Robust shape memory nanocellulose based aerogels decorated with silver nanoparticles for dye discoloration

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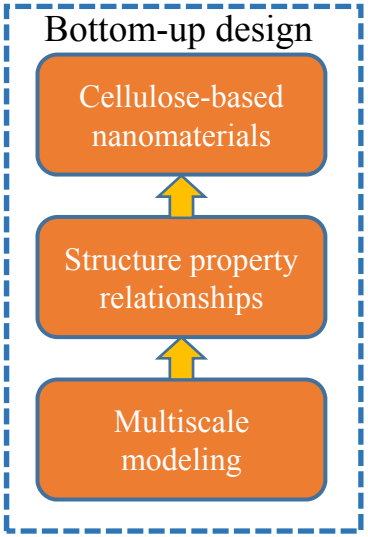
Outline

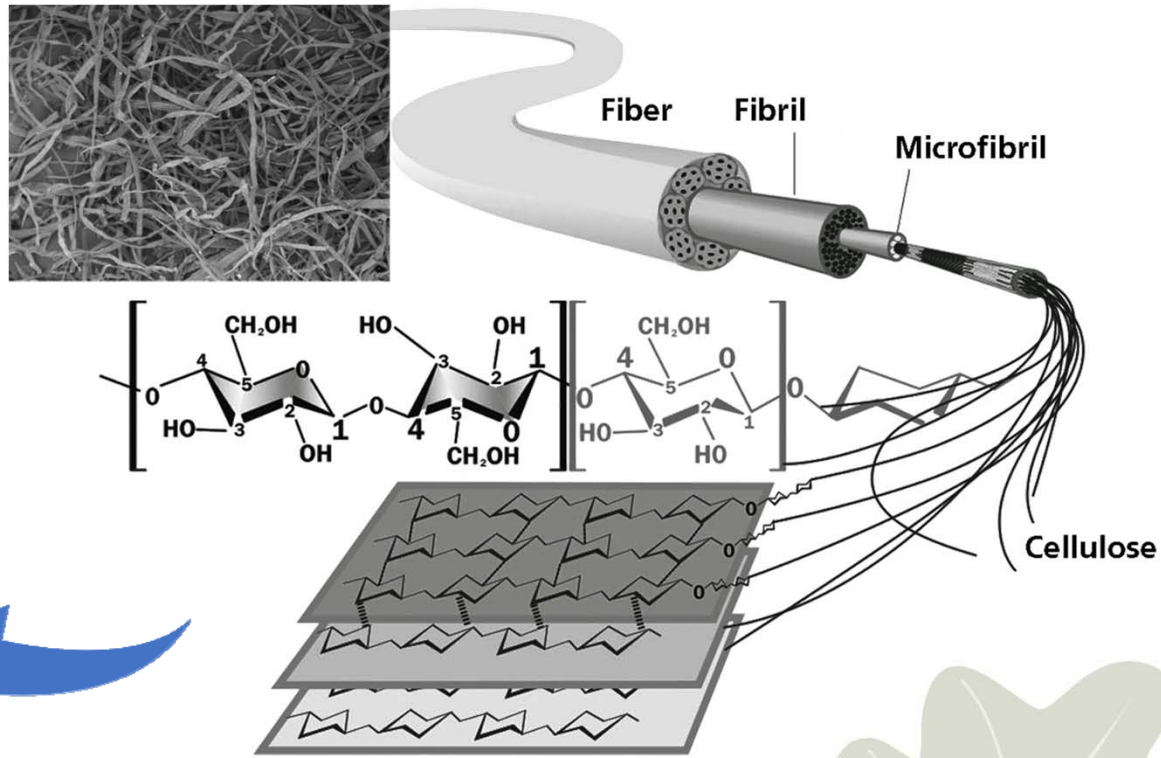
- Background
- Composite aerogel preparation
- Characterizations
- Highlights

Background

Pictures from google

Why nanocellulose?

