

## Introduction

- Low-income Latino communities, known as *Colonias*, lack access to basic needs such as water and sewer, electricity, and more (Larson, 2002). A concern among these communities is tap water quality contaminated with lead (Pb) and polychlorinated biphenyls (PCBs).
- A prototype water filter was evaluated to address these issues. It was made from biochar and geomaterials (pumice). Biochar, also known as "biomass-derived black carbon," is a highly porous material produced through pyrolysis (Fig 1) while pumice is an extrusive igneous rock.
- The biochar feedstocks for this project include avocado seeds (AB), aspen bedding (BE), and palm tree bark (PT) pyrolyzed at 400, 600, and 800°C (Fig 2-3). A mixed-media filter was tested for its efficiency in removing Pb from aqueous solution (Fig 6).

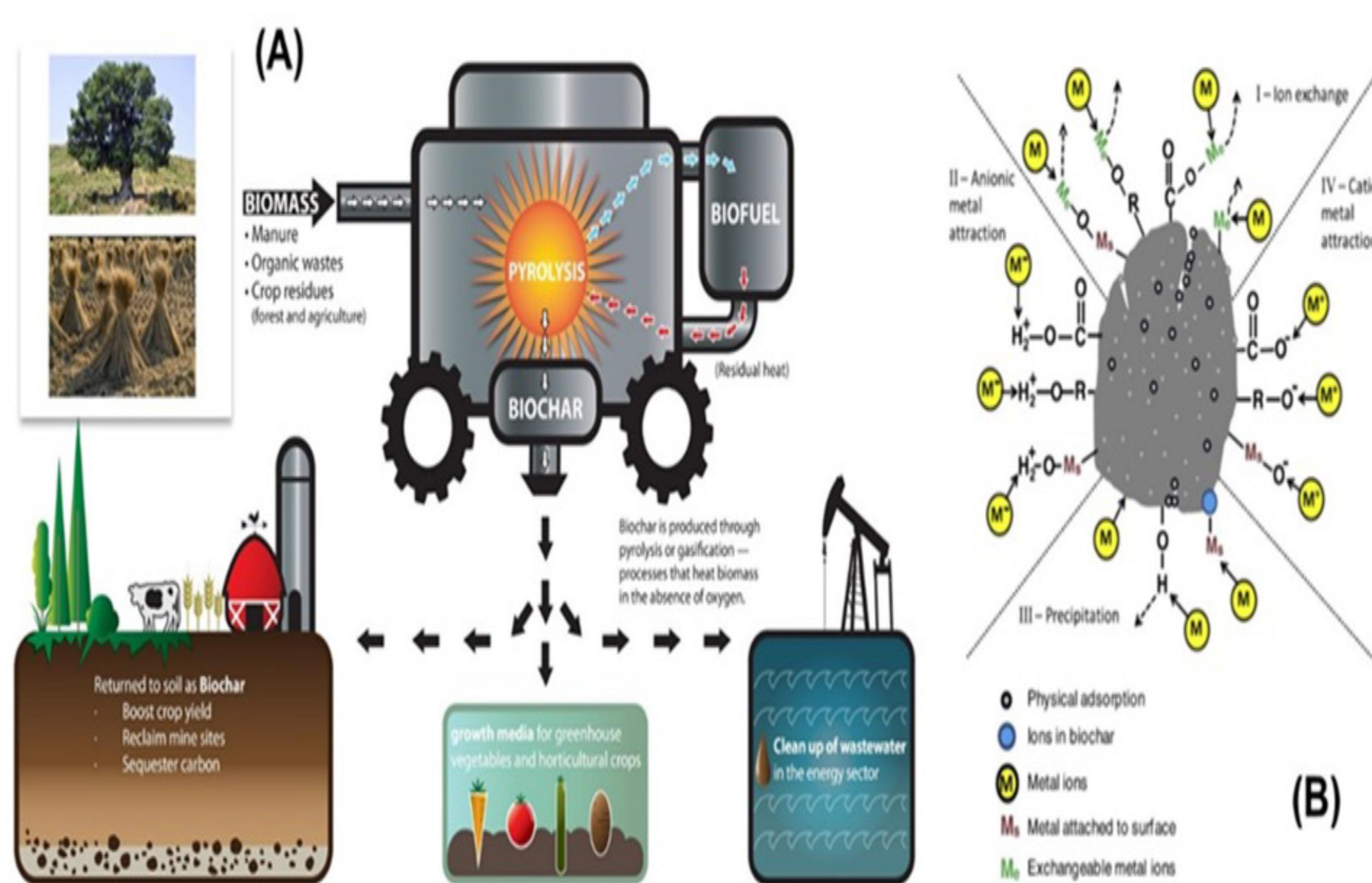


Fig. 1. (A) How biochar is made, and its potential applications. (B) Methods of biochar interaction with metal ions (Alberta Biochar initiative, 2015; Ahmad et al., 2014).

