

Mitra Naghdi¹, Mehrdad Taheran¹, Satinder K. Brar¹, Azadeh Kermanshahipour², Antonio Avalos Ramirez^{1, 3}

¹INRS-ETE, Université du Québec, 490, Rue de la Couronne, Québec, Canada G1K 9A9

²Department of Process Engineering and Applied Science, Dalhousie University PO 15000, Halifax, Nova Scotia, Canada B3H 4R2,

³Department of Chemical Engineering and Biotechnological Engineering, Faculty of Engineering, Université de Sherbrooke, Québec, Canada J1K 2R1

Phone: 1 418 654 3116; Fax: 1 418 654 2600; E-mail: satinder.brar@ete.inrs.ca

1 Abstract

Carbamazepine (CBZ) is one of widely used antiepileptic/anticonvulsant drugs around the world. It is toxic for several aquatic organisms and classified as a harmful compound to aquatic organisms according to European legislations.

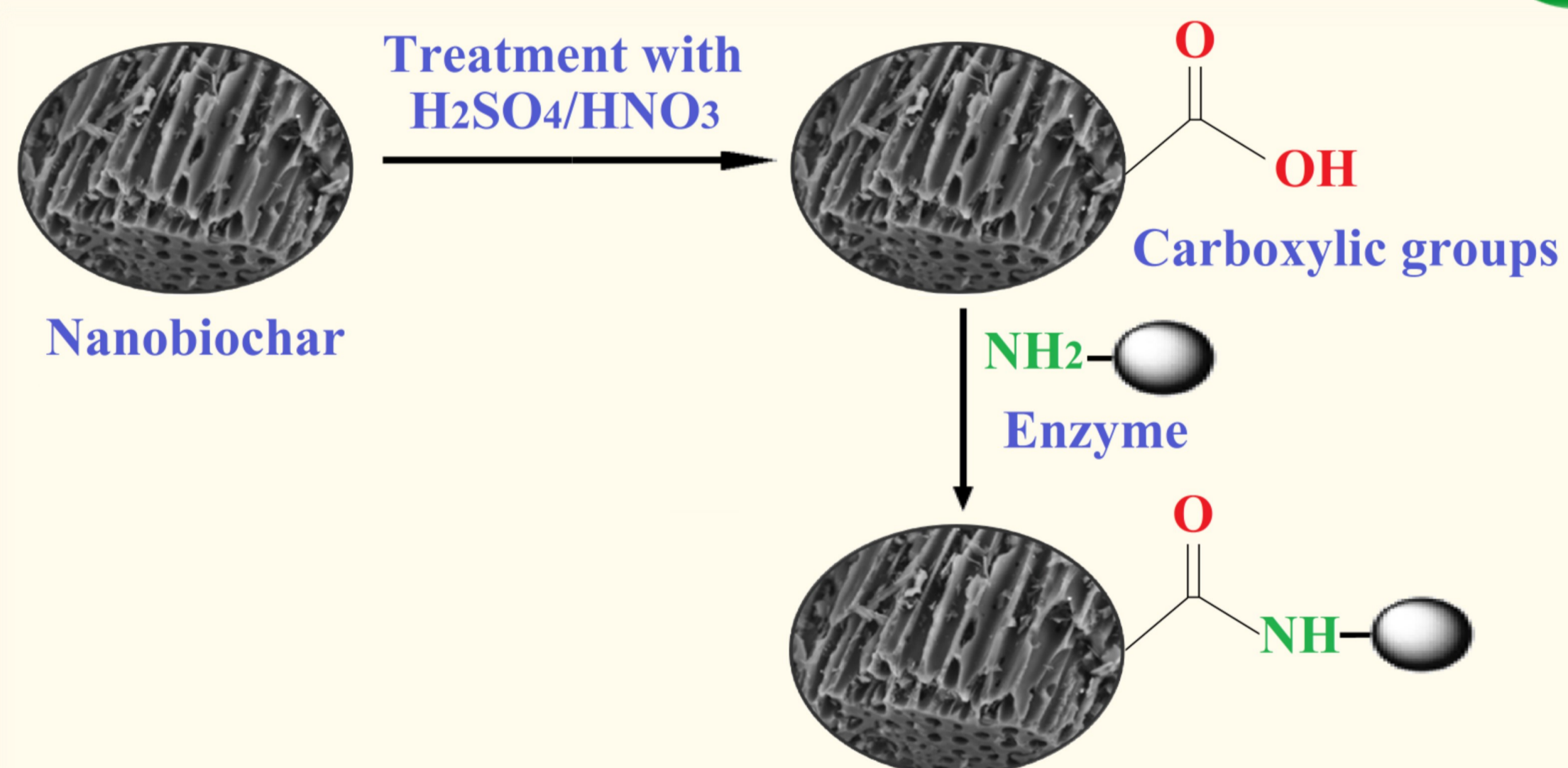
In this research, functionalized nanobiochar was prepared through acidic treatment and used as a support for immobilization of the laccase. Finally the **Immobilized Laccase** was employed for removal of CBZ from water and wastewater.



