THE AMERICAN UNIVERSITY IN CAIRO
الجامعة الأمريكية بالقاهرة

Deploying nanoparticle-doped polymeric membranes in treating water contaminated with ciprofloxacin

Presenter
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outline

- Why we chose ciprofloxacin
- Outline for the project
- Discussion of the outline
- Our results

Ciprofloxacin (CPH)

Contaminant of emerging concern (CEC)

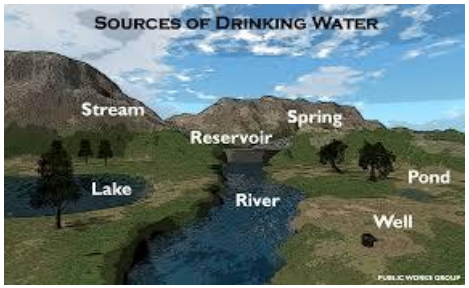
1- Not detected till recent sophisticated analytical instruments were applied

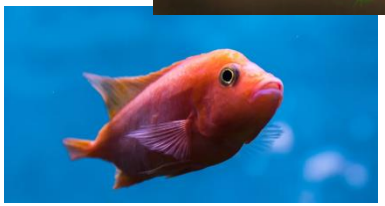
2- Present in minute amounts but possibly could harm human and animals over long time

Wastewater treatment plant

Irrigation water

Ciprofloxacin (CPH)





Design a method for CPH removal

Outline of the project

Preparation of metal impregnated PLA membranes

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Characterization of the membranes

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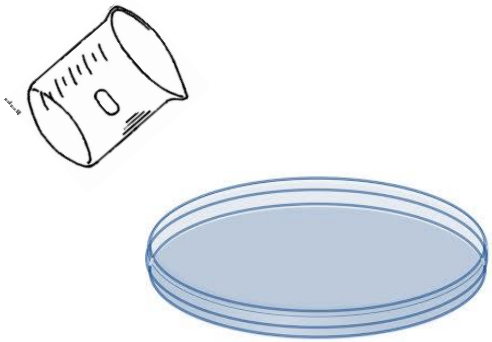
Adsorption experiments

Preparation of the membranes

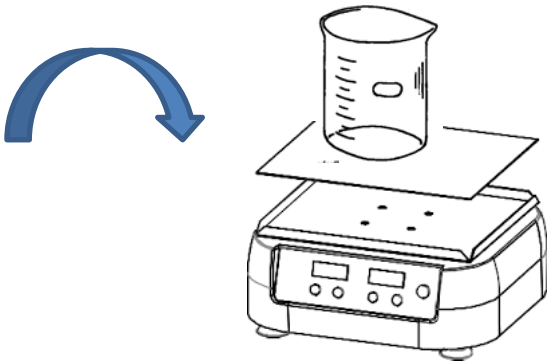
1) Solvent casting

2) Metal ion impregnation

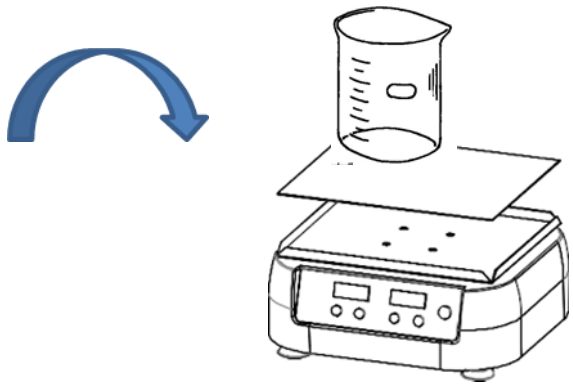
3) Metal ion reduction to metal nanoparticles