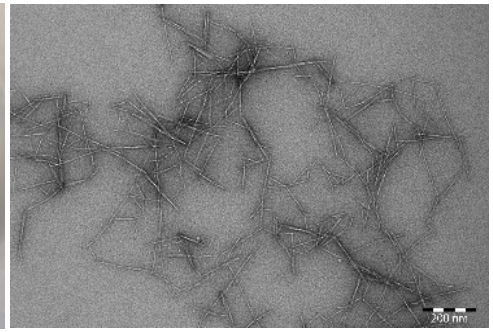


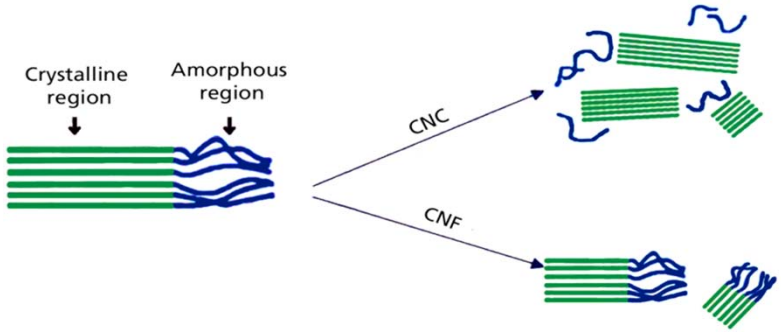


Parallel stack of cellulose chains

Barrios, J. E. R. (2017)

Nanocellulose





Types:

