

The utilization of cellulose nanocrystal decorated silver nanoparticles with antibacterial properties for wastewater treatment

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Introduction

To ensure the availability of clean water, there is a significant focus on wastewater management using nanotechnology around the world.

The use of cellulose nanocrystals (CNCs) in wastewater treatment as a sustainable and renewable material is essential.

3 GOOD HEALTH AND WELL-BEING



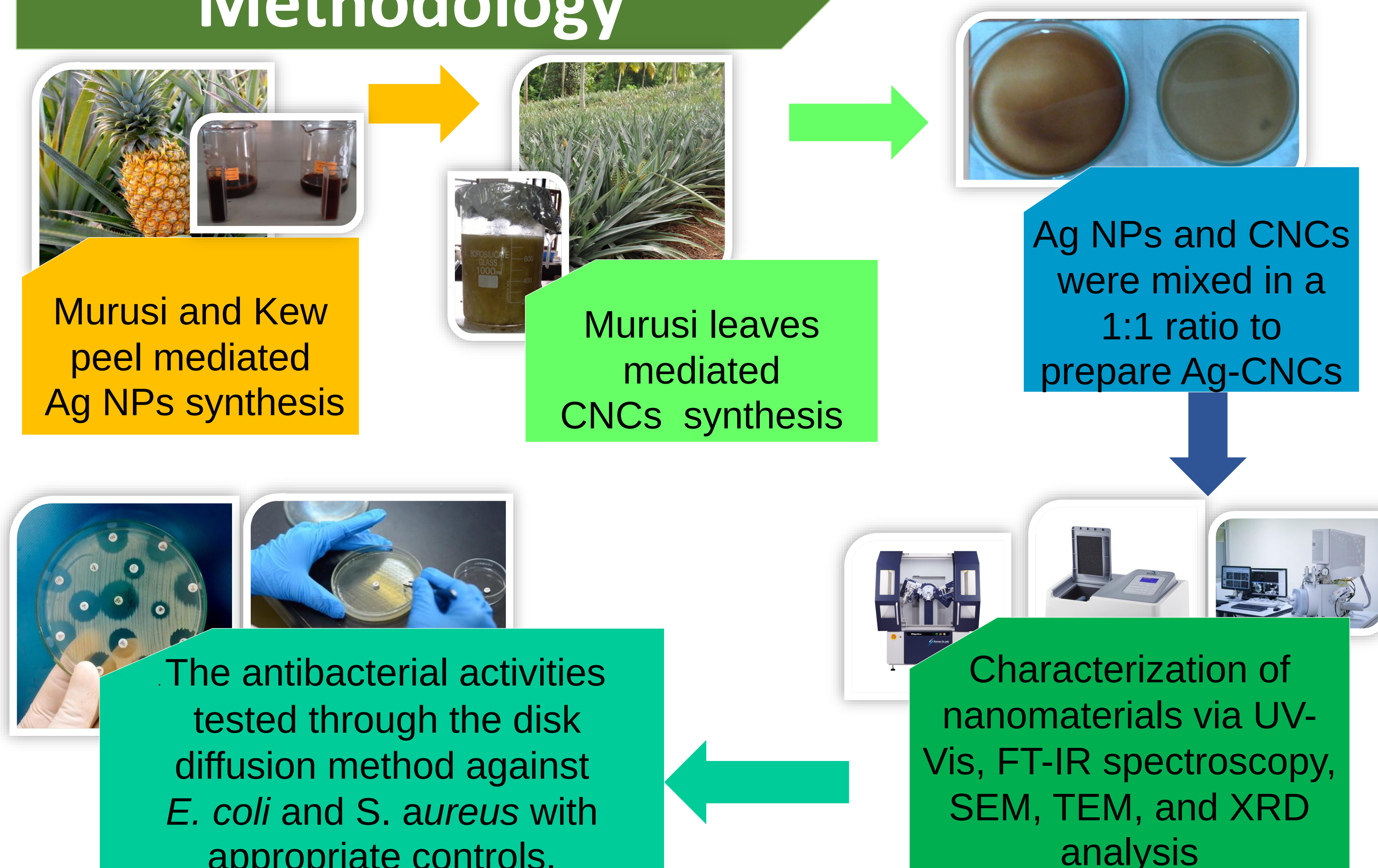
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