## Lead Adsorption

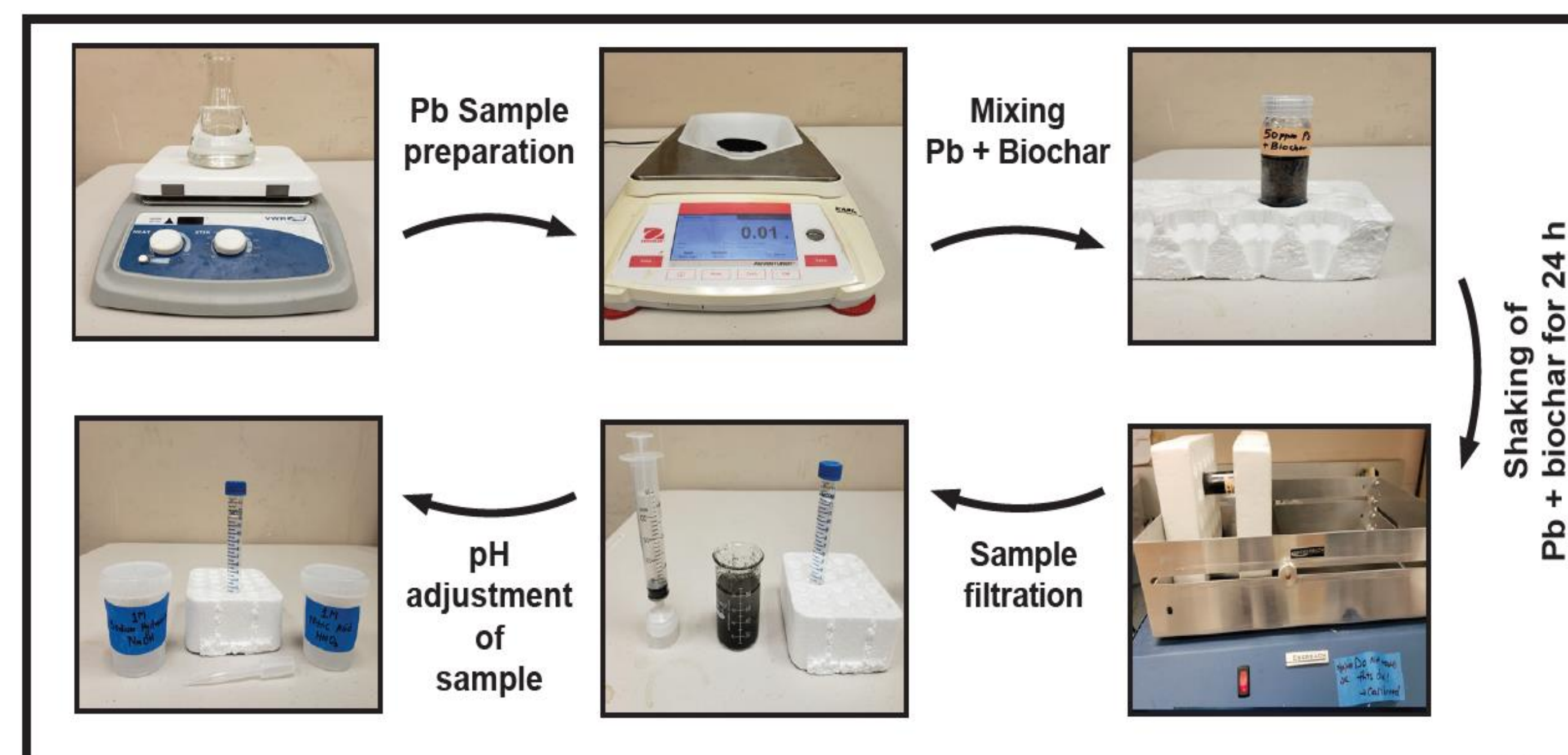


Fig. 4. Methods for batch adsorption tests of Pb.