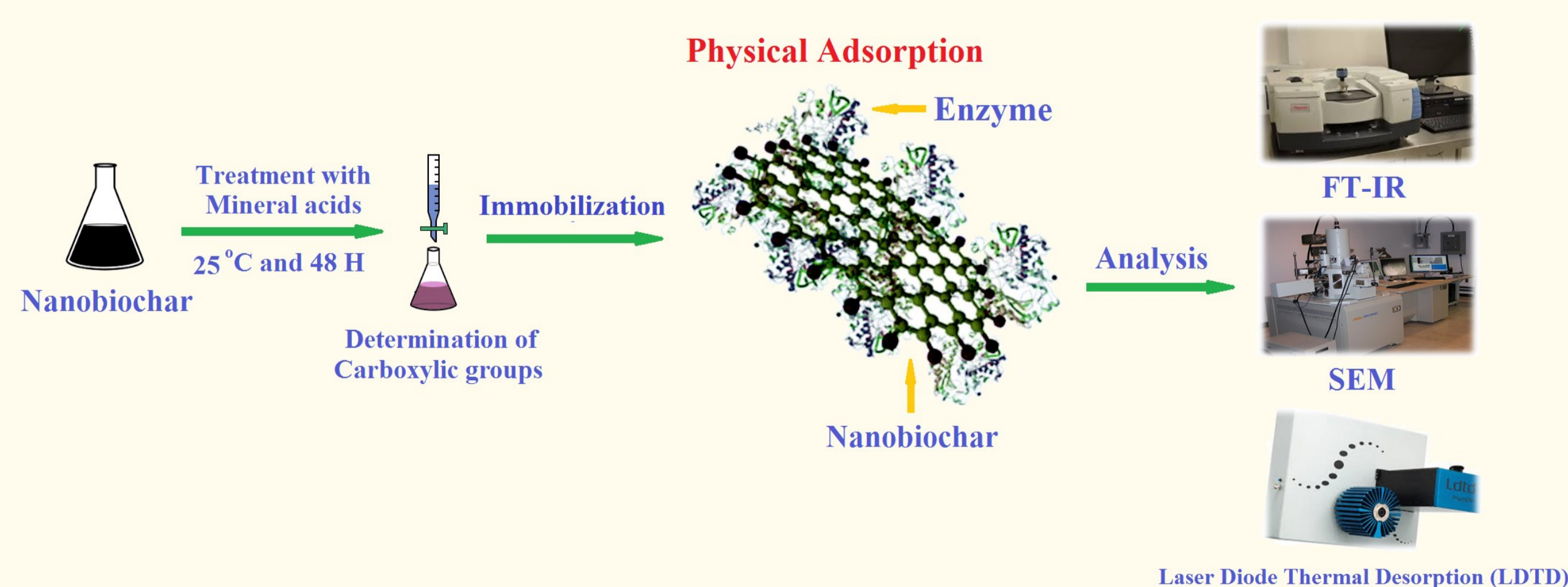
2 Objectives

- ◆ Functionalization of nanobiochar using three mineral acids including HCl, H₂SO₄, HNO₃ and their binary and ternary mixtures.
- ◆ Immobilization of the laccase on functionalized nanobiochar with (H₂SO₄/HNO₃ 1:1 (v/v)).
- ◆ Performance of nanobiocatalyst for CBZ removal from water and wastewater.

