جامعة التقنية والعلوم التطبيقية
University of Technology and Applied Sciences

Ecofriendly and low-cost adsorbent for efficient removal of heavy metals from aqueous solution

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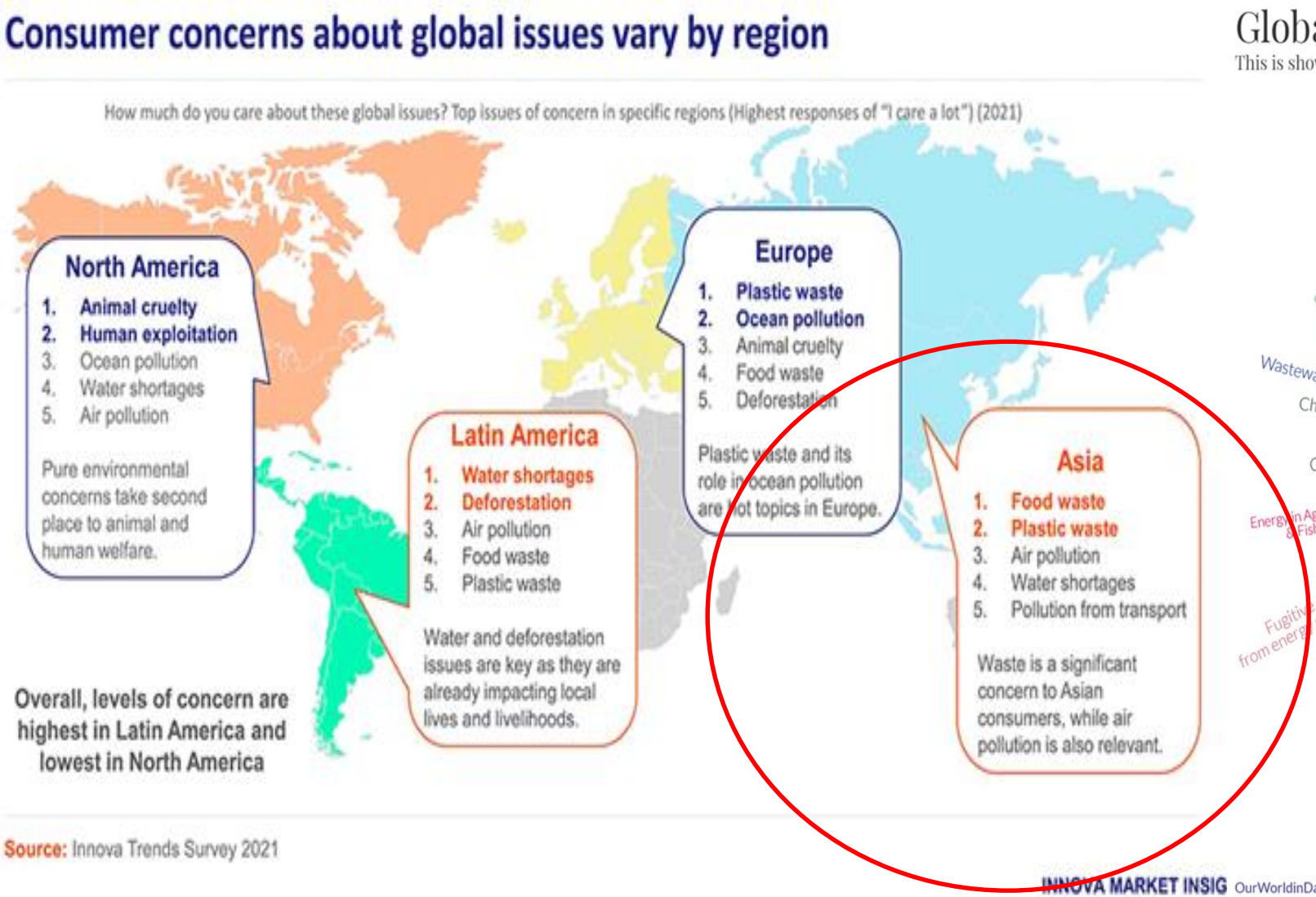
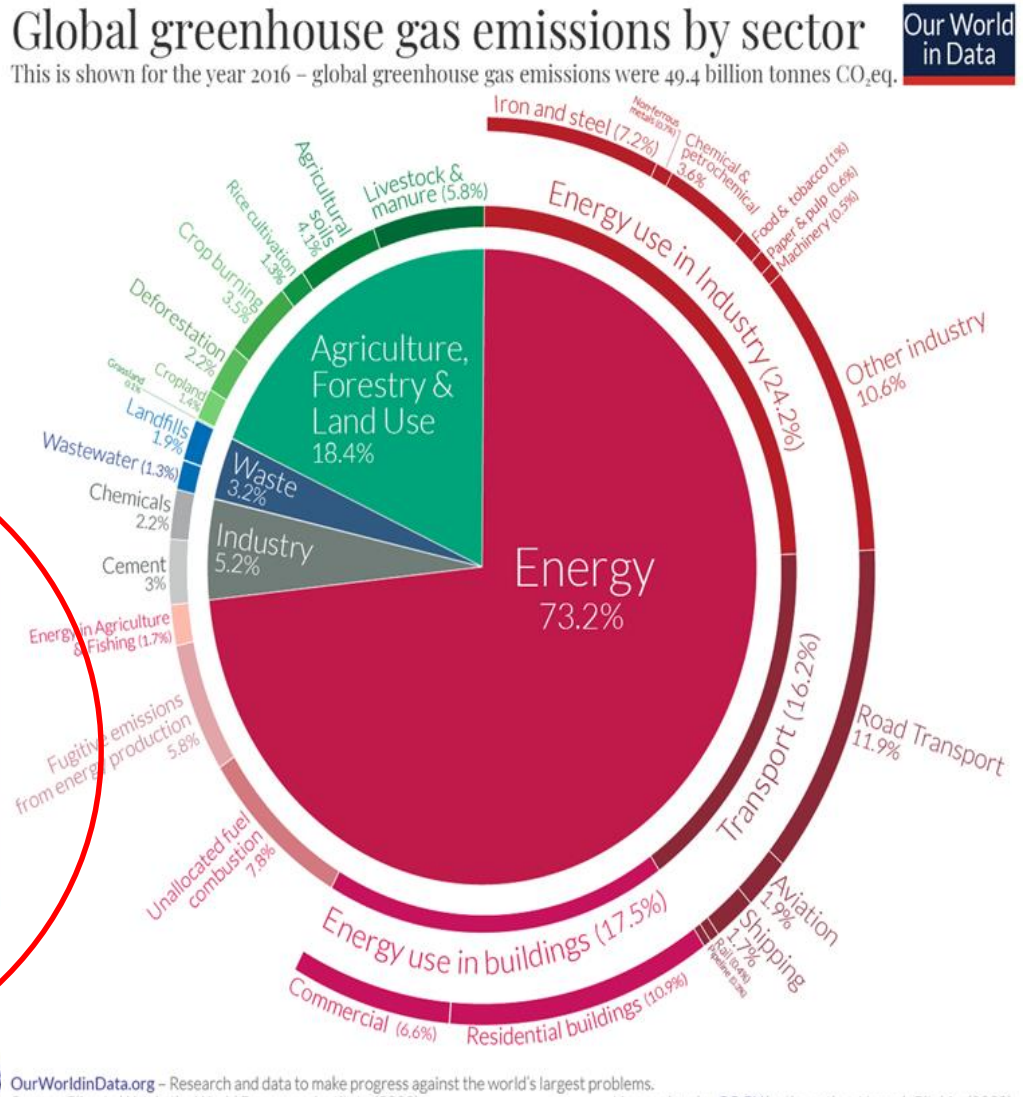
Contents

