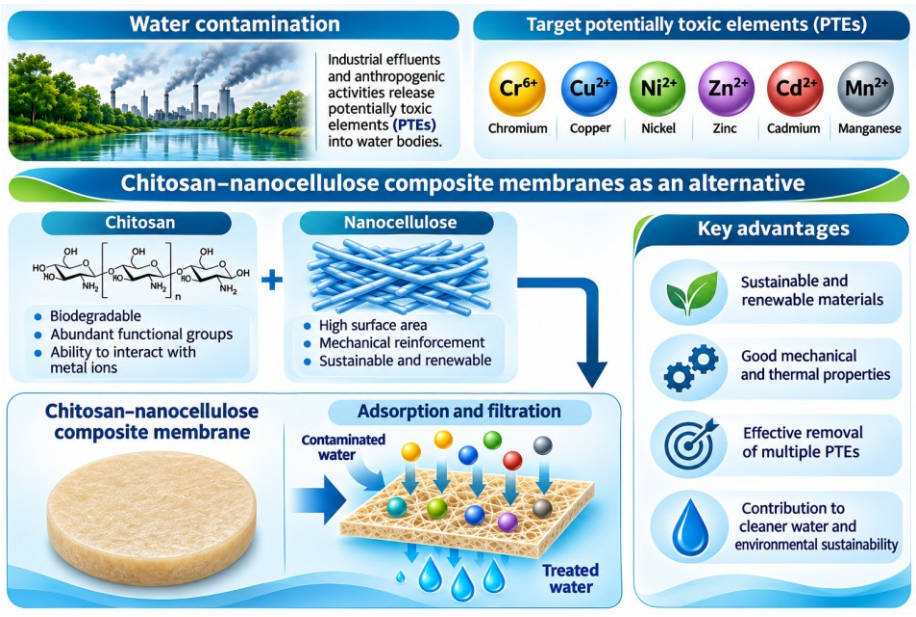
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Development of Chitosan–Nanocellulose Composite Membranes for the Efficient Removal of Potentially Toxic Elements from Water

Éléa Löiez[1], Lucas R. Gonçalves[2], Christelle Delaite[1] and Derval S. Rosa[2*]
[1]Université de Haute-Asasse; [2]Universidade Federal do ABC (UFABC)
*dervalrosa@yahoo.com.br

1. Introduction



2. Objective

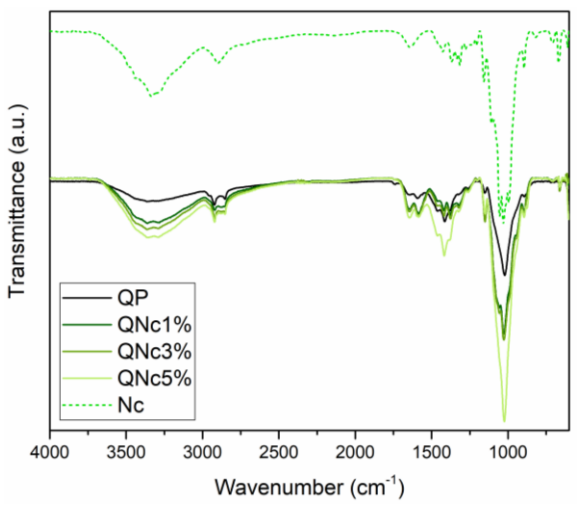
To develop and evaluate chitosan-based hydrogel membranes reinforced with nanocellulose at different contents (1, 3, and 5% w/w), investigating their structural characteristics, thermal stability, and adsorption performance for the removal of metal ions from aqueous multicomponent systems.