3 Principle



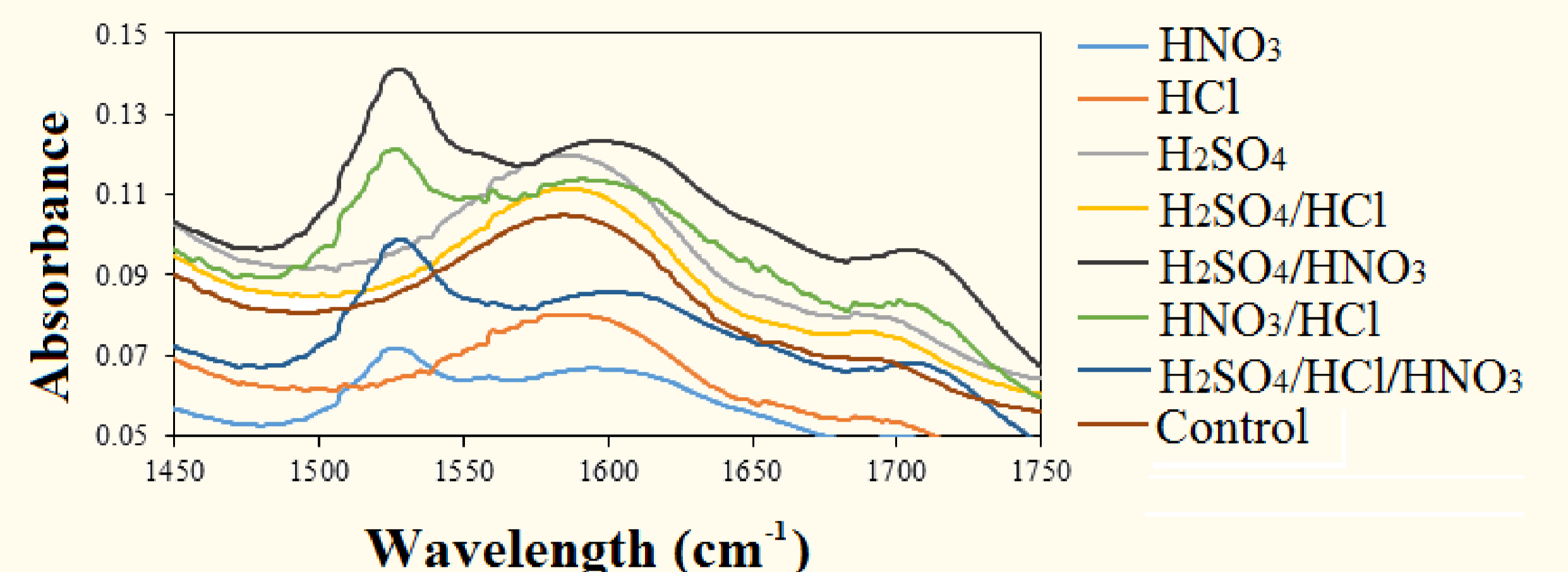
4 Methodology



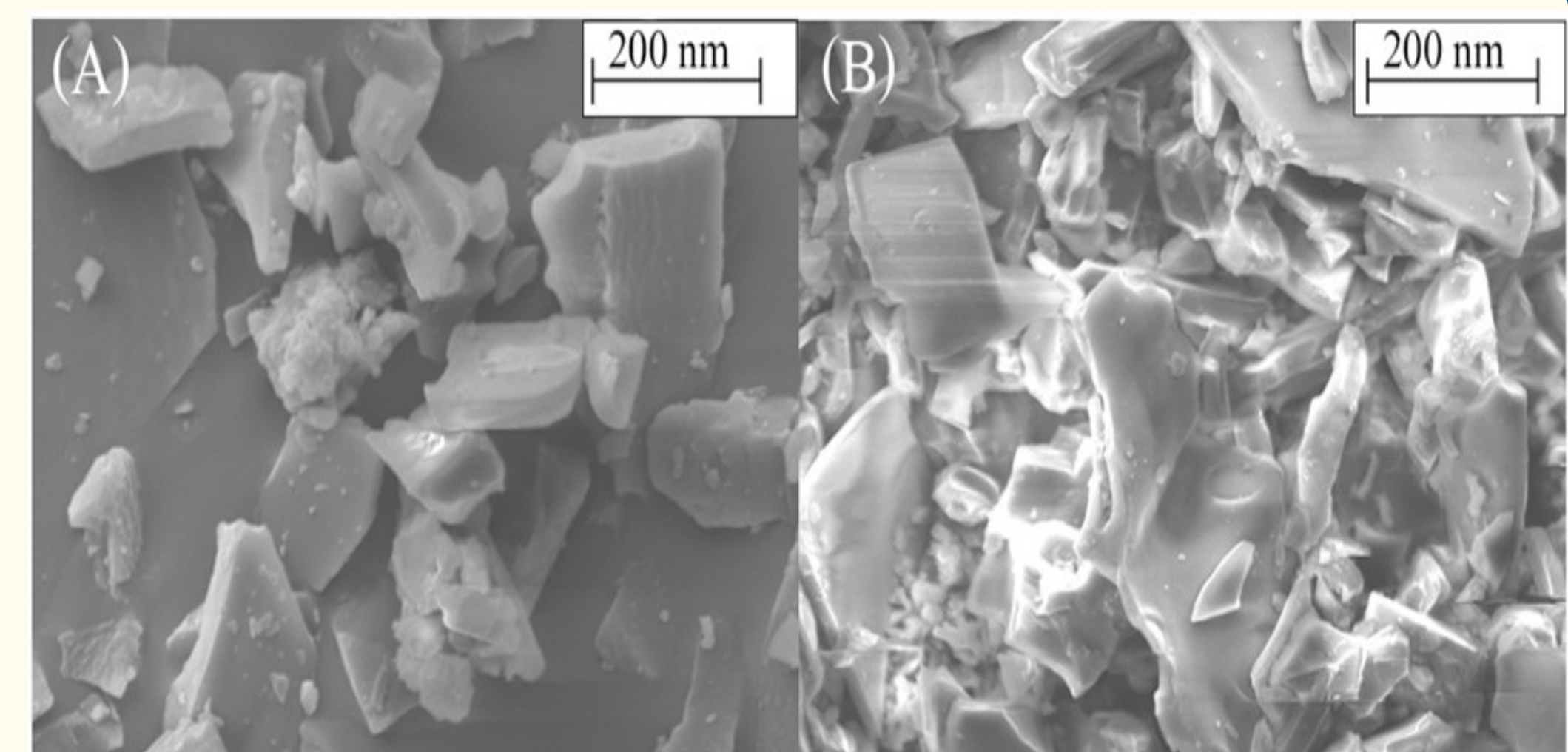
References

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 Nguyen, L.N., *et al.*, Bioresource Technology, 2016. 210: p. 108-116.
 Tan, X., *et al.*, Chemosphere, 2015. 125: p. 70-85.

