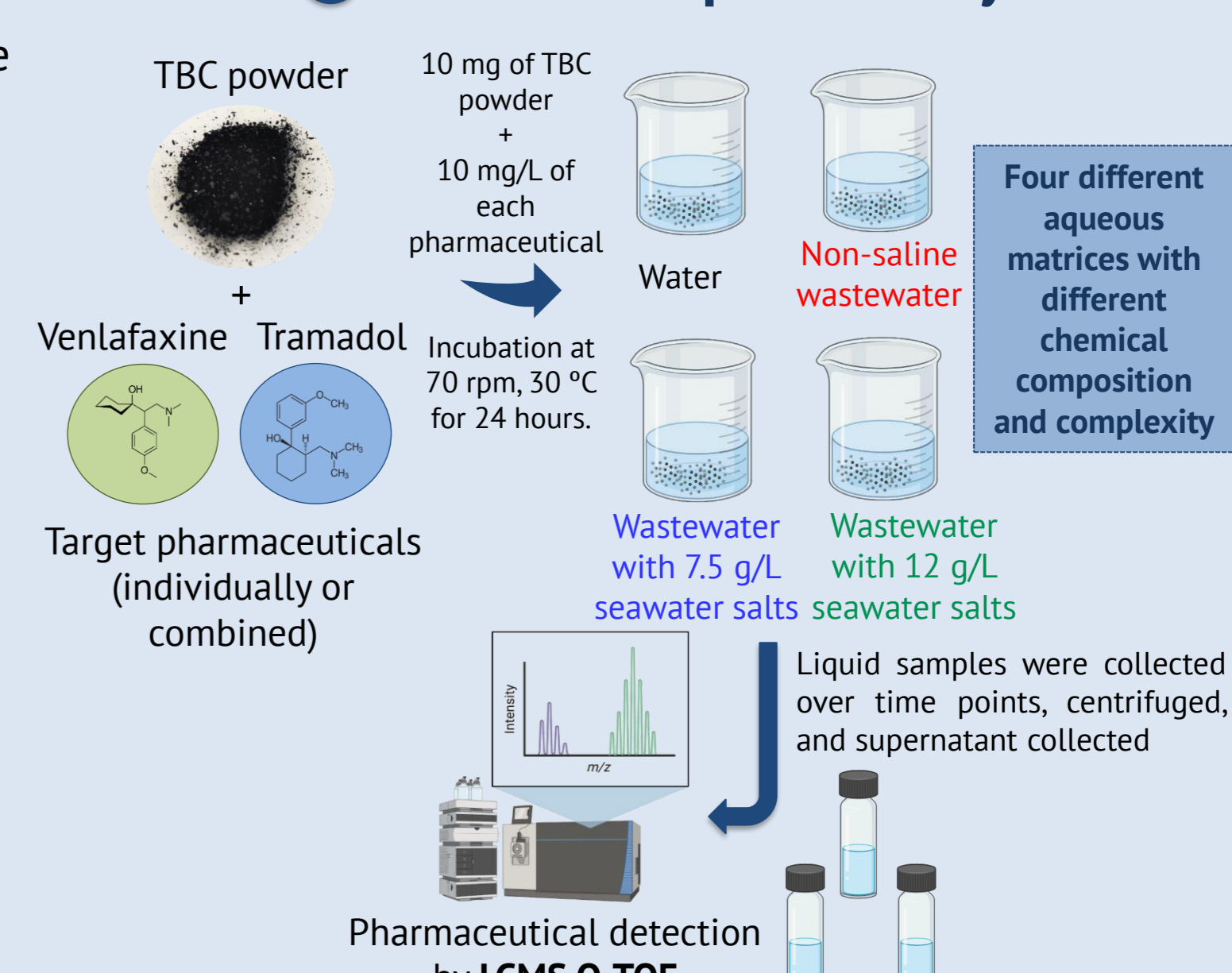
### 1 Waste-derived sorbent



### TBC powder characterization

- Fourier transform infrared spectroscopy (FTIR);
- Scanning electron microscopy (SEM);
- TBC surface area and charge;
- TBC powder size.

### 2 Batch adsorption assays



## Results & Discussion

### 1 TBC characterization

- The morphology of the TBC powder was assessed through SEM methodology.