3. Materials and Methods

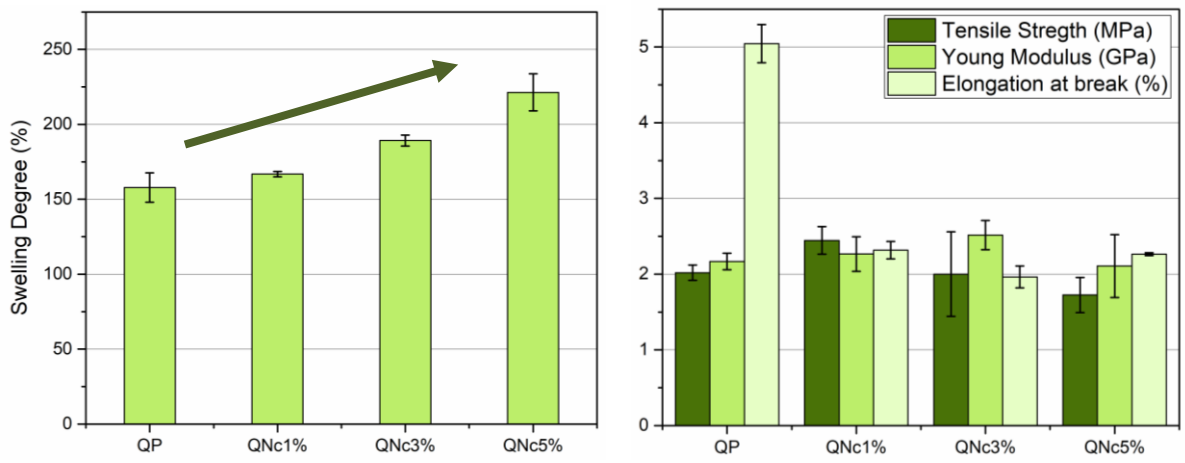


4. Results and Discussion

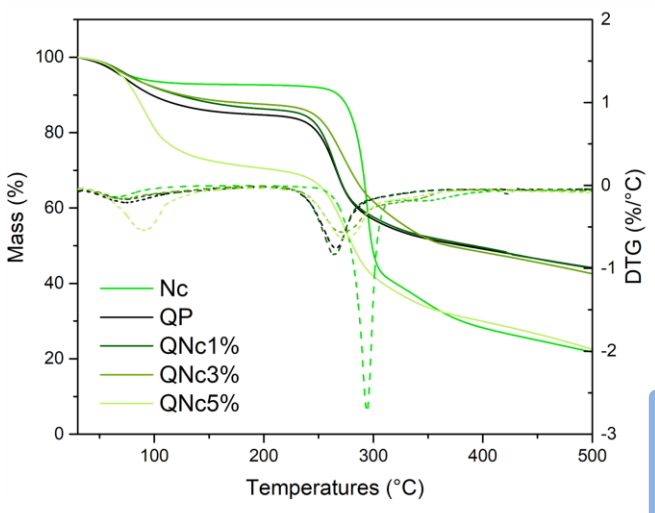
FTIR



Structural properties



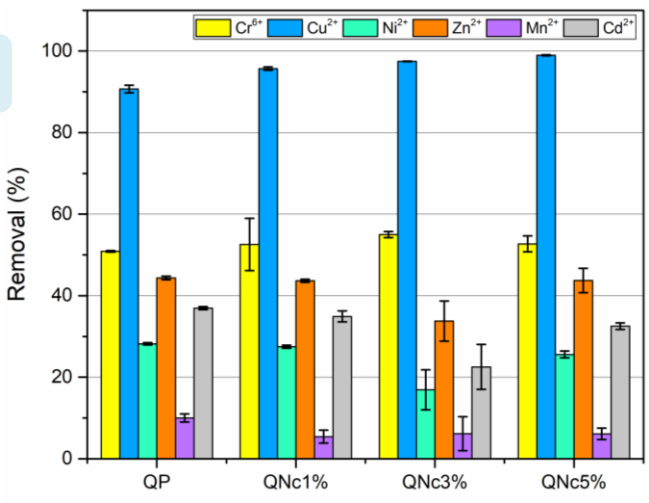
TGA



Sample	T_{max} (°C)
Nc	294
QP	266
Q1%Nc	265
Q3%Nc	272
Q5%Nc	275

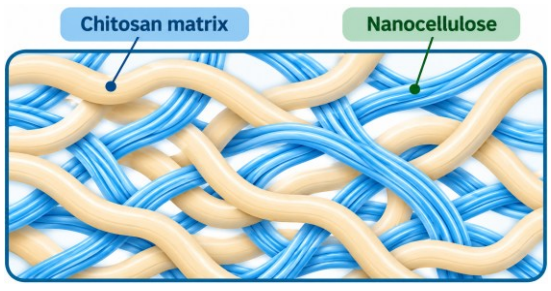
Selectivity

0.1 mmol/L of each metal ion, pH 4, room temperature, and 130 rpm.



Excellent Cu^{2+} Removal and Preferential Affinity
Cu^{2+} removal increased progressively with Nc content (~90-99%), potentially due to additional hydroxyl groups and enhanced metal-ion interactions within the chitosan-nanocellulose network.

5. Conclusions



- Nc incorporation enhanced the thermal stability of chitosan membranes;
- Increasing Nc content improved tensile properties, highlighting its reinforcing effect;
- Water absorption increased with Nc content, indicating enhanced membrane hydrophilicity.
- The membranes exhibited outstanding Cu^{2+} removal (90-99%), with progressively higher efficiency at increased Nc contents.
- These results highlight the potential of chitosan-nanocellulose membranes for metal removal from multicomponent aqueous systems.

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