Introduction

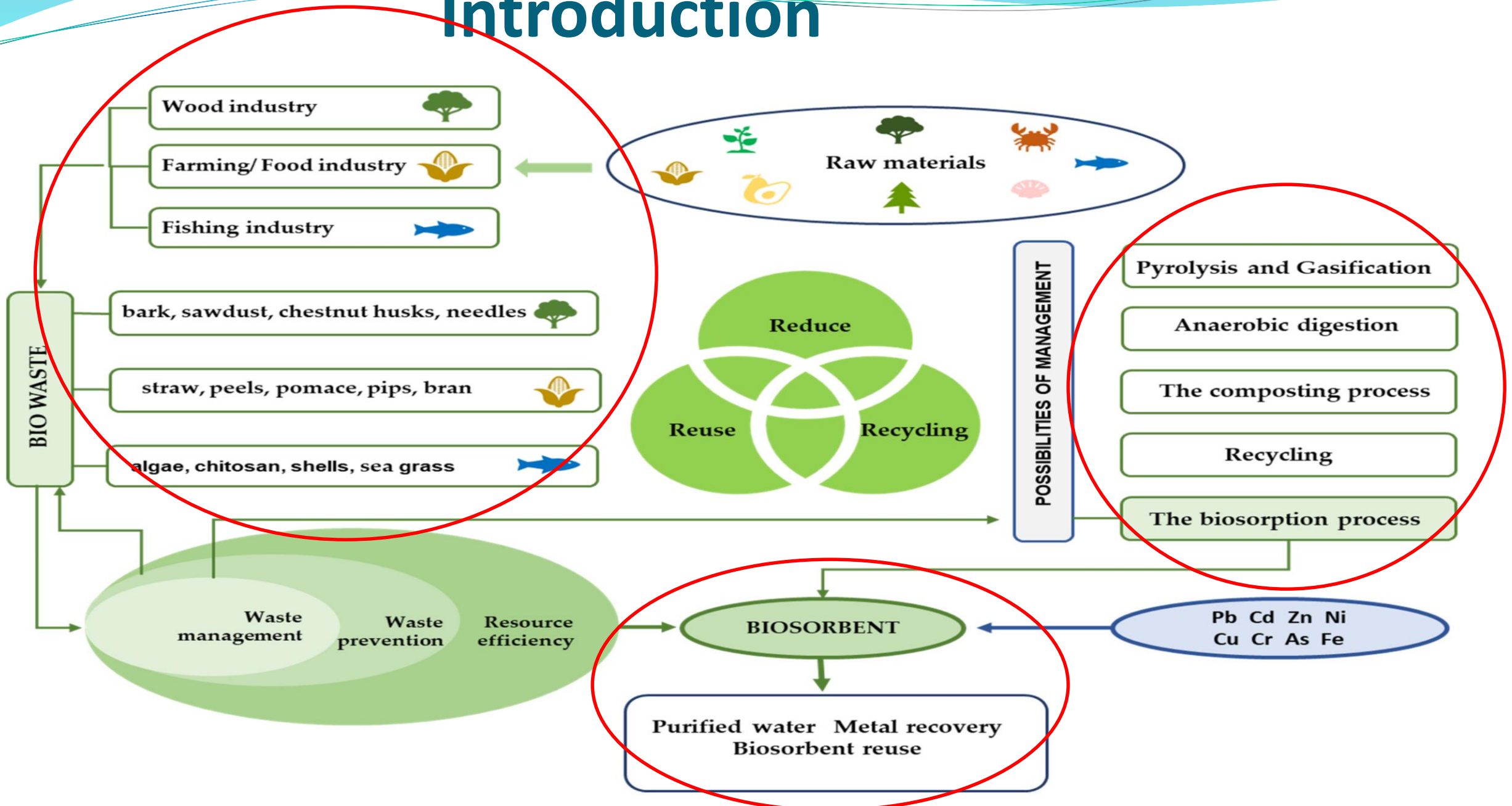




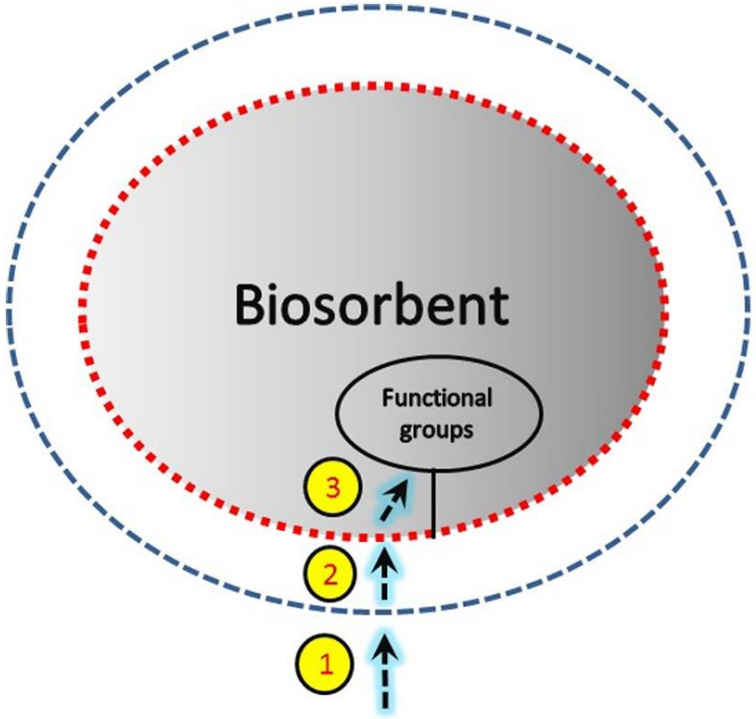
Fruit Waste

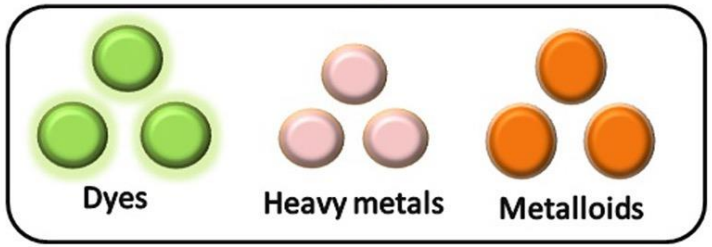
- A large amount of fruit waste is generated during agricultural and food production, mainly fruit residues such as peels, seeds, stones, and hulls.
- This waste is often problematic during disposal or recycling and has little or no economic value.