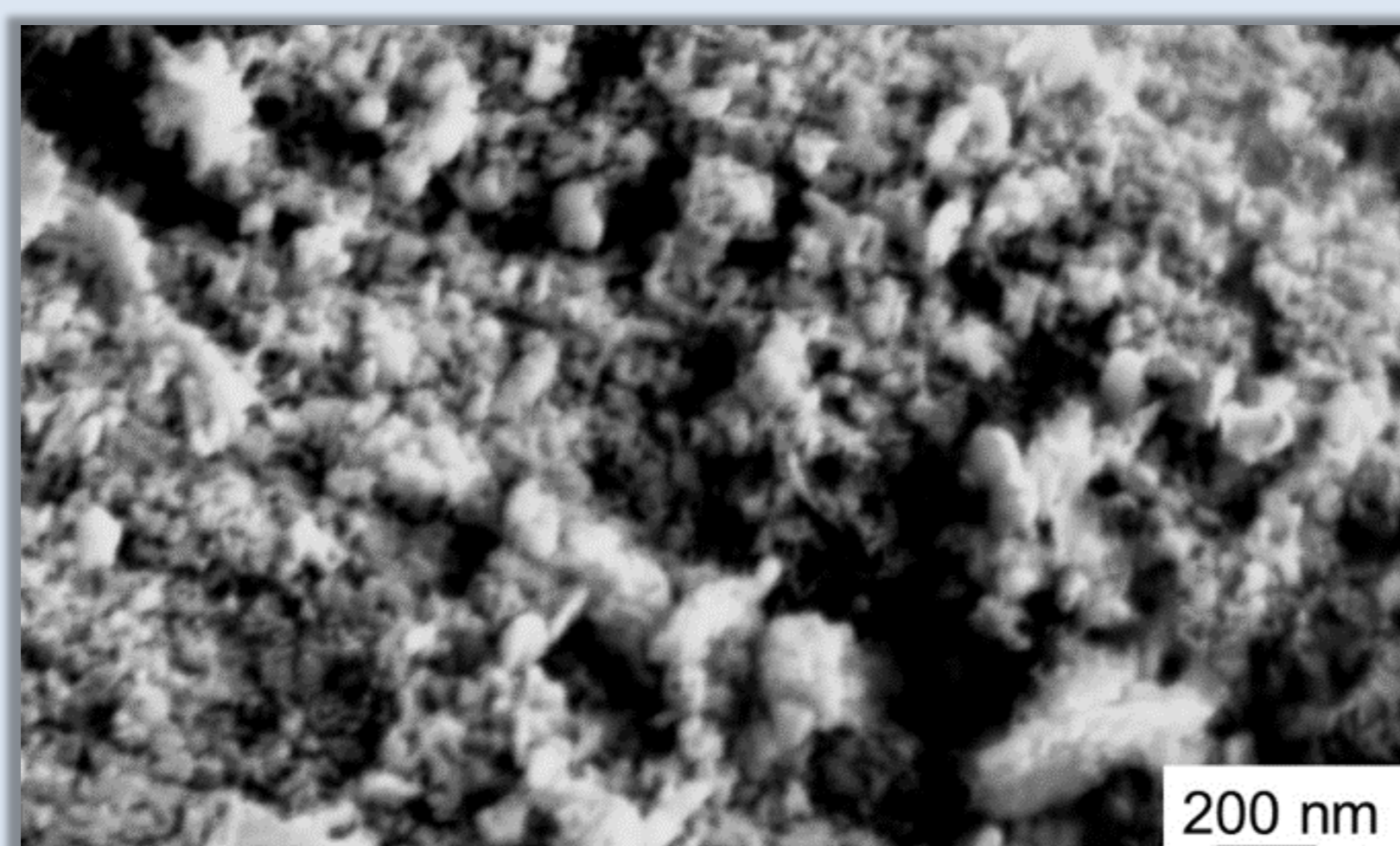


Figure 1. SEM micrograph of the TBC powder.

The TBC powder is composed of small round particles of about 40 nm in diameter, typical of a nanostructured material;

The aggregation of the particles into larger ones can be observed;

The TBC powder presents a rough surface morphology.

Table 1. Surface charge and area, total, and mesopore volume of the TBC powder.

