RECOVERY OF EUTROPHICATION AGENTS AND METAL IONS FROM POST TREATMENT EFFLUENT: A STUDY OF BIOCHAR-LDH COMPOSITE IN ADSORPTION

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Introduction

[1]

Anaerobic treatment;
Aerobic treatment;
Anammox, etc...

Treatments[3] → Adsorption

Leachate [2]

Organic compounds

Heavy metals

Eutrophication agents

Materials and methods

Sawdust → Pyrolysis/ activation → CO_2

Co^{2+}, Ca^{2+}, Fe^{3+} chloride salts

Coprecipitation[4] ← 3M NaOH

→ CoCaFe-LDH/ (CO_2) biochar

Adsorbate preliminary studied on synthetic aqueous solution containing Lead (Pb^{2+}) or Phosphate (PO_4^{3-}) ions.
- pH, adsorbate dosage, kinetics, isotherm were studied;

Results and Discussion

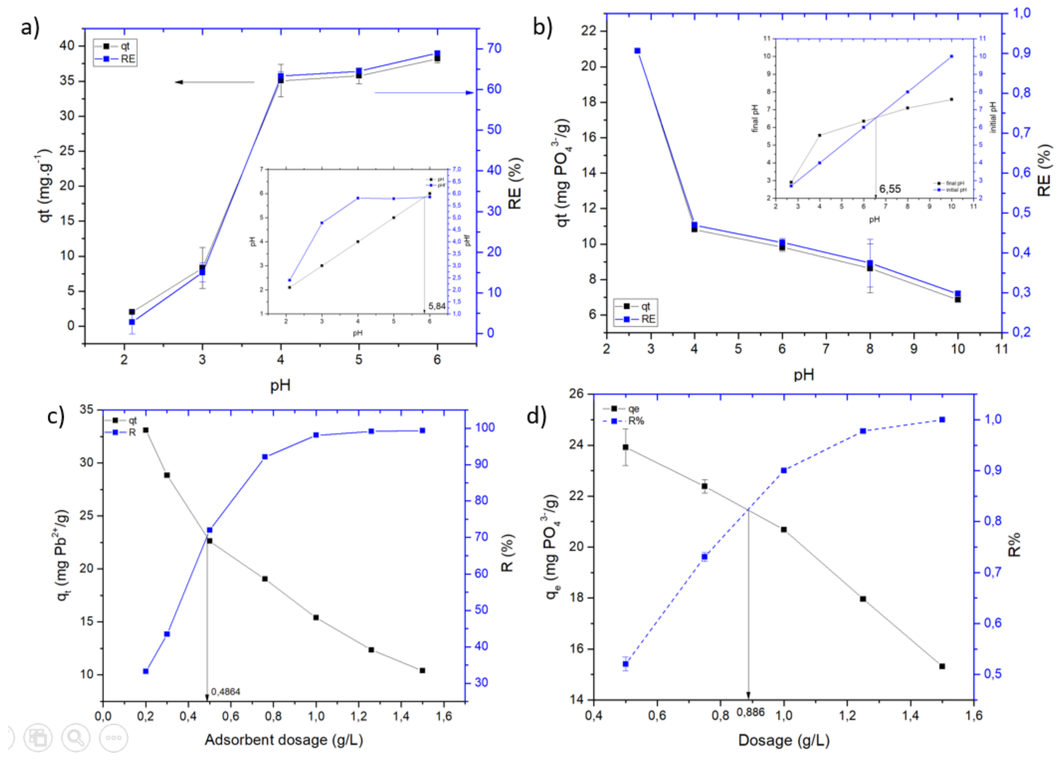

Figure 1: pH influence on the capacity of adsorption and efficiency removal of a) lead and b) phosphate. Dosage studies for c) lead and d) phosphate.