PLA + 10% Cellulose acetate + 50% NaCl



Soaked in 0.1 M metal salt for 3 days

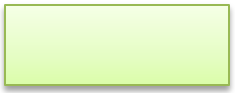


Added to 0.5 M $NaBH_4$ for 24 h

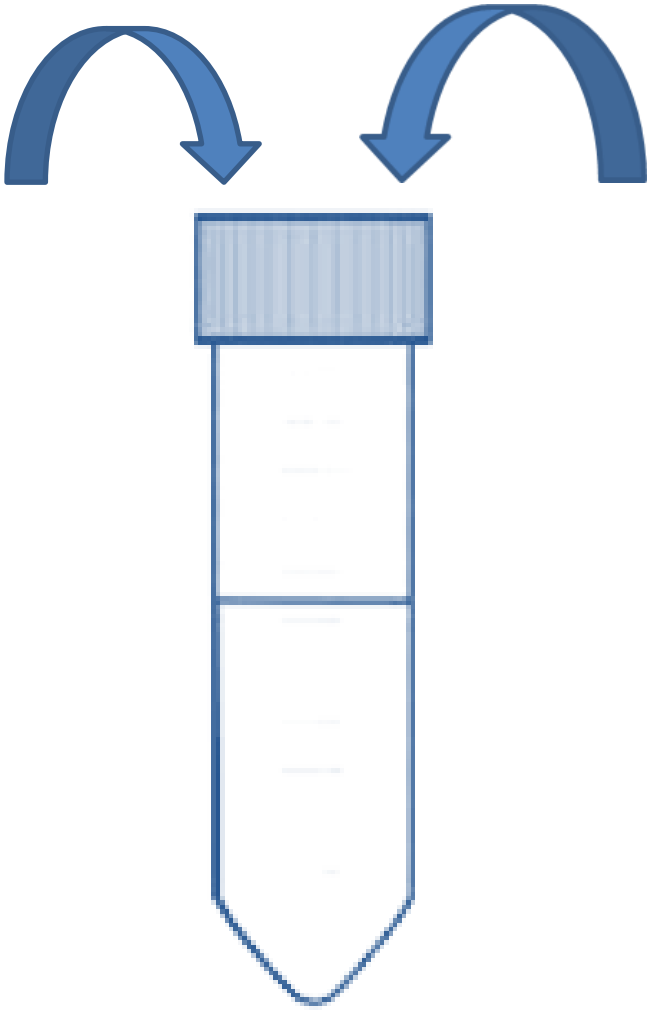
Characterization of the membranes

Fourier Transform Infra-Red (FTIR) spectroscopy	→	To determine the present functional groups
Dynamic Light Scattering (DLS)	→	To determine the zeta potential
Scanning electron microscopy (SEM)	→	To determine the morphology
Brunauer, Emmett and Teller (BET)	→	To determine surface characteristics
Thermogravimetric analysis (TGA)	→	To investigate their thermal stability.

Adsorption experiments



Cut membranes 1X2 cm^2



15 ml of various concentrations of CPH (2.5, 5, 10, 25 and 50 ppm)

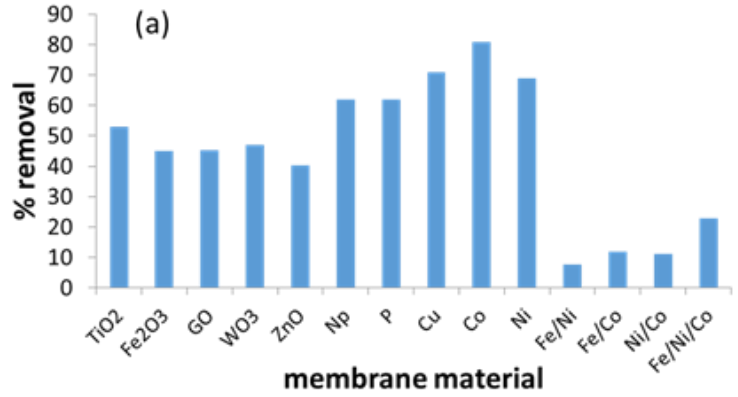
$$\%\ \boldsymbol{Removal} = \frac{(C_i - C_e)}{C_0}$$