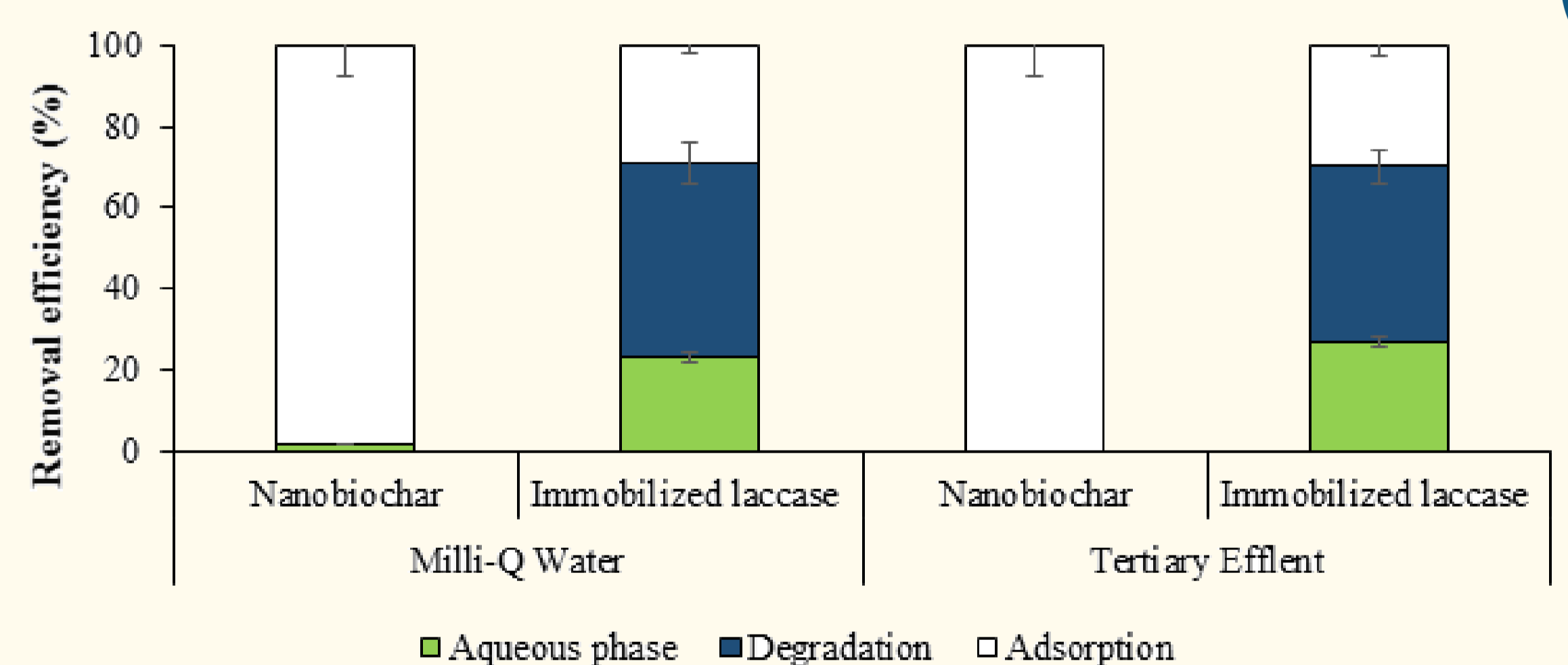
5 Results



FT-IR spectra of nanobiochar treated with mineral acids and their combinations



SEM images of nanobiochars treated with: (a) H₂SO₄/HNO₃ for 24 h at 25 °C and; (b) as-produced nanobiochars



Carbamazepine removal via nanobiochar and immobilized laccase on functionalized nanobiochar after 24 h

6 Discussion

- ◆ Sample treated with H₂SO₄/HNO₃, showed the highest intensity at 1680-1730 cm⁻¹ which corresponded to **carboxylic acid group**.
- ◆ The titration tests confirmed that the nanobiochar sample treated with H₂SO₄/HNO₃ had the highest level of carboxylic acid group (4.7 mmol/g).
- ◆ **No morphological alteration** of nanobiochars were observed in SEM.
- ◆ The contribution of **biodegradation** in both matrices (ultrapure water and tertiary effluent) was **higher than 45%** while adsorption accounted for less than 30% of the total removal.

Conclusion

- ◆ Carboxylic content of nanobiochar was improved by acid treatment.
- ◆ Immobilized laccase showed higher pH, temperature and storage stability.
- ◆ Nanobiocatalyst maintained 70% of initial activity after 3 cycles.