- The biochemical composition of agrifood waste includes, among others, cellulose, hemicellulose, lignin, lipids, simple sugars, proteins, hydrocarbons, and starch.
- These compounds contain various functional groups that are capable of binding and removing harmful substances from water and wastewater.

Introduction



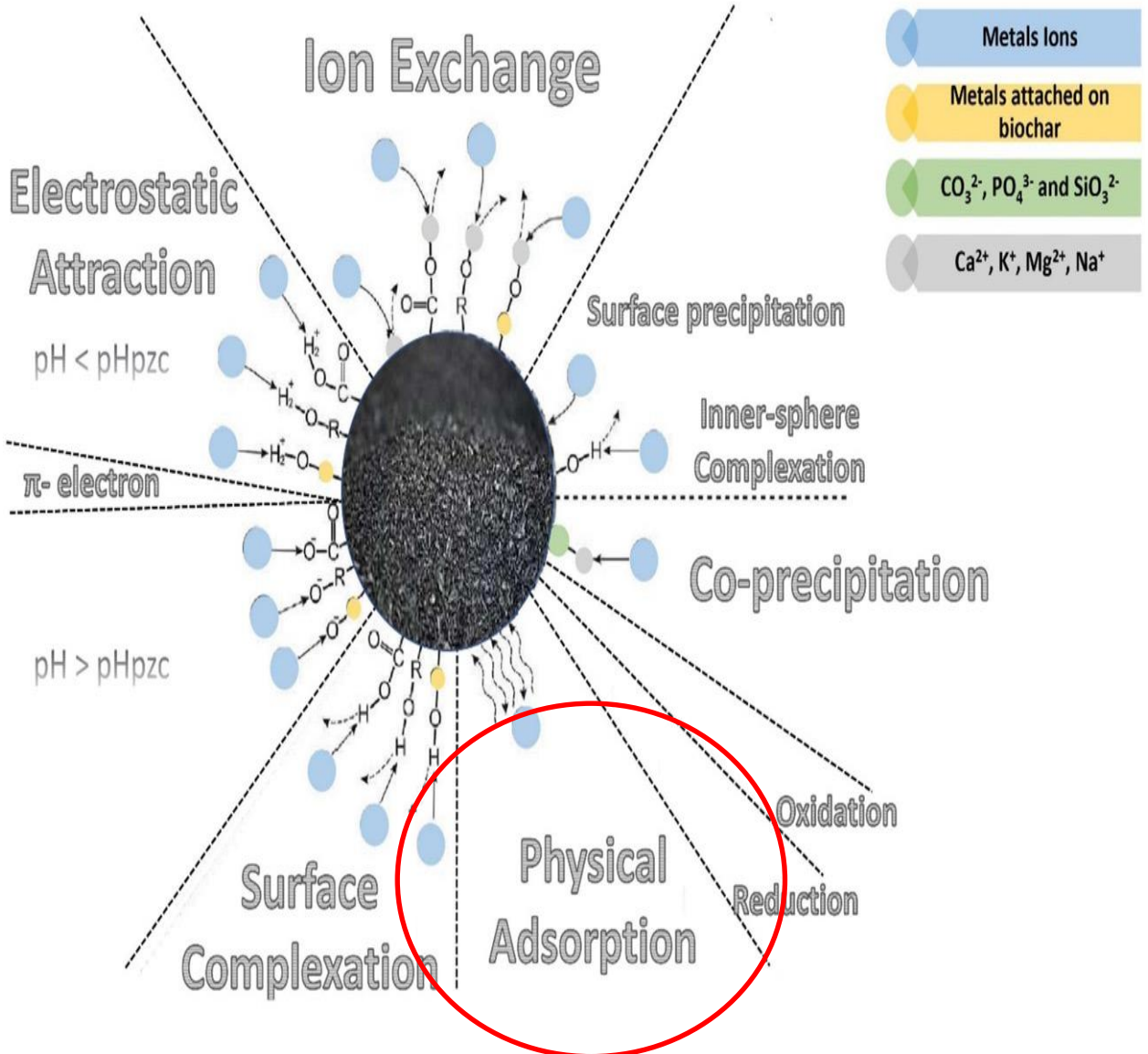
Mechanisms involved in the biosorption process.