CNF: smallest structural unit of plant fiber

d<100nm

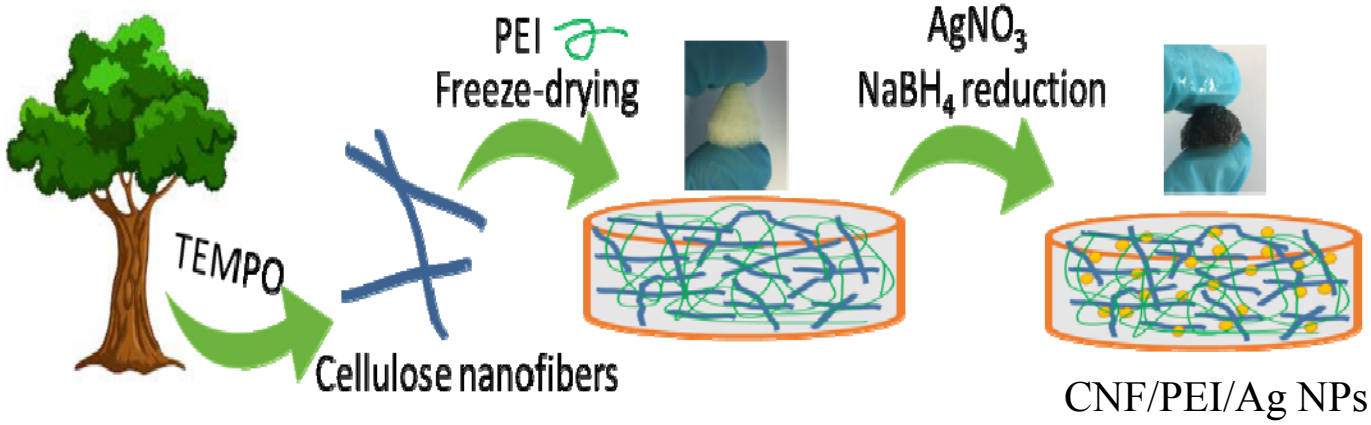
"spaghetti" shape

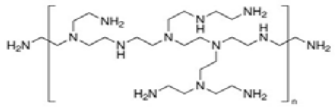
CNC: highly crystalline structure

d<50 nm

"rice grain" shape

Nanocellulose-based Ag NPs composite formulation





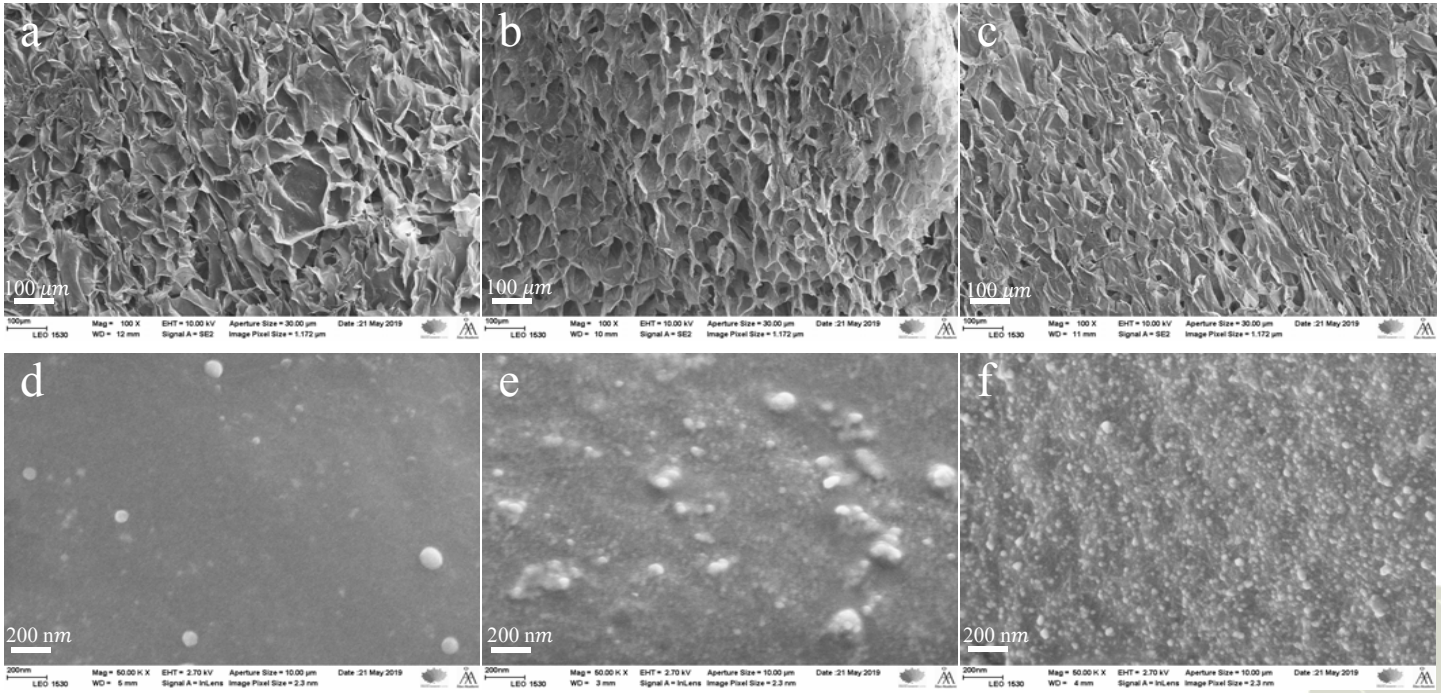
Polyethyleneimine (PEI)

Cellulose nanofiber (CNF)

Ag NPs

Tunable Ag NPs loading

CNF/PEI/Ag I (4.7% Ag) CNF/PEI/Ag II (15.5% Ag) CNF/PEI/Ag III (22.4% Ag)