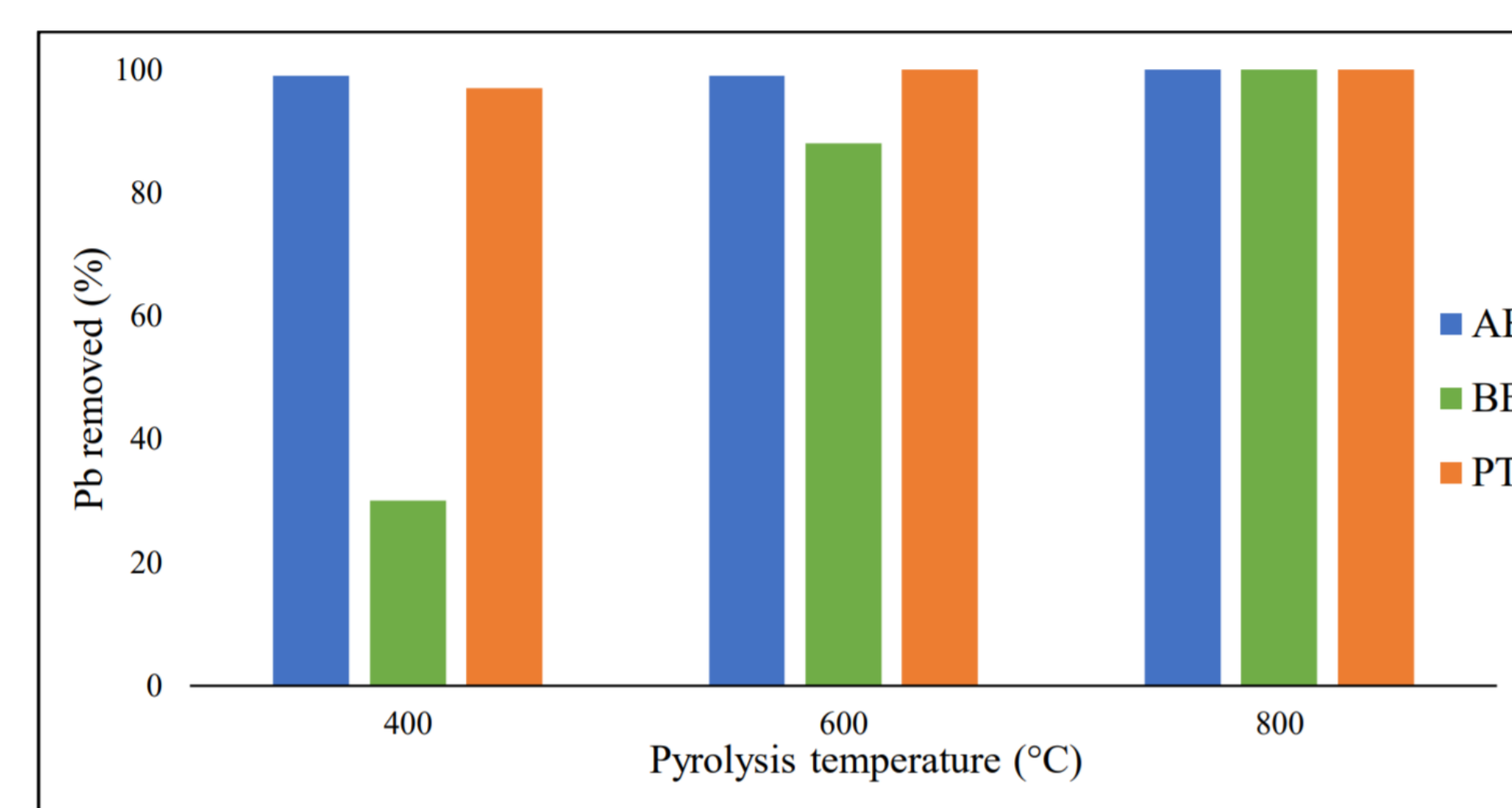


Fig. 5. Single point adsorption test results. The sample had an initial solution of 50 mg/L of Pb