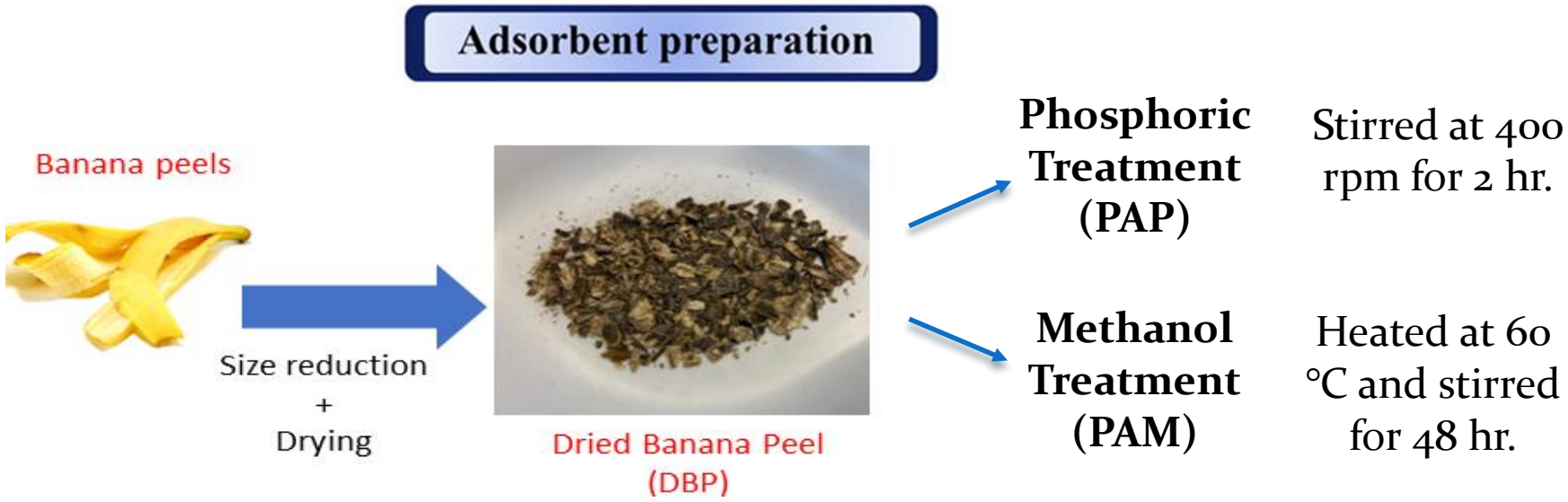


1. Boundary layer
2. Intraparticle diffusion
3. Interaction between pollutant and sorbent

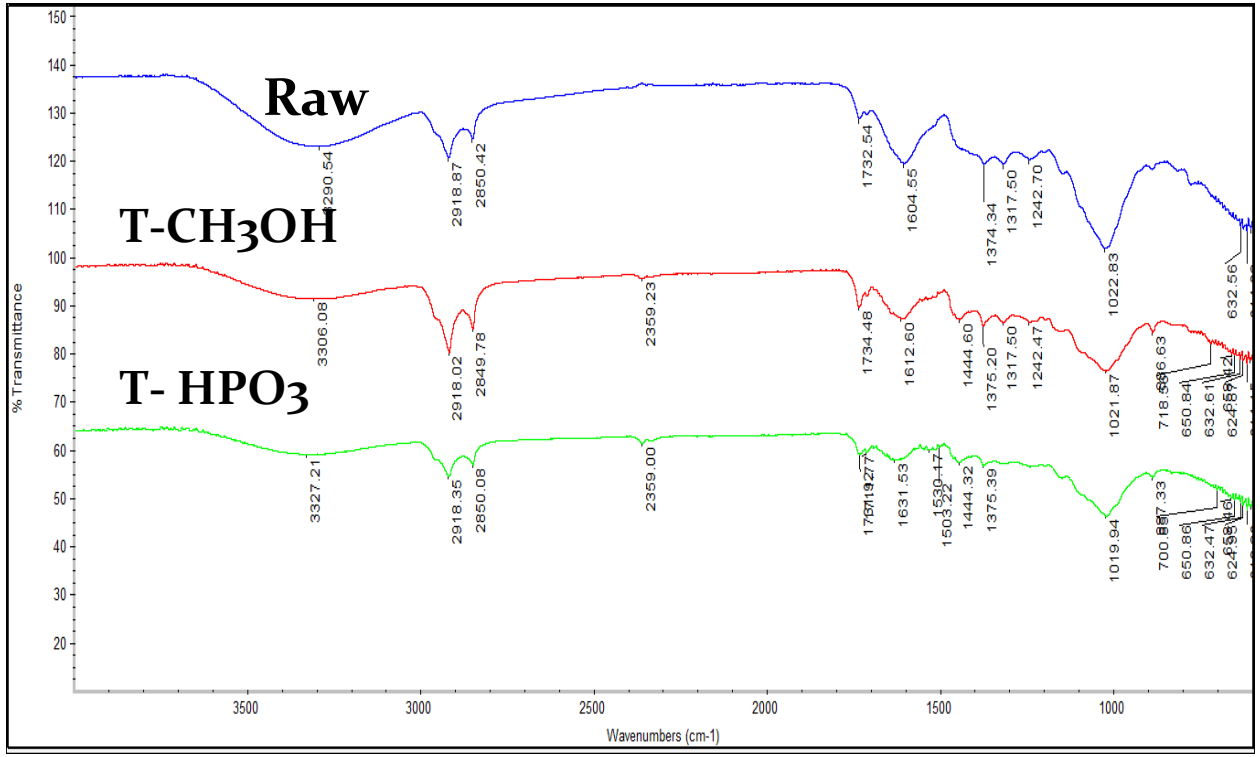
Examples of different mechanisms involved in the sorption process