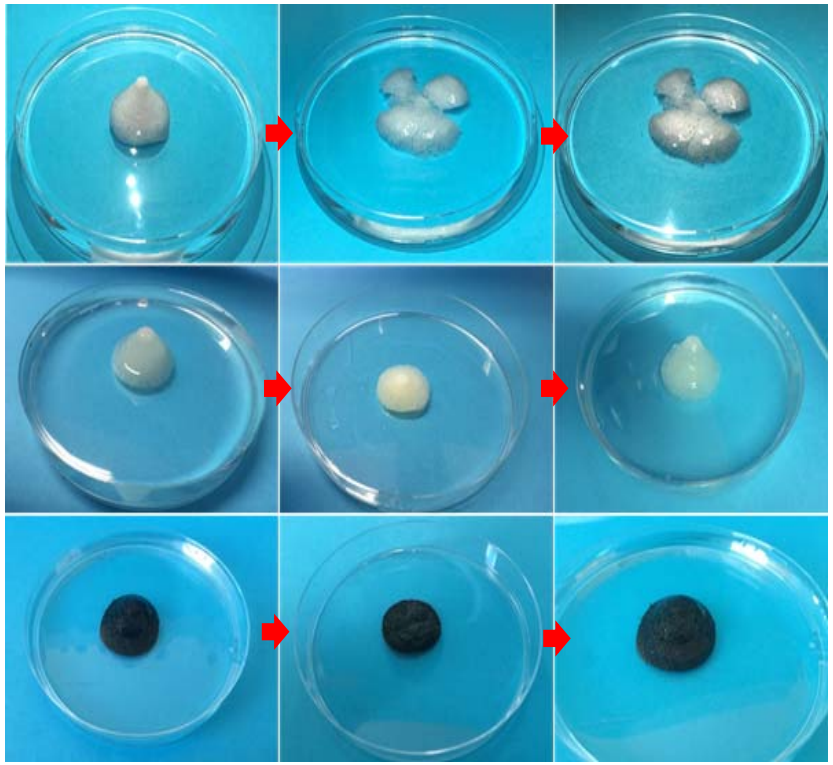


Mechanical performance

CNF

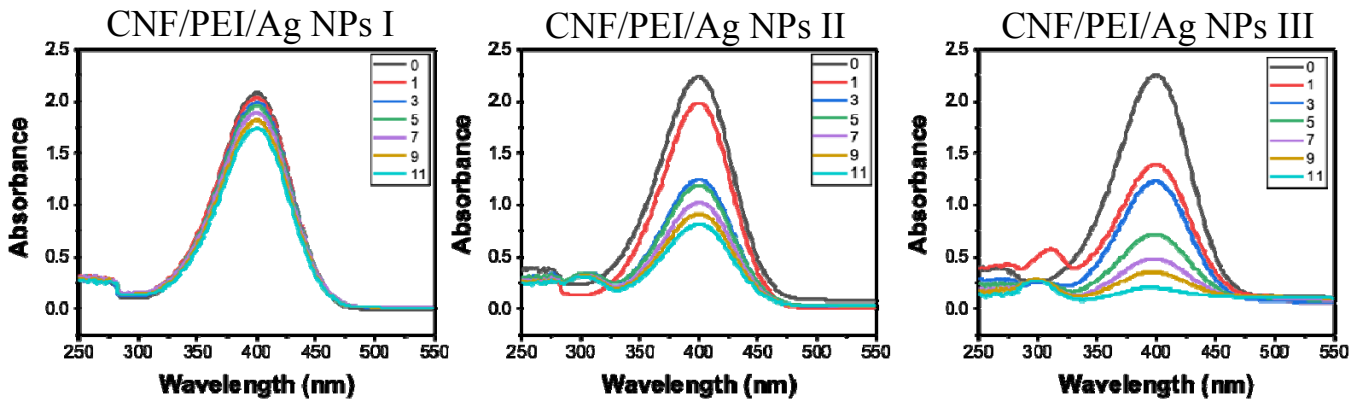
CNF/PEI

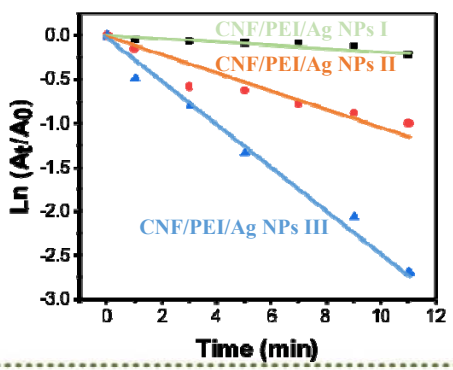
CNF/PEI/
Ag NPs



- Excellent wetting stability
- Shape memory

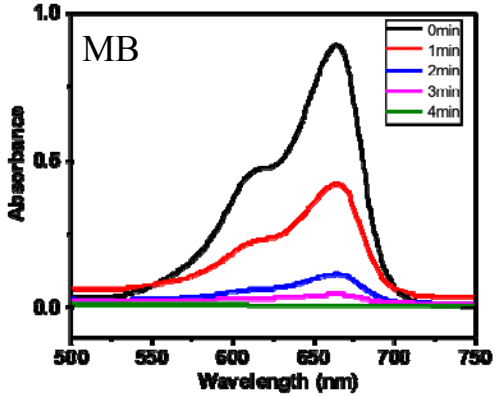
Catalytic performance (within 11min)

