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Removal of metals for improved sludge quality

Adsorption during primary settlement

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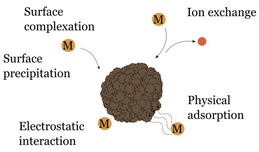
ABSTRACT

Separation of heavy metals (Pb, Cd, Cu, Cr, Ni and Zn) during municipal wastewater treatment could improve sludge and effluent quality. Biochar could be an effective adsorbent of heavy metals, in this experimental study especially for Cd.

INTRODUCTION

To reduce heavy metal concentrations in wastewater effluent and sludge it is of interest to both find ways to reduce the use of these metals in society and to increase metal separation during municipal wastewater treatment.

A possible way of achieving metal separation would be to add an adsorbent to remove dissolved heavy metals during primary treatment. Char produced by pyrolysis of waste organic matter is a low cost adsorbent that in previous studies has shown very high adsorption capacities.

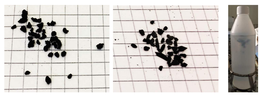


Several mechanisms control the sorption/ adsorption to char - contributing factors are the negative surface of char, the large porosity and an abundance of surface functional groups.

OBJECTIVE AND METHOD

The main objective of this study was to evaluate the possibility to use char for adsorption of heavy metals from municipal wastewater.

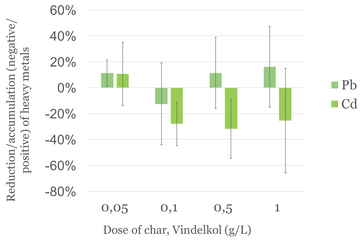
Adsorption efficiency from raw wastewater was evaluated during batch adsorption tests ("shake tests").



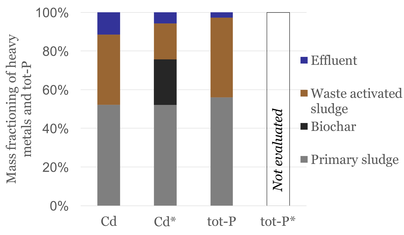
During "shake tests" wood derived char and a char produced from pyrolysis of sewage sludge (Linz WWTP, Germany) were added at different dosages.

RESULTS

- Wood derived char adsorbed ~25-30 % Cd from raw wastewater, at a char dose of 0.1 g/L or above.
- Preliminary calculations indicate that the Cd:P ratio of waste activated sludge could be improved, depending on how the char affects P fractioning.
- The concentrations of Pb seemed to increase after "char treatment", which could be caused by leaching of metals contained in char.



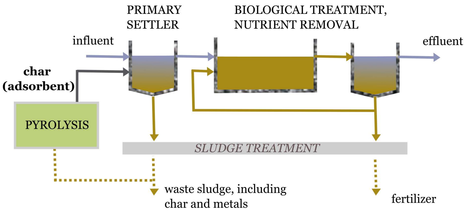
Reduction of heavy metals after "char treatment" of raw wastewater, at different doses of wood derived char.



Estimate of current distribution of Cd and tot-P at Kungsängsverket WWTP in Västerås, and theoretical distribution with addition of wood based char(*).

CONCLUSIONS

- Experimental results indicate that the tested char could be an efficient adsorbent of Cd.
- A serious drawback is the risk of leaching of Pb from char to wastewater.
- Further investigations are needed, including:
  - How high is the risk of metals leaching from char and could it be reduced?
  - How could the char be efficiently separated (sedimentation/flotation etc.)?
  - How will the char affect the process as a whole, in particular nutrients (P and N)?



If heavy metals were separated in primary treatment while nutrients were separated in subsequent treatment steps, then the waste activated sludge could be a high-nutrient/low-metal fraction which would be appropriate as a fertilizer.

ACKNOWLEDGEMENT

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