## Biochar



Fig. 2. Biomass feedstocks and their respective biochar products

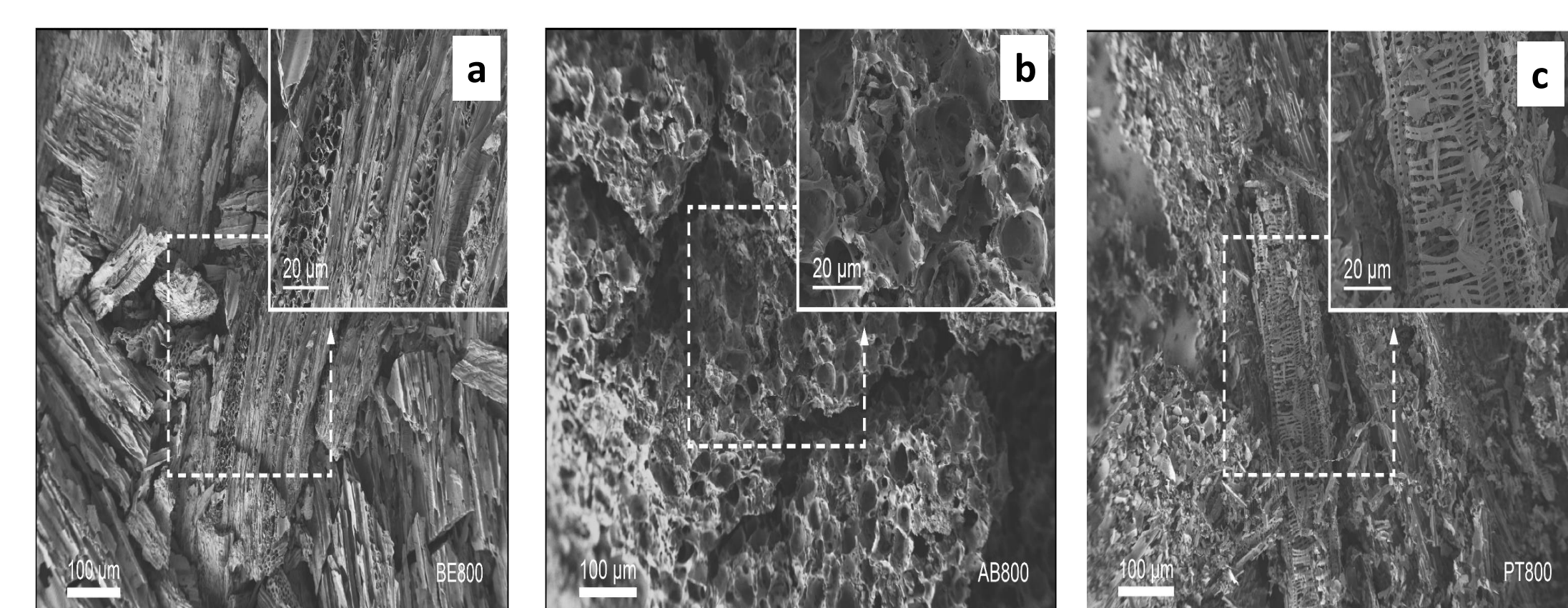


Fig. 3. SEM micrographs of a) BE800, b) AB800, and c) PT800

## References

- Ahmad, M., Rajapaksha, A. U., Lim, J. E., Zhang, M., Bolan, N., Mohan, D., ... & Ok, Y. S. (2014). Biochar as a sorbent for contaminant management in soil and water: a review. *Chemosphere*, 99, 19-33.
- Alberta Biochar Initiative (2015). How biochar is made, and its potential applications. Available at <http://albertabiobiochar.ca/wp-content/uploads/2014/04/ABI-Pamphlet.pdf>. Accessed on May 17, 2015.
- Larson, J. E. (2002). Informality, illegality, and inequality. *Yale L. & Policy Rev.*, 20, 137.