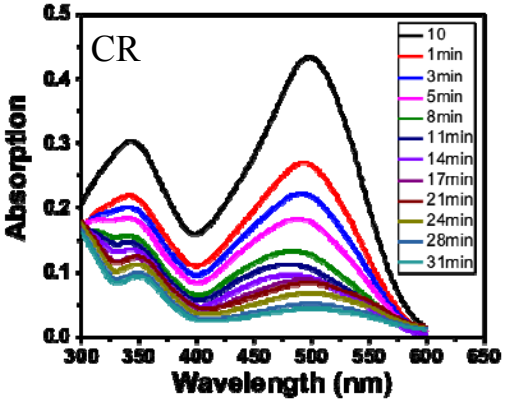


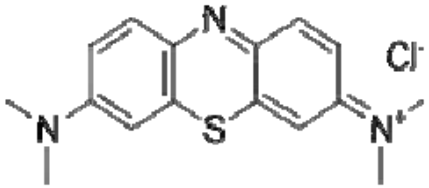


- The composite aerogel showed excellent catalytic performance towards to model molecule (4-Nitrophenol)
- More Ag NPs loading, better catalytic performance

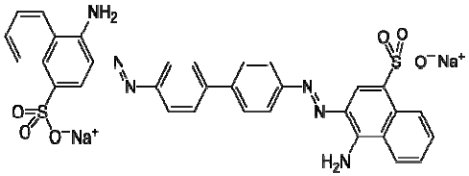
Catalytic performance for dyes in batch





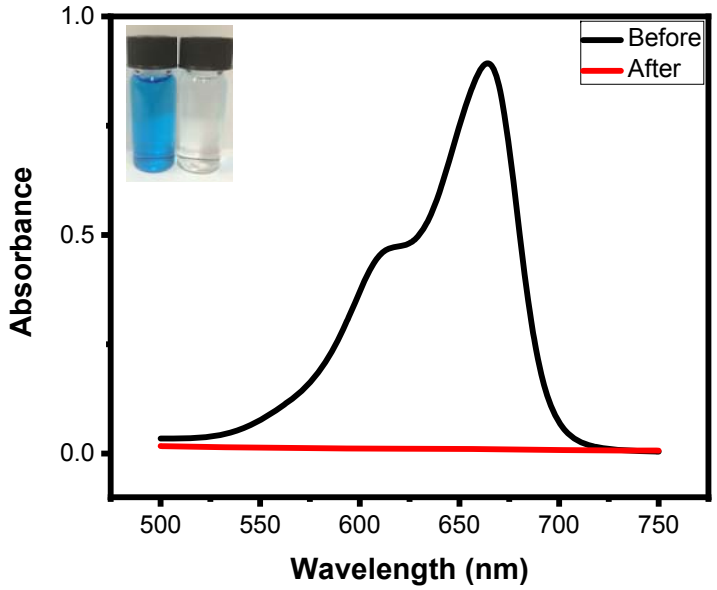


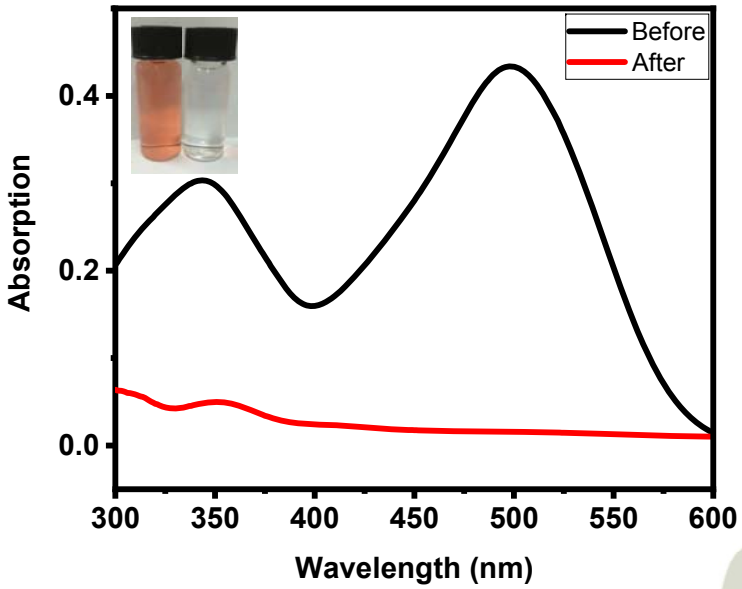
Methylene blue(MB)