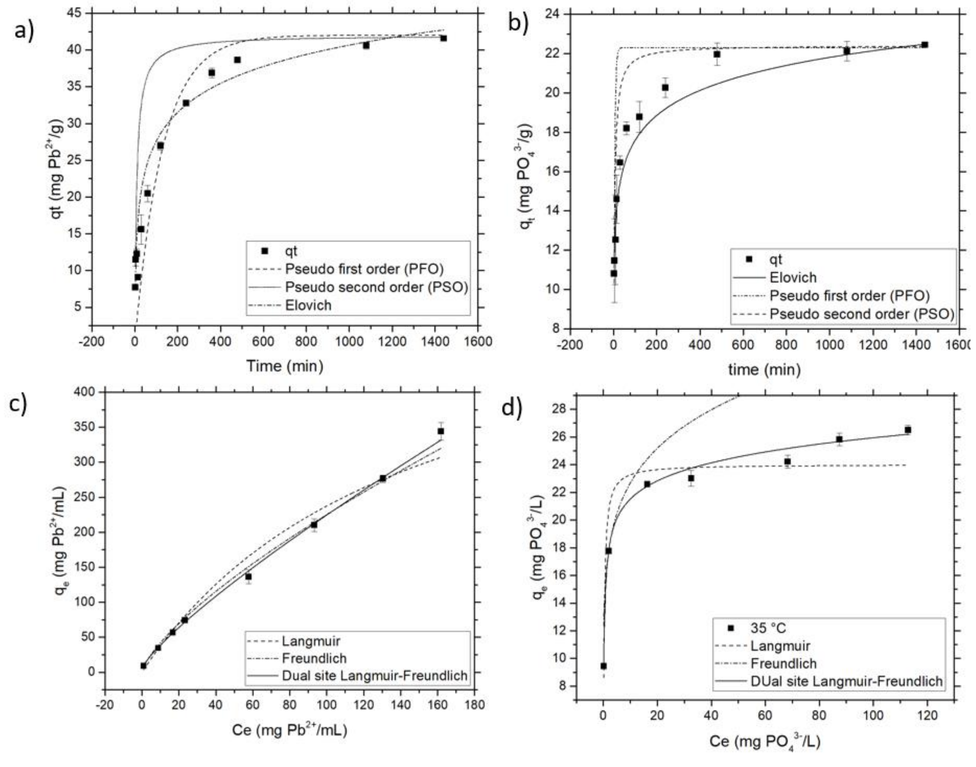

Figure 2: kinetic curves for the adsorption of a) lead b) phosphate and equilibrium isotherms for c) lead and d) phosphate.

Conclusions

-Both adsorbates kinetic and isotherm models were better fit to Elovich and Dual site Langmuir-Freundlich, respectively.

-The highest adsorption capacity observed were:

- q_m Pb^{2+}: 344.29 mg/g (35 °, 0.5 g/L, 18 h, pH 5);
- q_m PO_4^{3-}: 26.17 mg/g (35 °, 0.88 g/L, 8 h, pH 2.5).

-The synthetized composite shows good adsorption capacity towards lead and phosphates. Adsorbent seems to have more affinity to Lead and is also efficient for phosphate adsorption. The material seems a promisor adsorbent towards landfill leachate treatment.

References

[1]: 500 toneladas dos resíduos que chegam ao aterro sanitário são recicláveis. Jornal do Guara. Accessed 01/05/24. https://jornaldoguara.com.br/2021/12/03/500-toneladas-dos-residuos-que-chegam-ao-aterro-sanitario-sao-reciclaveis/

[2]: Y.-J. Li et al.: Antibiotic resistance genes and heavy metals in landfill: A review, J. Hazard. Mater., (2024). doi: 10.1016/j.jhazmat.2023.132395.

[3]: H. Omar, S. Rohani.: Treatment of landfill waste, leachate and landfill gas: A review, Front Chemic. Science Eng. (2015). doi: 10.1007/s11705-015-1501-y.

[4] J. Missau, D. A. Bertuol, and E. H. Tanabe.: Highly efficient adsorbent for removal of Crystal Violet Dye from Aqueous Solution by CaAl/LDH supported on Biochar. Appl. Clay. Sci. (2021). doi: 10.1016/j.clay.2021.106297.