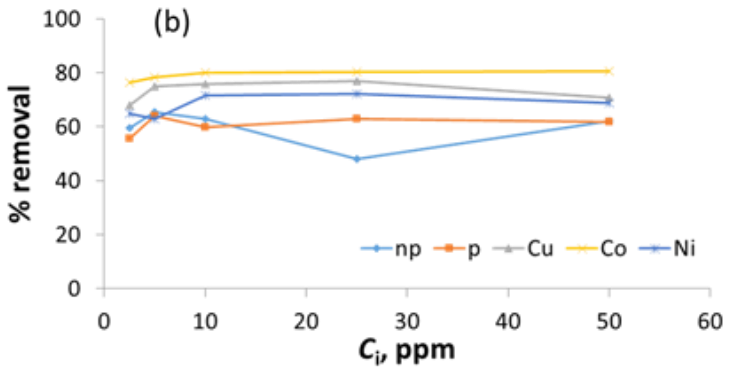
$$q_e = \frac{(C_i - C_e)\,V}{X}$$

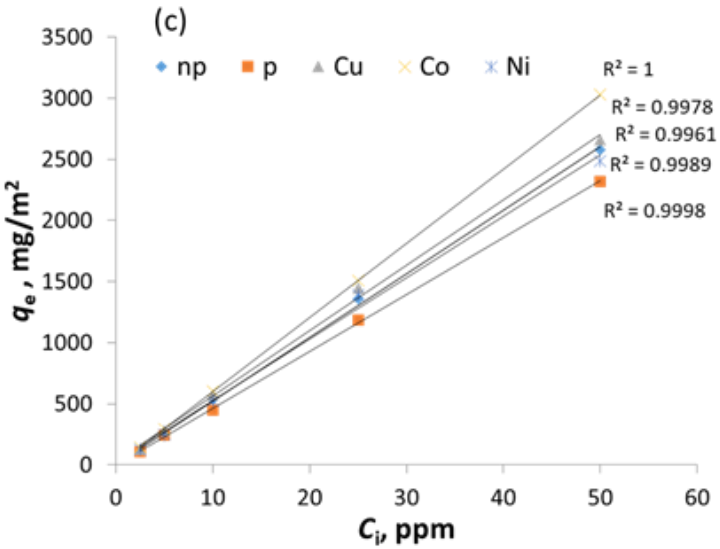
Shaking for 8hours then measuring the absorbance of the solution with UV spectrophotometer