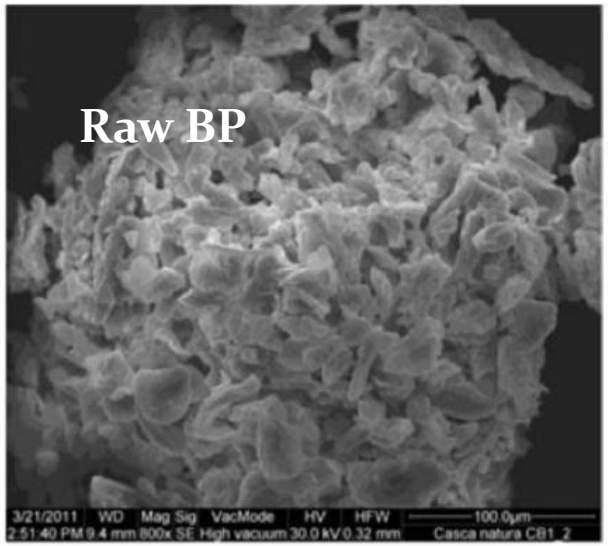


Methodology

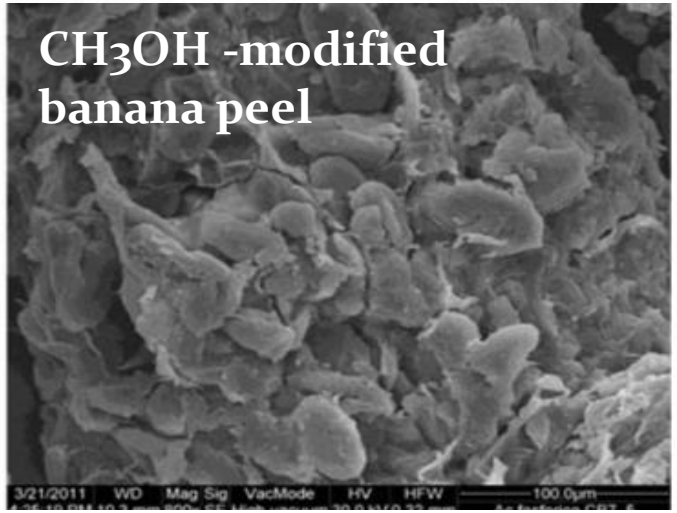


Results


Raw
T-CH3OH
T- HPO3
% Transmittance
Wavenumbers (cm-1)
3500
3000
2500
2000
1500
1000
3290.54
2918.87
2850.42
1732.54
1604.55
1374.34
1317.50
1242.70
1022.83
632.56
3306.08
2918.02
2849.78
2359.23
1734.48
1612.60
1444.60
1375.20
1317.50
1242.47
1021.87
718.63
650.84
632.61
3327.21
2918.35
2850.08
2359.00
1631.53
1503.22
1444.32
1375.39
1019.94
700.33
650.86
632.47