Surface charge (mV)	-12.1
Surface area (m <sup>2</sup> /g)	100.67
Total pore volume (mm <sup>3</sup> /g)	575.2
Mesopore volume (mm <sup>3</sup> /g)	137.0

- The TBC surface area, charge, and total pore volume were comparable to other fish-derived bone chars [1, 2, 3];
- Materials with a high surface area are generally considered efficient for pollutant removal.

### 2 TBC adsorption capacity for pharmaceuticals

- The efficiency of the TBC powder to adsorb two target pharmaceuticals, tramadol (TRA) and venlafaxine (VNF).

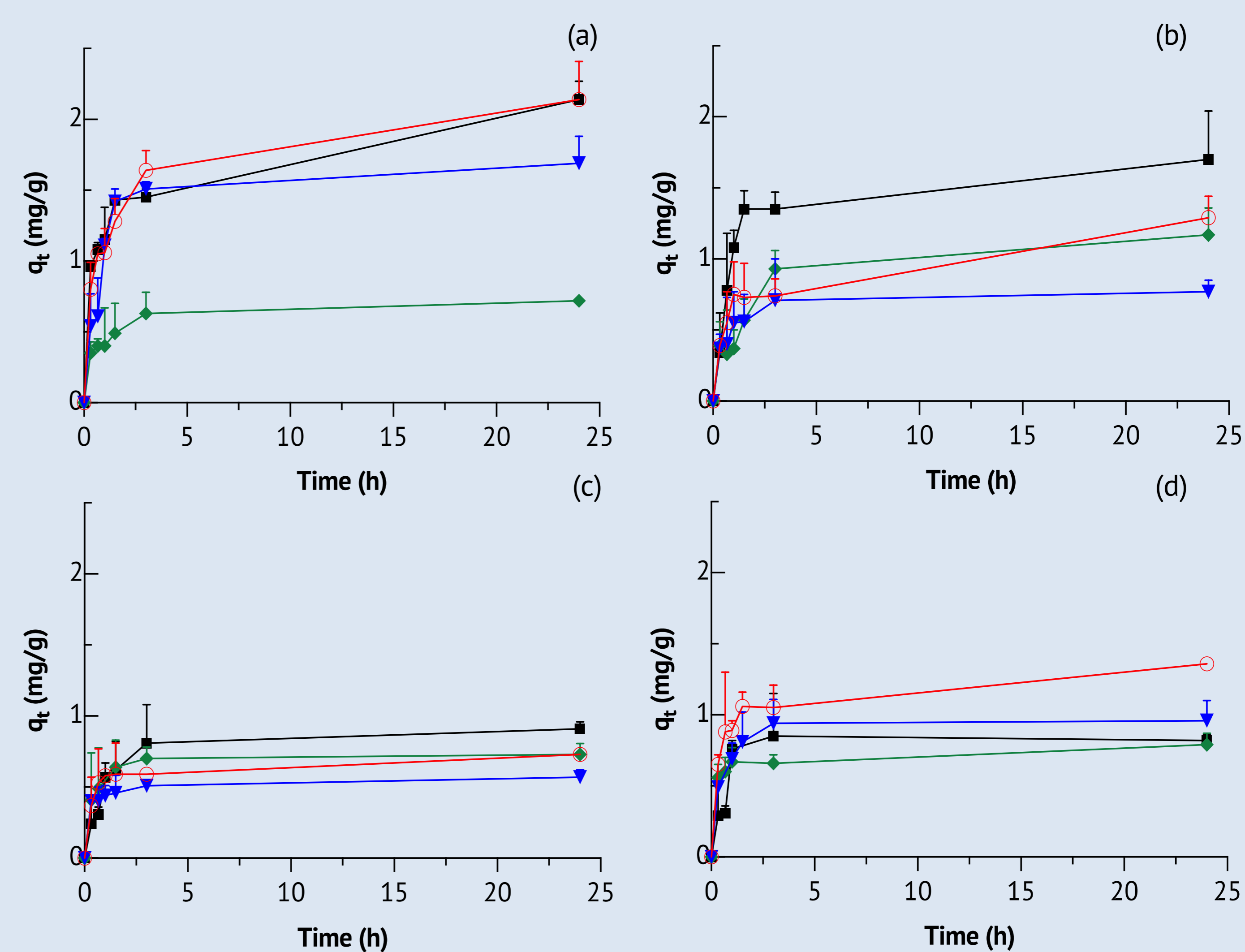
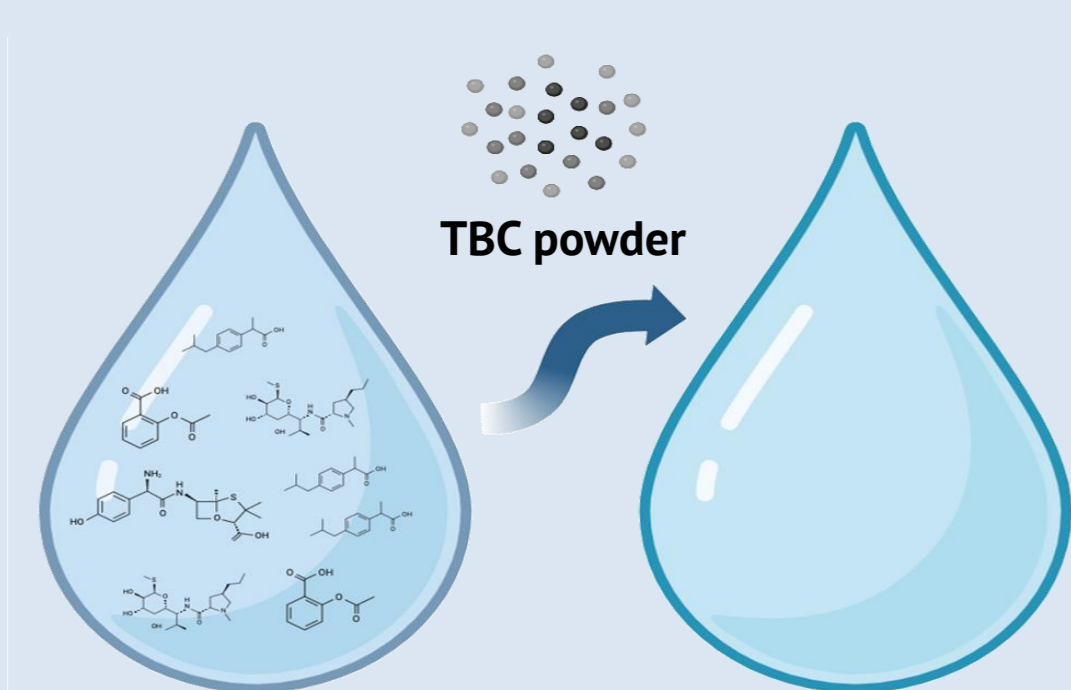


