Managing Wastewater Contaminants Treatment via Food Byproducts-based Biochars

Ruogu Tang[1], Boning Liu[1,2] Juzhong Tan[1]*

1. Department of Animal and Food Science, University of Delaware. Newark, DE, USA. 19713.
2. Department of Mathematics, West Chester University of Pennsylvania. West Chester, PA, USA. 19383.

* Corresponding author: jztan@udel.edu

foods
an Open Access Journal by MDPI

Highlights

By utilizing food byproducts-based biochars, this study developed a novel and practical approach toward managing wastewater treatment.

Background

Wastewater treatment is a significant part of food engineering and industry.

Critical factors:
* Feasibility
* Cost
* Side effects
* Recycle and reuse

Aim & Strategy

1. The food byproducts were “turned” into biochars;
2. Biochars were used as adsorbents against contaminants in the filtration system.

Biochar Harvesting

Representative food byproducts for producing biochars

Corn cob stalks

Bamboo stalks

Nutshells

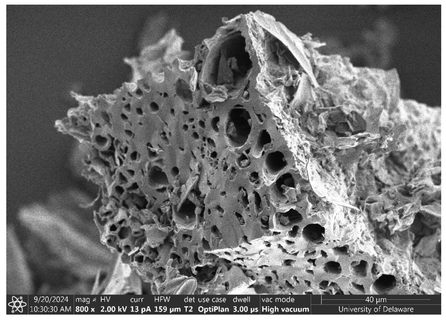
Byproducts were pyrolyzed under O_2 free environment

Muffle furnace

Corn cob biochars

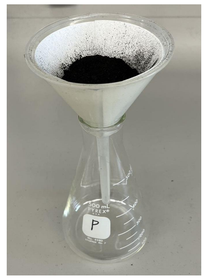
Bamboo biochars

Nutshell biochars



Porous structure of biochar (Observed on corn cob biochar via SEM)

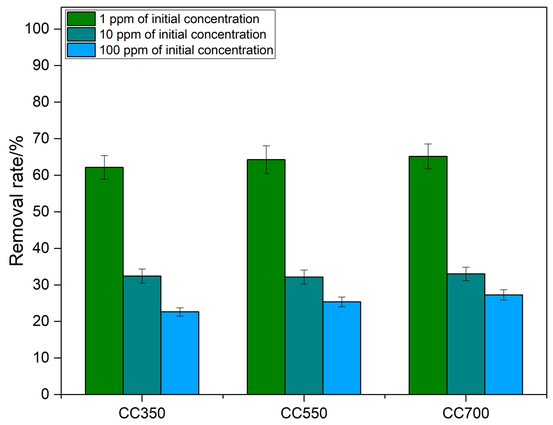
Contaminants Treatment



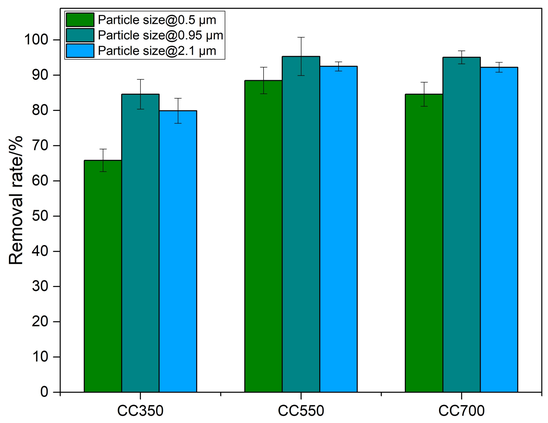
Simplified water filtration system

Test samples:
Corn cob biochars (CC) pyrolyzed under 350°C, 550°C and 750°C.

Against targets:
1. Ammonia
2. Microplastic



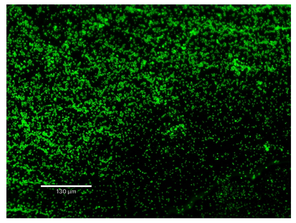
Ammonia filtration/adsorption



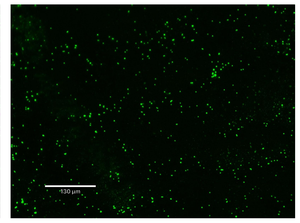
Microplastic filtration/adsorption

Contaminants Treatment

Representative fluorescent images of microplastic (green dots)-rich wastewater



Before treatment



After treatment

Conclusions

The biochar products demonstrated the capabilities of adsorbing and removing contaminants to achieve wastewater treatment.

Future Directions

The research scope will be expanded, which includes:
1. Mechanism studies;
2. Recycling/reusing investigations.

Acknowledgement: USDA NRCS Award#: NR243A750004G028