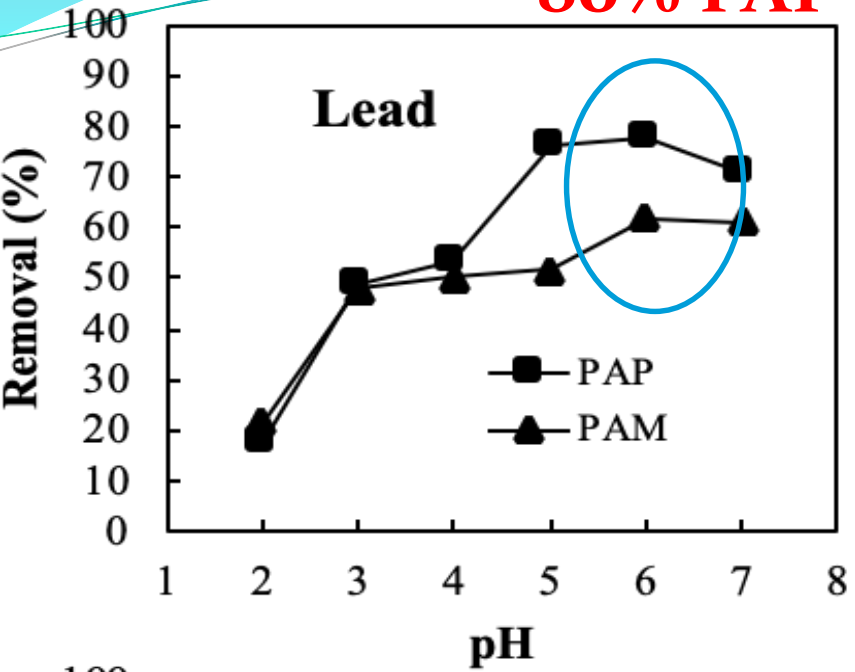

Raw BP


HPO3 -modified banana peel

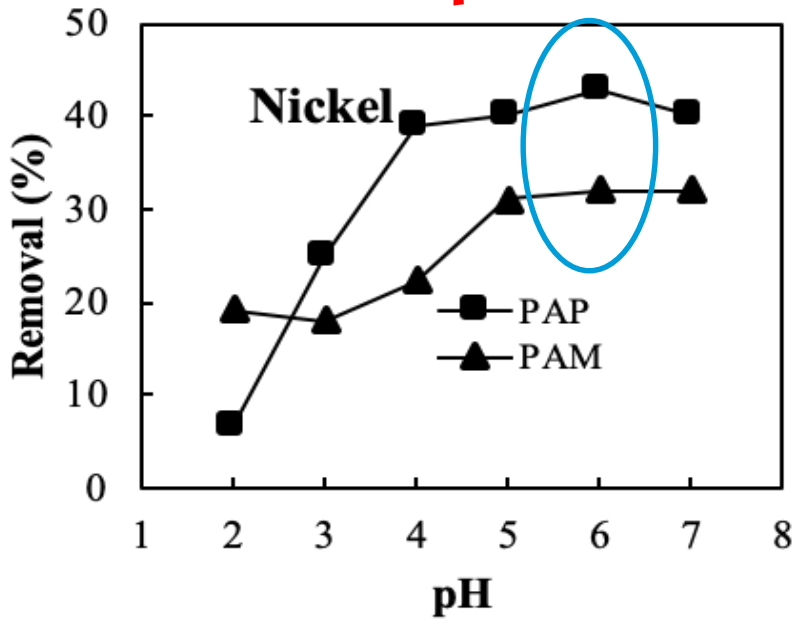

CH3OH -modified banana peel

Results

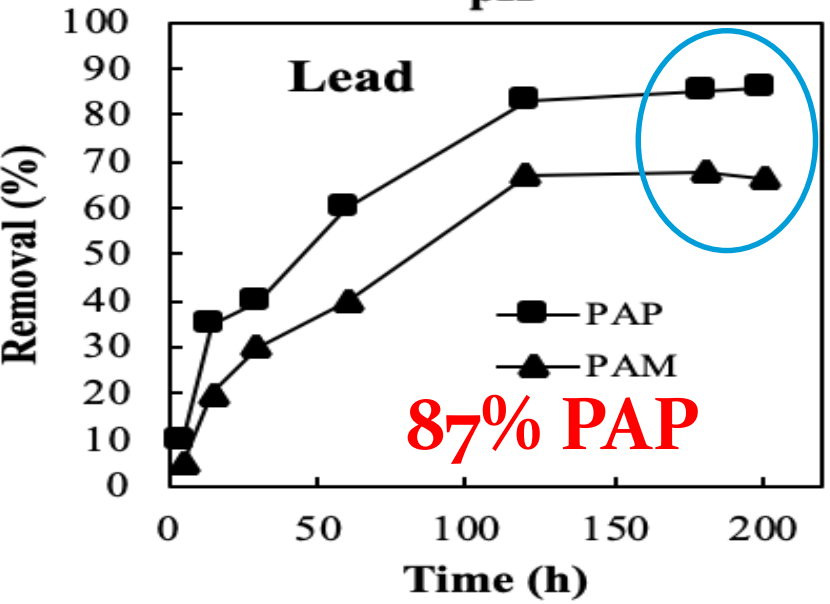
80% PAP

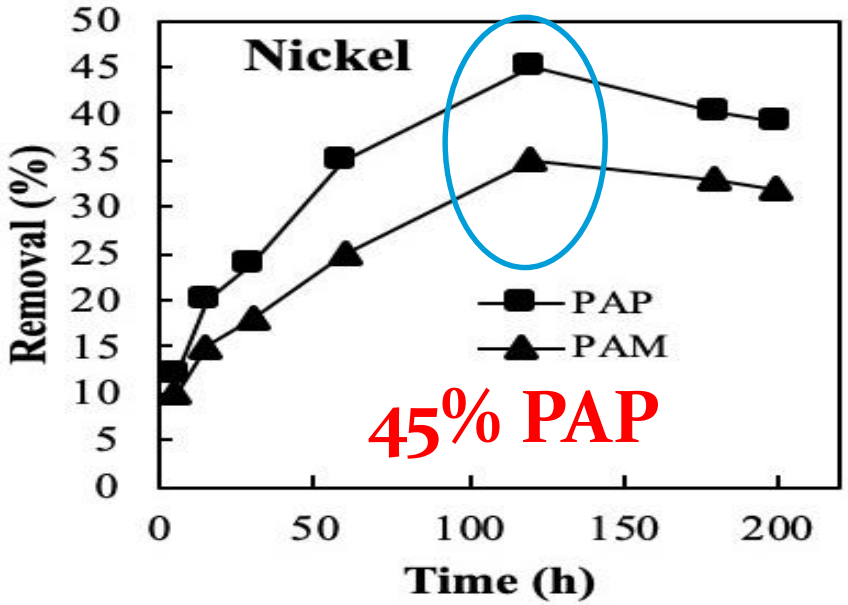


42% PAP

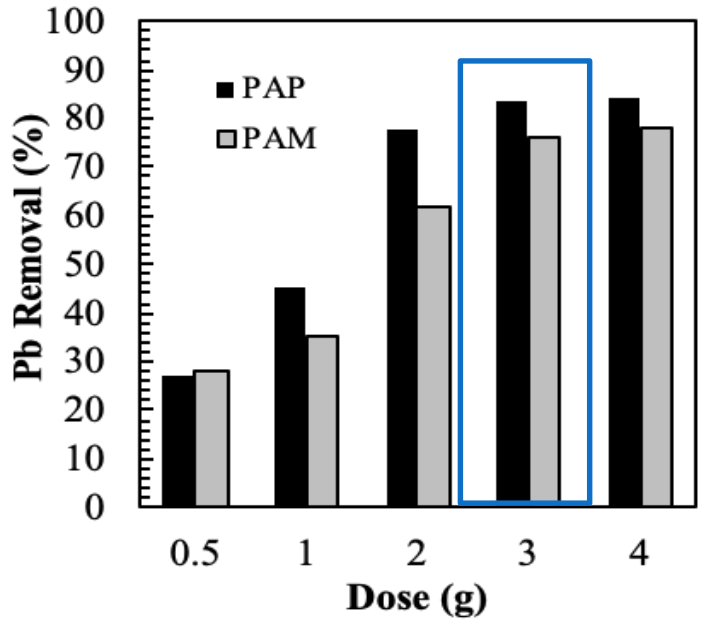


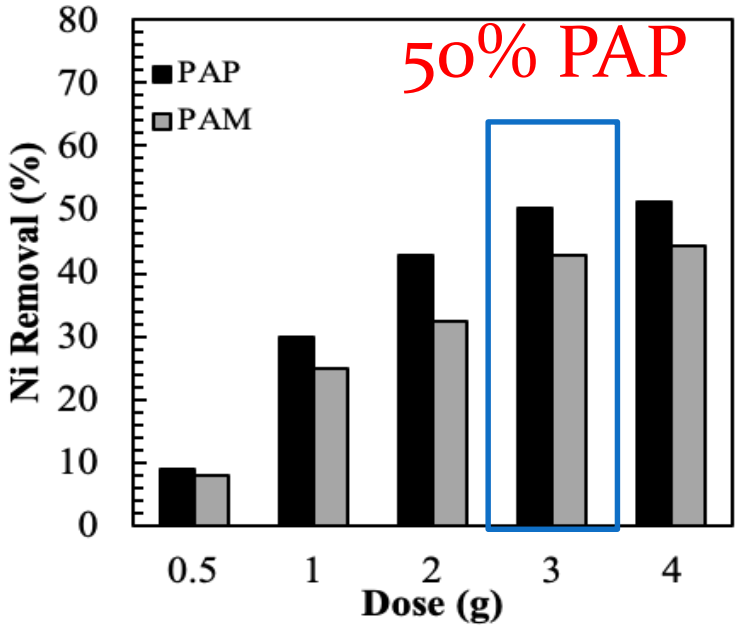
Adsorption parametric study



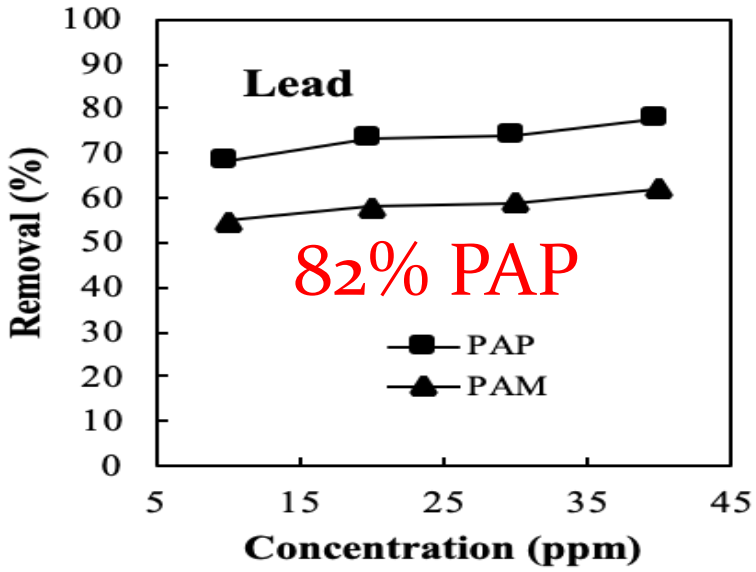


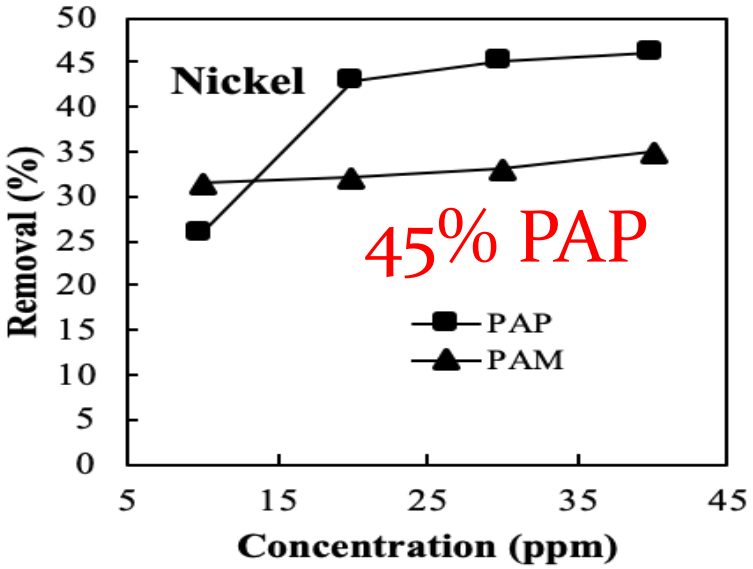
Results





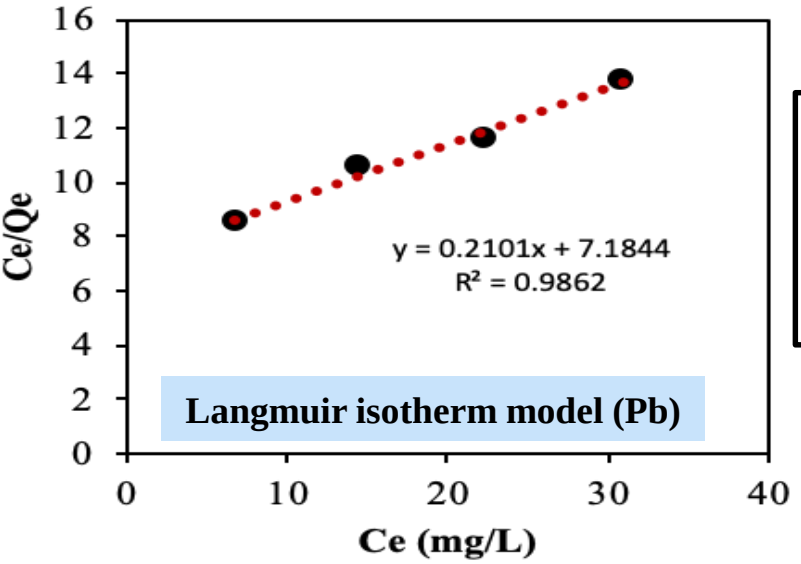
Adsorption parametric study



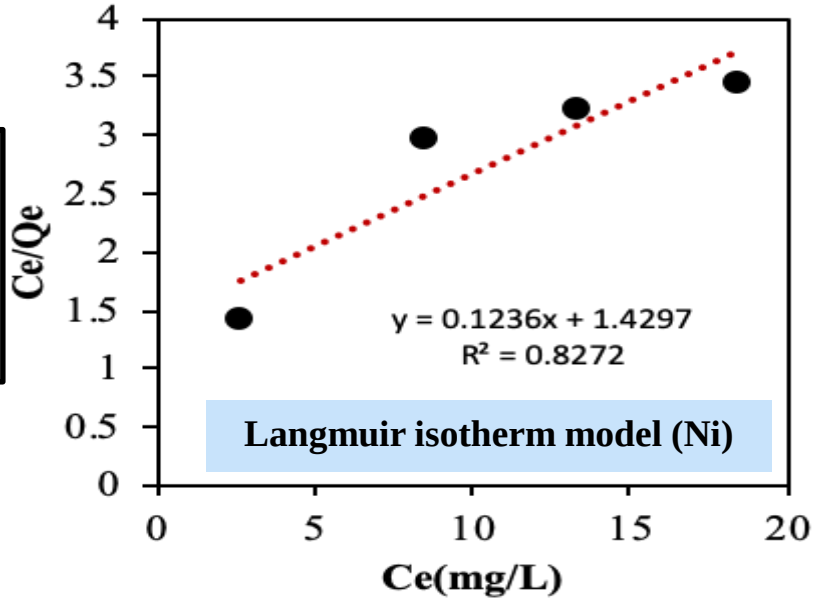


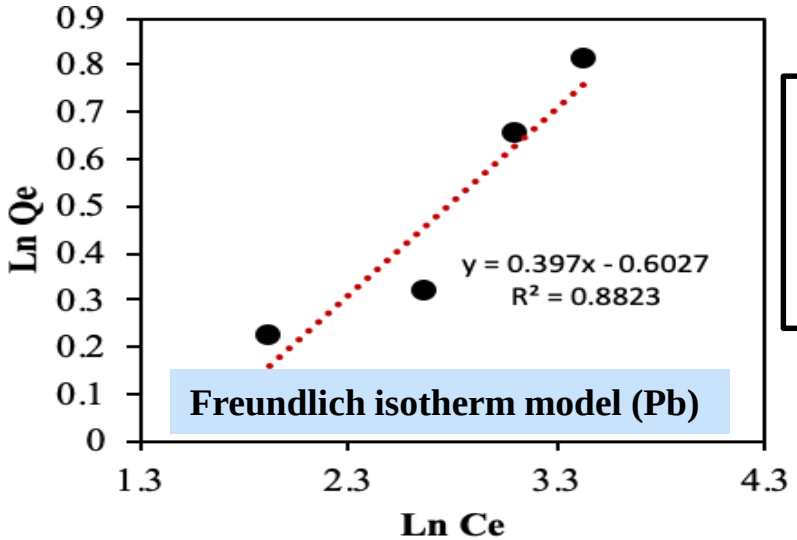
Results

Kinetic study

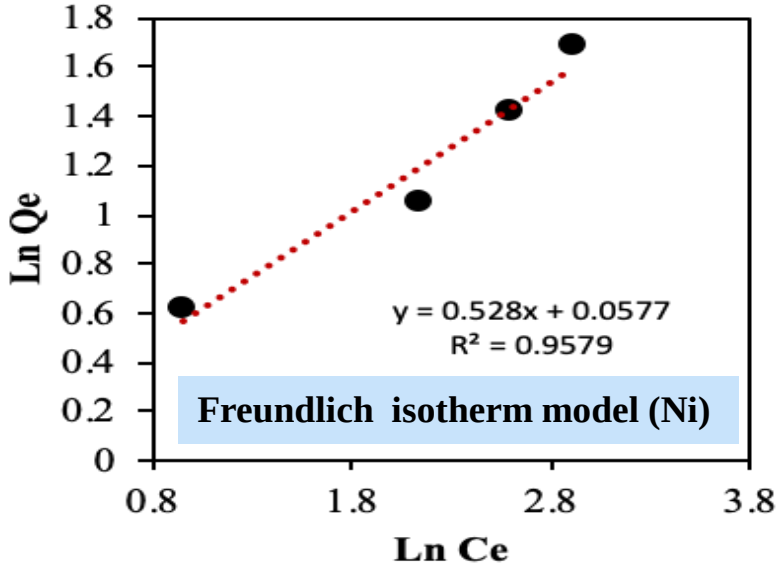


Lead ion's highest surface coverage on the used adsorbent occurred in a monomolecular layer on the adsorbent surface.