Figure 2. The adsorption capacity ( $q_t$ ) of the TBC sorbent for TRA and VNF when present individually (a and b, respectively), or as a mixture (c and d, for TRA and VNF), in the different types of aqueous matrices. Adsorption assays were performed in four different aqueous matrices, namely in water (■), non-saline wastewater (○), saline wastewater with 7.5 g/L of seawater salts (▼), and saline wastewater with 12 g/L of seawater salts (◆).

Individually		In mixture	
TRA:	VNF:	TRA:	VNF:
<ul style="list-style-type: none"> <li>Highest <math>q_t</math> in water and non-saline wastewater;</li> <li>Salt decreased the TBC adsorption capacity, especially at high concentrations (12 g/L).</li> </ul>	<ul style="list-style-type: none"> <li>Highest <math>q_t</math> in water;</li> <li>TBC adsorption capacity was affected by the presence of other compounds in the aqueous matrices.</li> </ul>	<ul style="list-style-type: none"> <li>TRA <math>q_t</math> in a mixture was lower than <math>q_t</math> as sole pharmaceutical;</li> <li>TBC material was effective for simultaneously adsorbing TRA and VNF.</li> </ul>	<ul style="list-style-type: none"> <li>Higher <math>q_t</math> for VNF in non-saline wastewater and wastewater w/ 7.5 g/L sea salts;</li> <li>The <math>q_t</math> was lower in the wastewater w/ 12 g/L sea salts.</li> </ul>

## Final remarks



Adsorption-based processes

- TBC powder presented a nanometric structure with a high surface area;
- TBC was efficient in removing TRA and VNF in saline and non-saline wastewaters;
- Preferential adsorption of TBC powder for TRA than VNF;
- TBC was able to simultaneously adsorb TRA and VNF when they co-existed in the aqueous matrices;
- TBC powder, a material obtained from waste of the fish food industry, can be transformed into an efficient sorbent;
- TBC material can be an alternative for environmental remediation processes.

## References

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