## Adsorption Isotherm

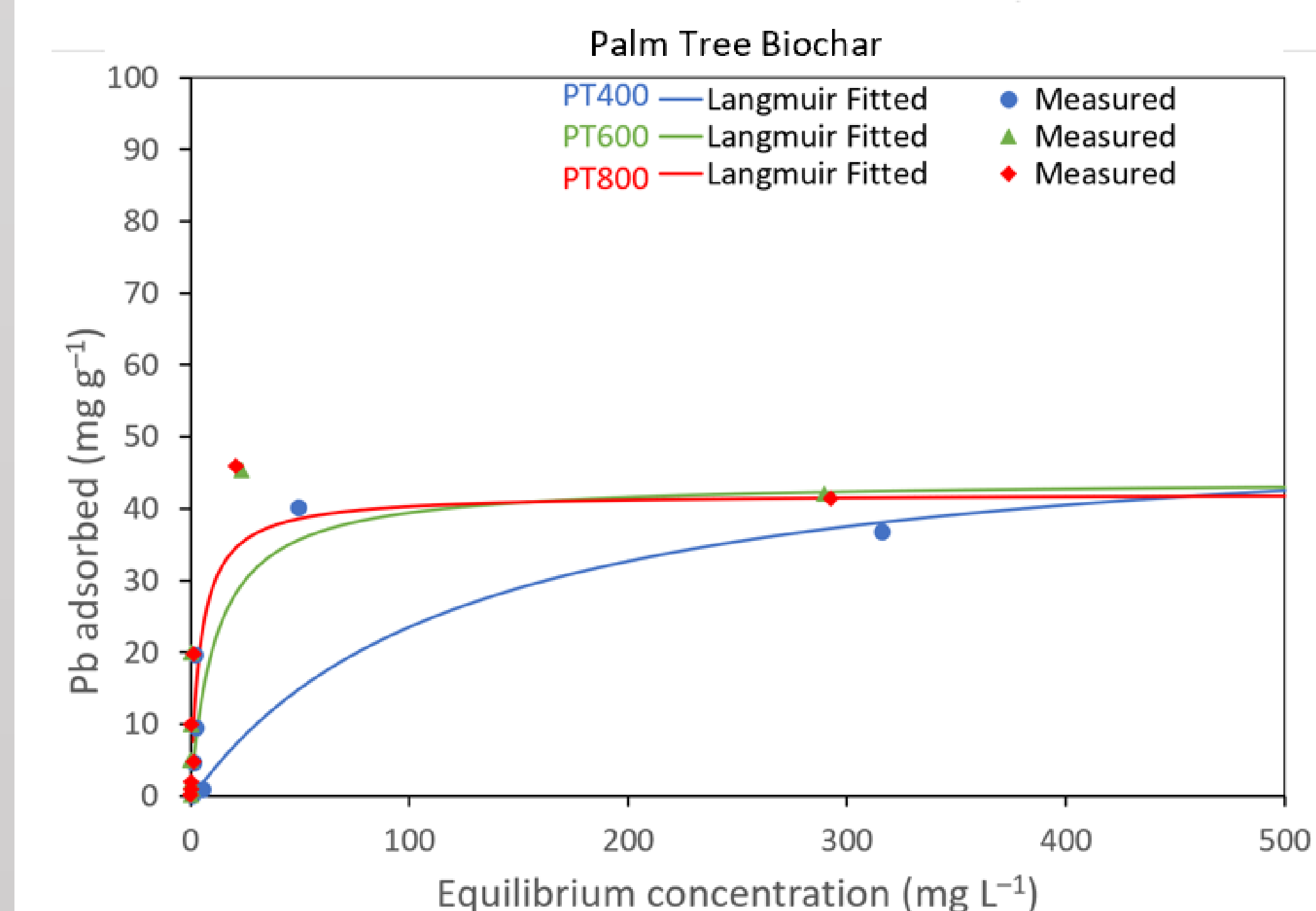
