Biochars have a greater adsorption capacity for lead(II) from aqueous solutions than hydrochars

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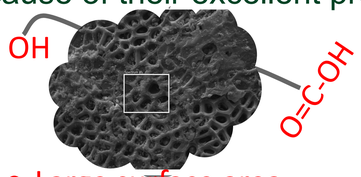
Biomass-derived biochars & hydrochars can capture contaminants in industrial process water

- More than 1 trillion liters of contaminated process water generated from oil sands mining needs to be treated using a cost effective and environmentally friendly technique such as adsorption

- Biochar & hydrochar produced by thermal processing of waste biomass are promising adsorbents because of their excellent properties



- Large surface area
- Meso/microporous

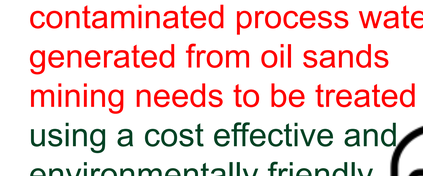
- We studied how biochars & hydrochars derived from 4 feedstocks at 3 temperatures affect lead(II) removal from synthetic wastewater

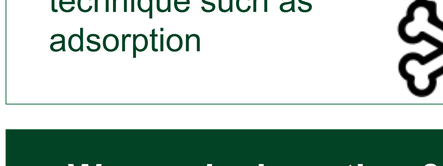
We used adsorption & kinetics studies to compare biochar & hydrochar lead(II) adsorption

Feedstock types


Canola straw


Manure pellets


Sawdust


Wheat straw

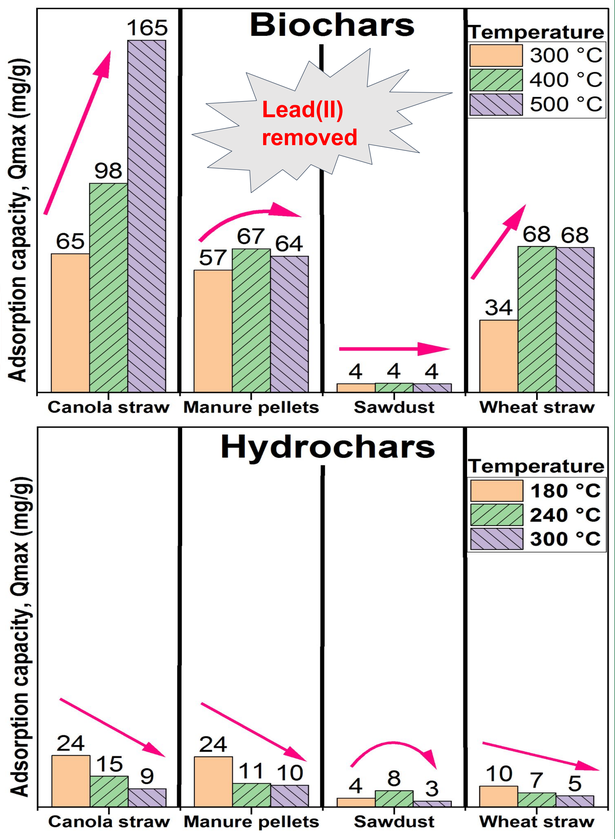
Biochar
@300, 400, 500 °C
Microwave pyrolysis
Hydrothermal process
@180, 240, 300 °C
Hydrochar

Chars in lead(II) solution

Batch adsorption & kinetics studies

Parameters: adsorption studies

- Concentration| 50-200 mg/L
- Contact time| 0.5-24 h
- Adsorbent dosage| 1 g/L
- Ionic strength| < 0.0032 mol/L
- Temperature| 25 °C
- pH| monitored



Biochars are best for lead(II) removal

1. Feedstock type and production temperature both affected lead(II) adsorption by biochars and hydrochars
2. Biochars removed lead(II) from synthetic wastewater more than hydrochars because their high element contents such as potassium and sodium increase cation exchange
3. Sawdust biochars & hydrochars are not recommended as adsorbents for lead(II) removal in wastewater due to their low adsorption capacities
4. Canola straw biochars are recommended as adsorbents for lead(II) removal in wastewater due to their high adsorption capacities

Acknowledgement & Reference

- The study was funded by Canada First Research Excellence Fund
- Authors acknowledge the technical support provided by Cole D. Gross

- See Nzediegwu et al. (2021a and 2021b) for characterization and adsorption results https://doi.org/10.1016/j.biortech.2020.124282; https://doi.org/10.1016/j.jhazmat.2021.125255

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Keys: OH: hydroxyl group; O=C-OH: carboxylic group

CANADA FIRST RESEARCH EXCELLENCE FUND