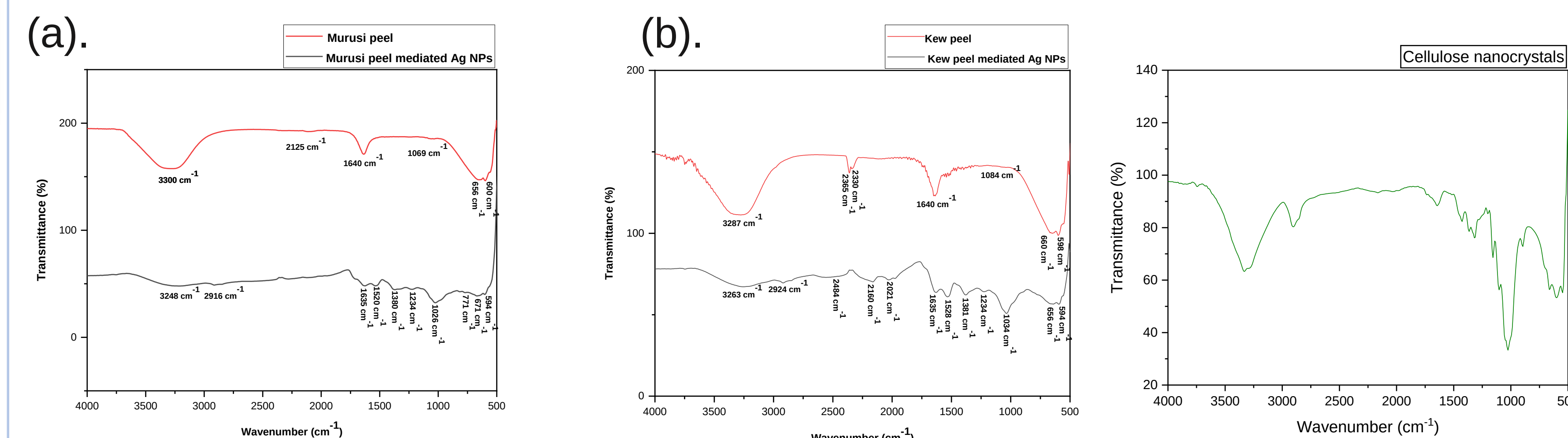
Objective

Application of phytogenic Ag nanoparticles (Ag NPs) incorporated CNCs nanocomposite for antibacterial activity in wastewater treatment.