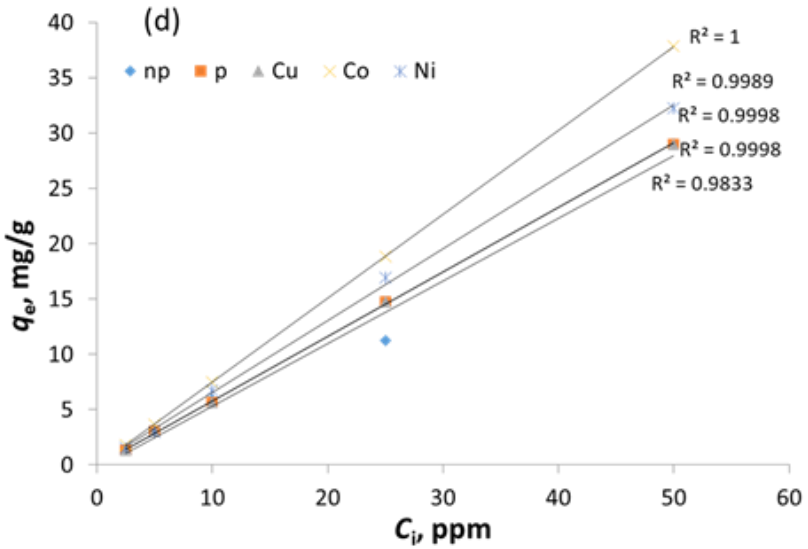
Results

Adsorption experiment



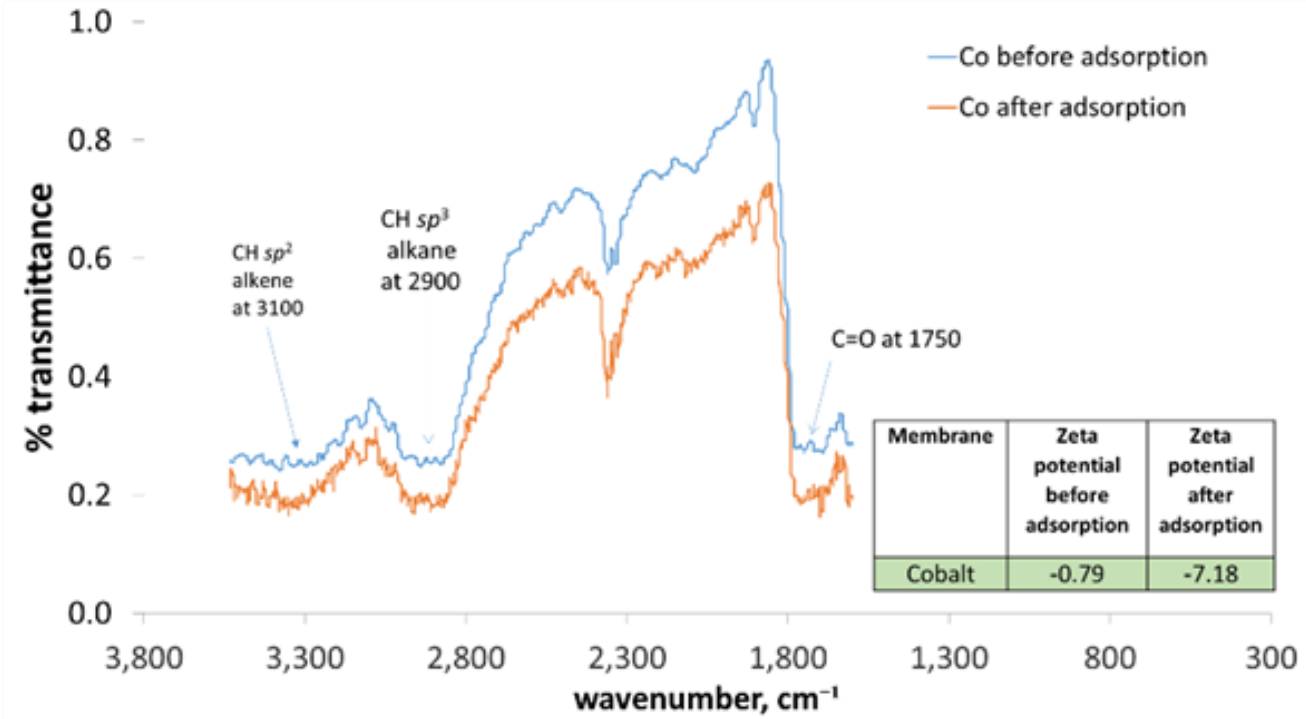






Results

DLS and FTIR



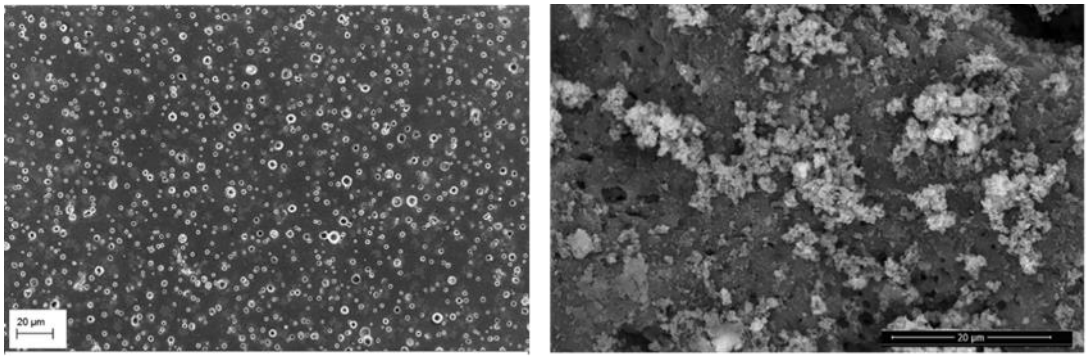
Membrane	Zeta potential before adsorption	Zeta potential after adsorption
Cobalt	-0.79	-7.18

- Cobalt-loaded membranes retained neutrality proposing physical interactions

- no apparent shift in peak energies for CH sp^2 alkene, CH sp^3 alkane and C=O was observed before and after adsorption.

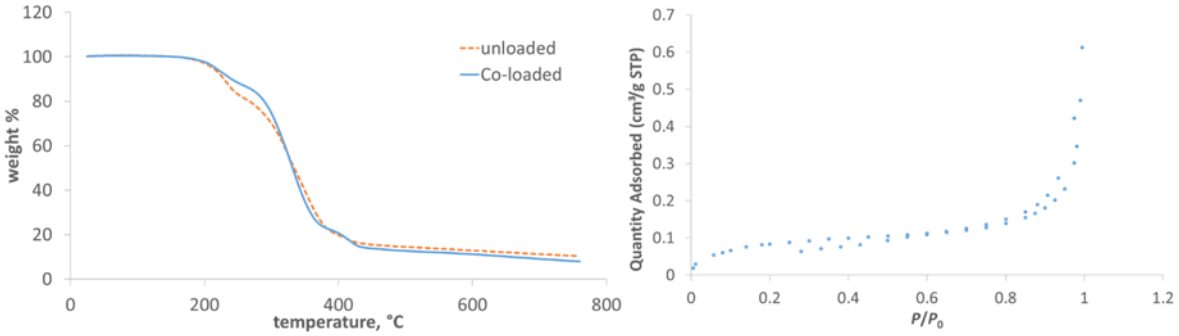
Results

SEM



SEM images for unloaded porous membranes (left panel), and Co-loaded membranes (right panel).

TGA & BET



TGA for unloaded and cobalt-loaded membranes (left panel), and BET for cobalt-loaded membranes (right panel).

Conclusion

Cobalt-loaded mesoporous membranes successfully removed CPH from aqueous solutions with an efficiency of more than 80%.

FTIR and zeta potential measurements suggest that binding took place through physical interactions and catalytic degradation mechanisms.

Acknowledgement

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Thank you very much