Freundlich isotherm best explained the nickel ion adsorption. Surfaces that are extremely heterogeneous are typically described by Freundlich equation.



Applications of Biosorbents in Wastewater Treatment

1

Effluent Polishing

Biosorbents can be used as a final step to remove trace heavy metals from treated water.

2

Continuous Treatment

Biosorbents can be incorporated into fixed-bed or fluidized-bed reactors for ongoing metal removal.

3

Sludge Stabilization

Biosorbents can immobilize heavy metals in sludge, reducing their environmental impact.

Challenges and Future Prospects of Biosorption Technology

1 **Scalability**

Developing cost-effective, large-scale biosorption systems remains a key challenge.

2 **Regeneration**

Efficient methods for desorbing and regenerating spent biosorbents need further research.

3 **Selectivity**

Improving the selectivity of biosorbents for specific heavy metals is an active area of study.

Conclusion

- Banana peels were chemically treated methanol and phosphoric acid.
- Banana peels treated with phosphoric acid exhibited a higher lead removal (84%) as compared to nickel using the initial concentration of 40 ppm, dosage of 4 g and pH of 6.
- Biosorbents offer a sustainable and cost-effective solution for water purification.
- This waste can be used directly after recycling, with the preparation of particles of the desired size or after modification using specific methods of pretreatment of the material before use.


THANK YOU