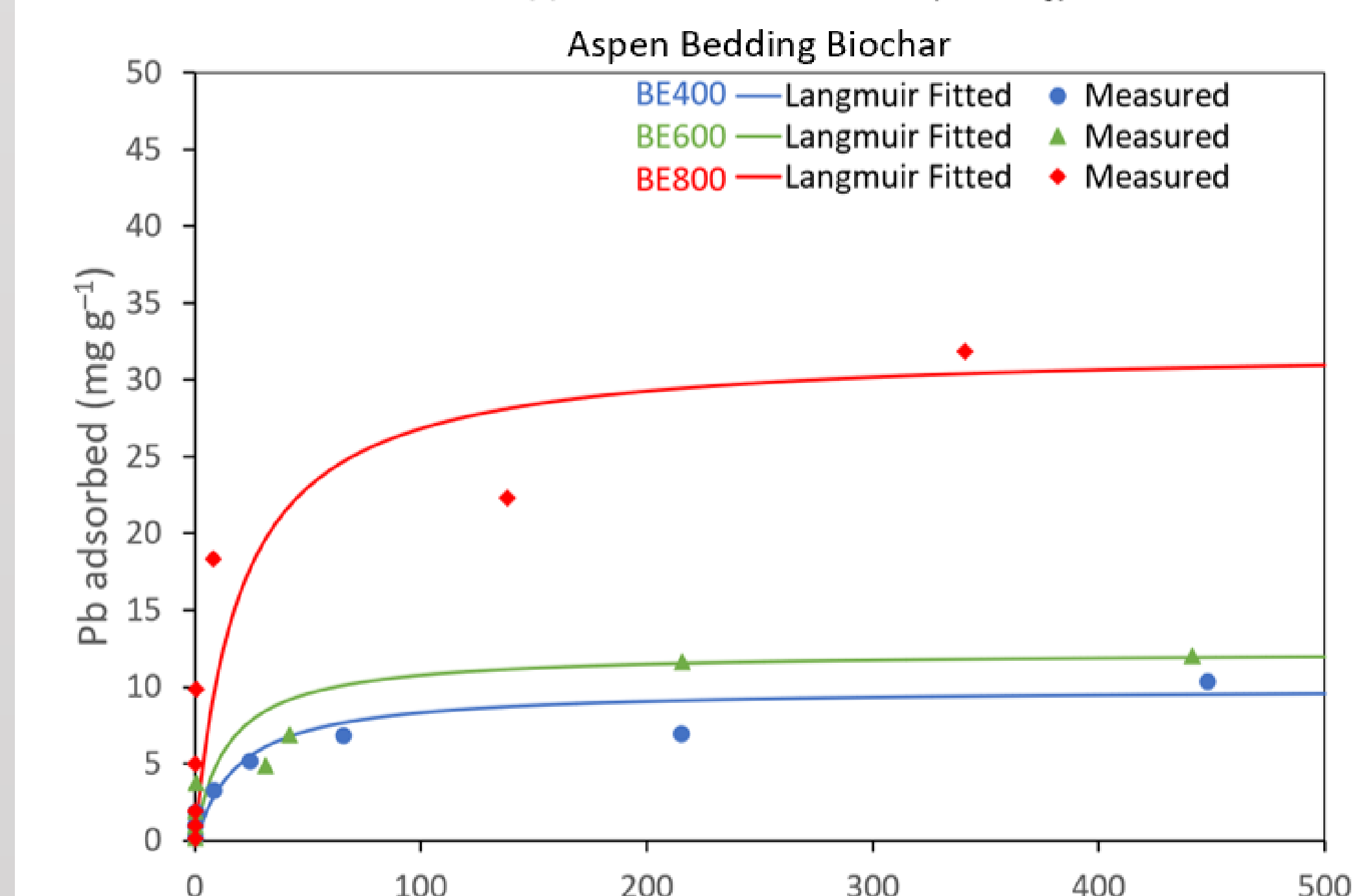
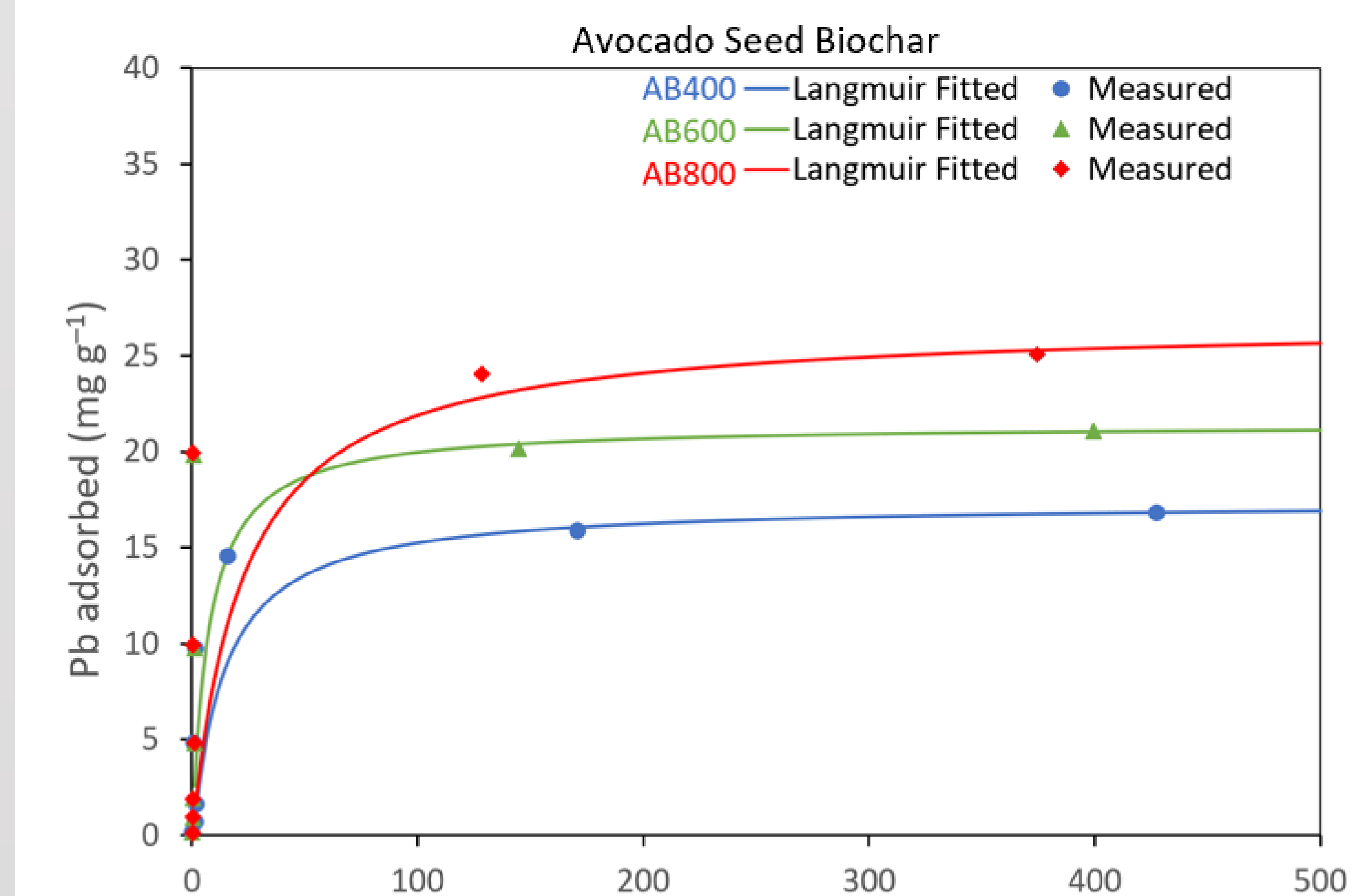