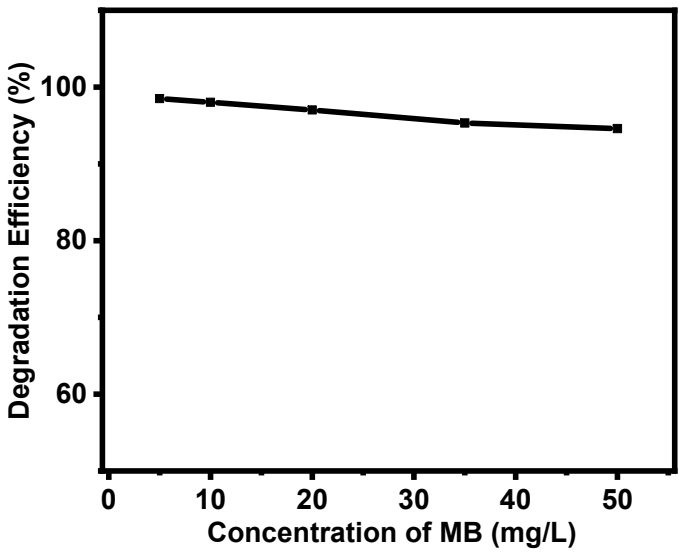
Congo red(CR)

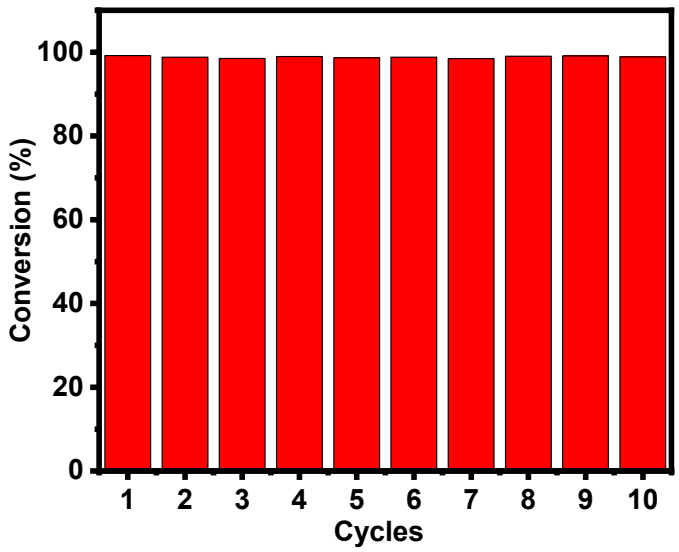
Filtration discoloration performance



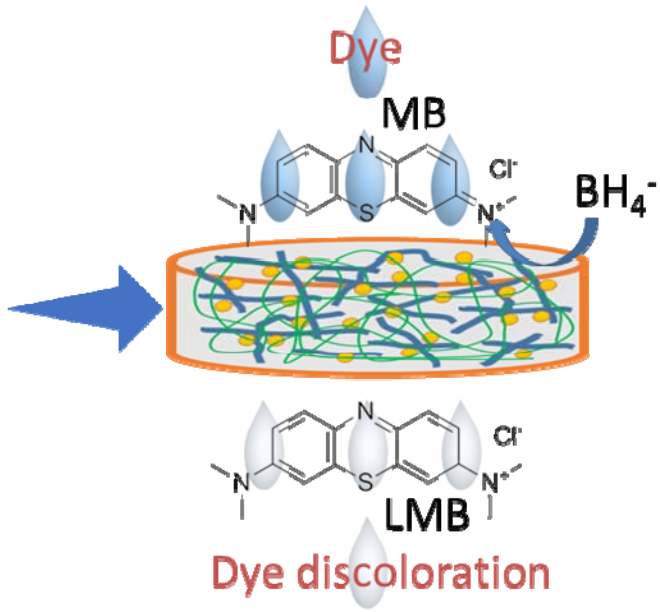


Excellent discoloration performance for MB





Continuous discoloration



$$BH_4^- + Ag_n + 3H_2O \longrightarrow BO_3^{3-} + Ag_n^{8-} + 10H^+$$

- MB solution become colorless after passing through the composite aerogel membrane
- Flux 5×10^4 $L\cdot m^{-2}\cdot h^{-1}$

Highlights

- A **facile method** was developed to prepared robust nanocellulose-based Ag NPs composite aerogel
- The composite aerogel showed **excellent stability and shape memory** in water
- The composite aerogel exhibited **good catalytic performance** for both cationic (MB) and anionic (CR) dyes, even after 10 time recycle use
- The composite aerogel was successfully applied to a packed column for **continuous dye discoloration** with a high flux

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Thank you!

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