Fig. 10. Pb Adsorption Isotherm fitted with Langmuir Model. This depicts how each of the biochar samples adsorb aqueous Pb at different concentrations.

## Biochar-Pumice Columns for Lead Removal

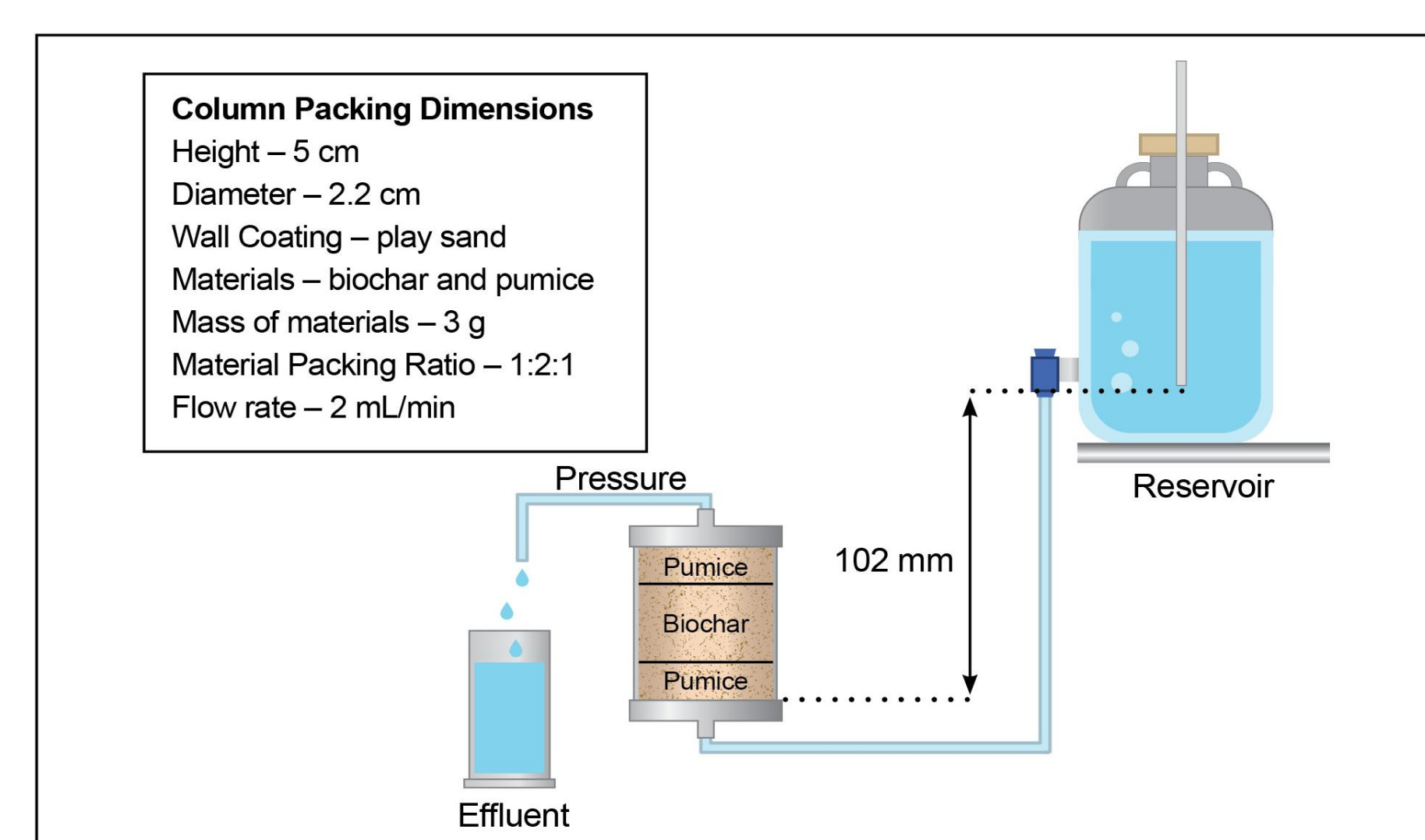


Fig. 6. Column packing dimensions for Biochar-Pumice filter

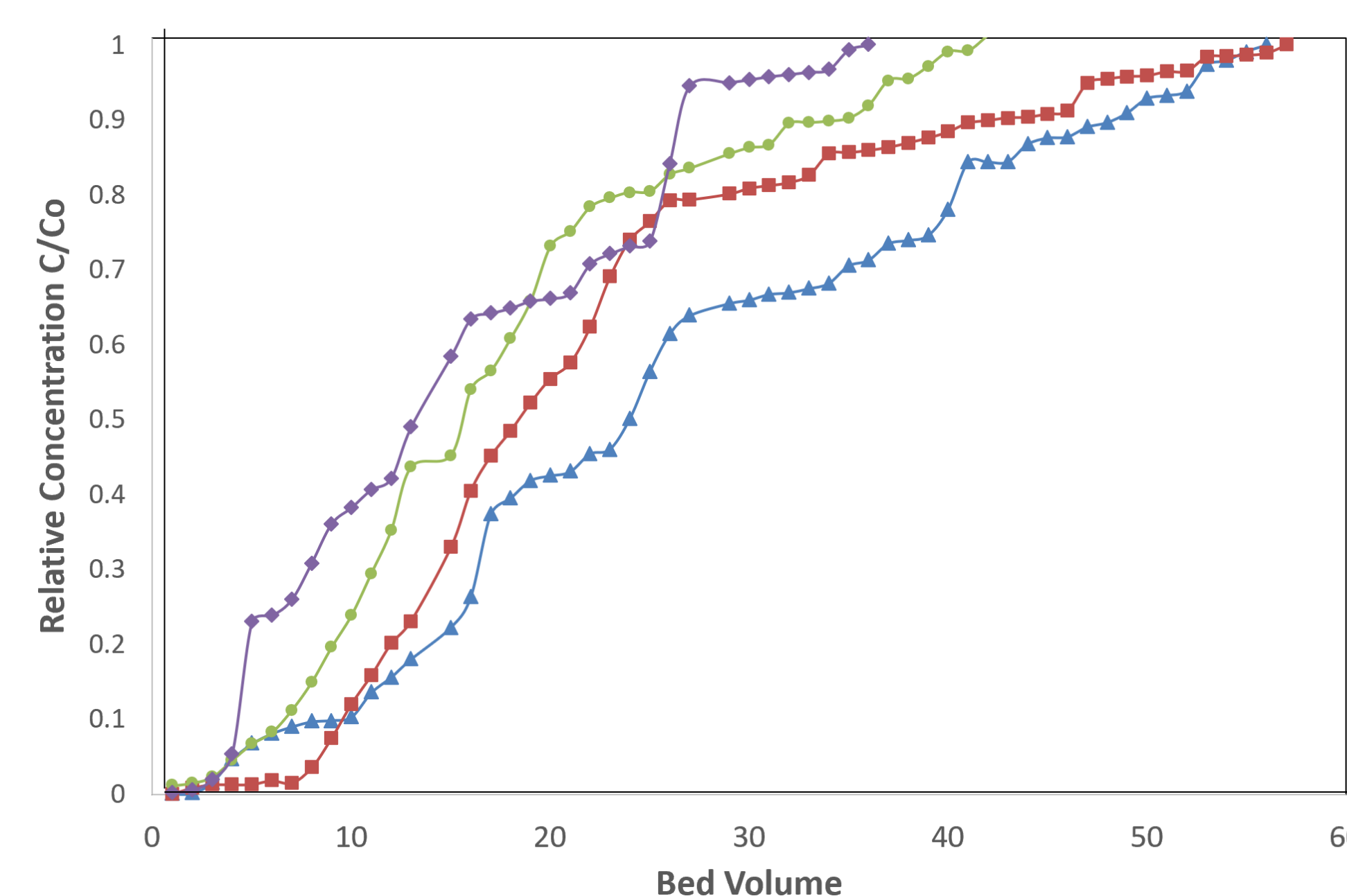


Fig. 9. Column Flow-Through Experiment Results. Cumulative Pb adsorbed by AB800, BE800, PT400, and PT800 is 24.2, 18.1, 26.9, and 32.3 mg while their respective number of pore volume for  $C/C_0 = 1$  is 40, 34, 54, and 56.

A concentration of 50 mg/L Pb was used for column experiments. A bottom-up approach was used to flow aqueous Pb solution through the column; this ran for a minimum of 6 hours and effluent was collected in 10-minute intervals.

Flow-through experiments was designed to evaluate the performance of biochar-pumice media for Pb retention via Pb transport under saturated condition (Fig 6).

In these biochar-pumice columns, the biochar was the material doing most of the adsorptions while pumice showed minimal adsorption for Pb. When the relative concentration  $C/C_0$  is equal to 1, this represents the breakthrough point of Pb, at which the biochars stopped adsorbing Pb. All biochar-pumice columns tested were able to adsorb at least 25 bed volumes.

## Summary

- Adsorption of Pb onto biochars was dependent upon feedstock source and pyrolysis temperature.
- Single point adsorption tests and column flow through tests both showed that AB800, BE800, PT400, and PT800 were the best performing biochars.
- $S_{max}$  values for AB800, BE800, PT400, and PT800 are 26.79, 32.17, 53.07, and 42.16 ( $\text{mg g}^{-1}$ ).
- With increasing concentration of Pb, higher temperature biochars became more efficient at adsorbing the Pb.

## Acknowledgments

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