Methodology

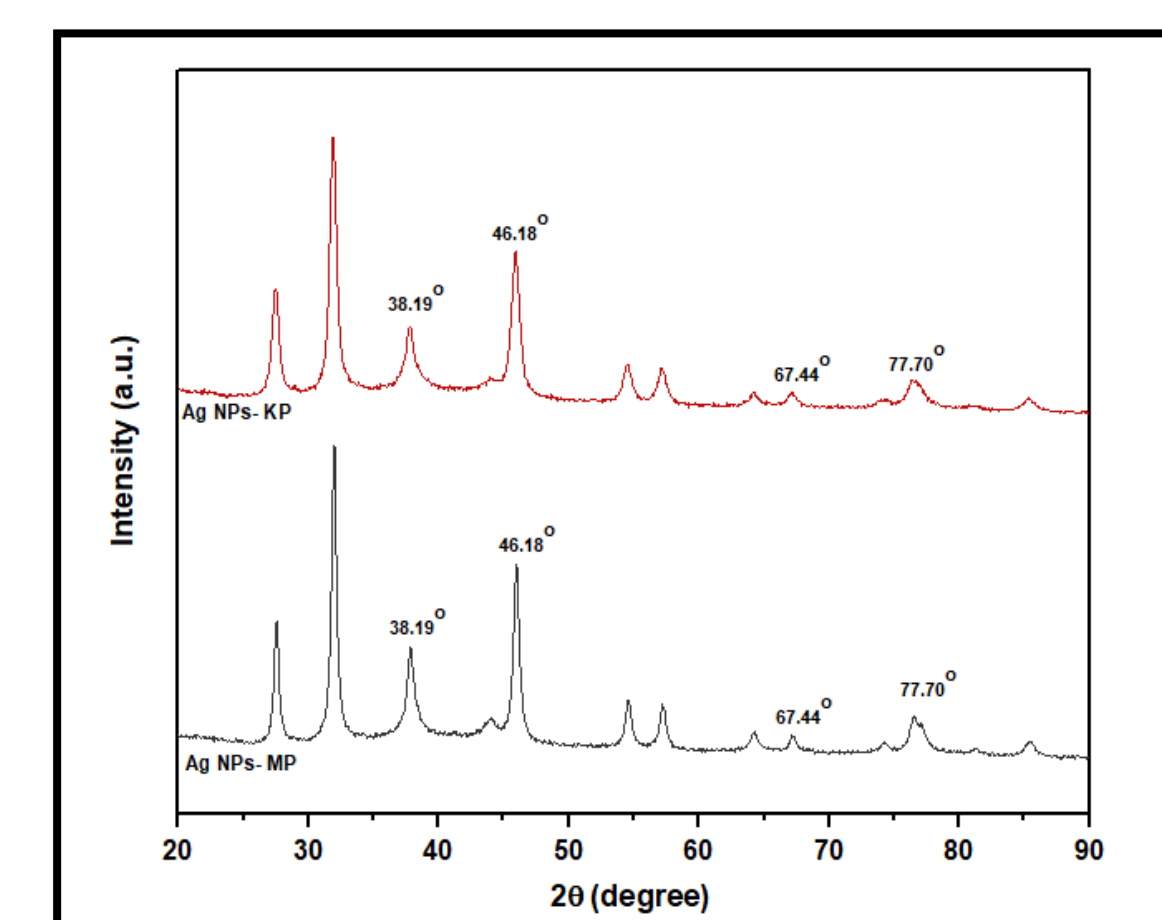


Results

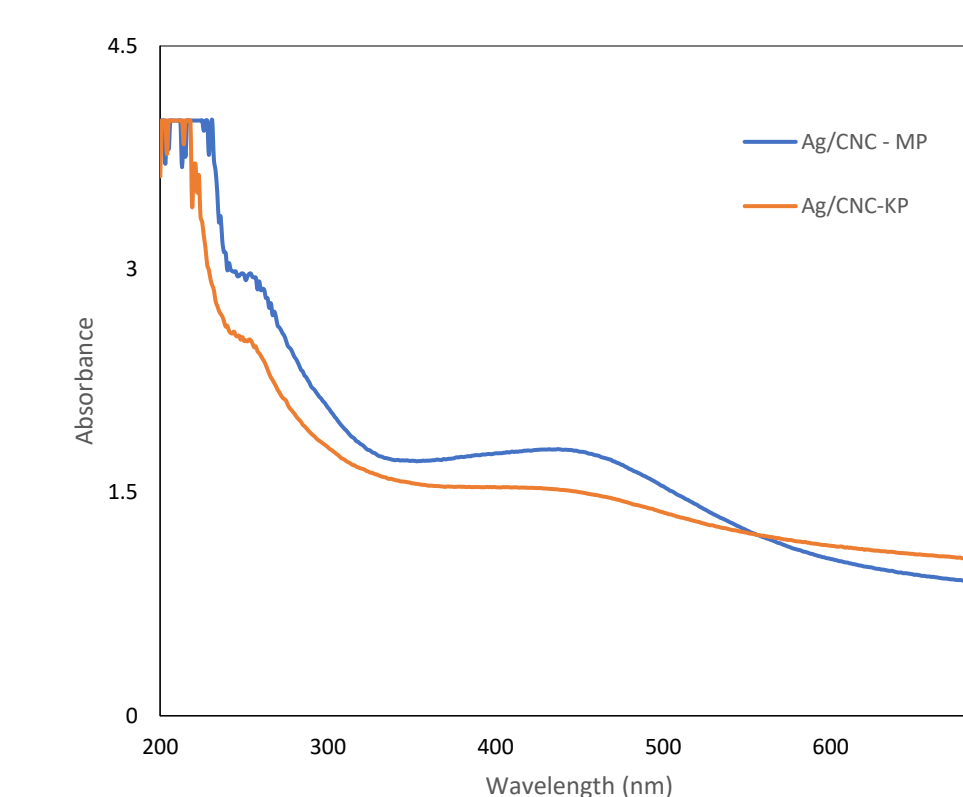


FTIR spectra of (a) Murusi peel (MP) -mediated AgNPs (b) Kew peel (KP) -mediate AgNPs.

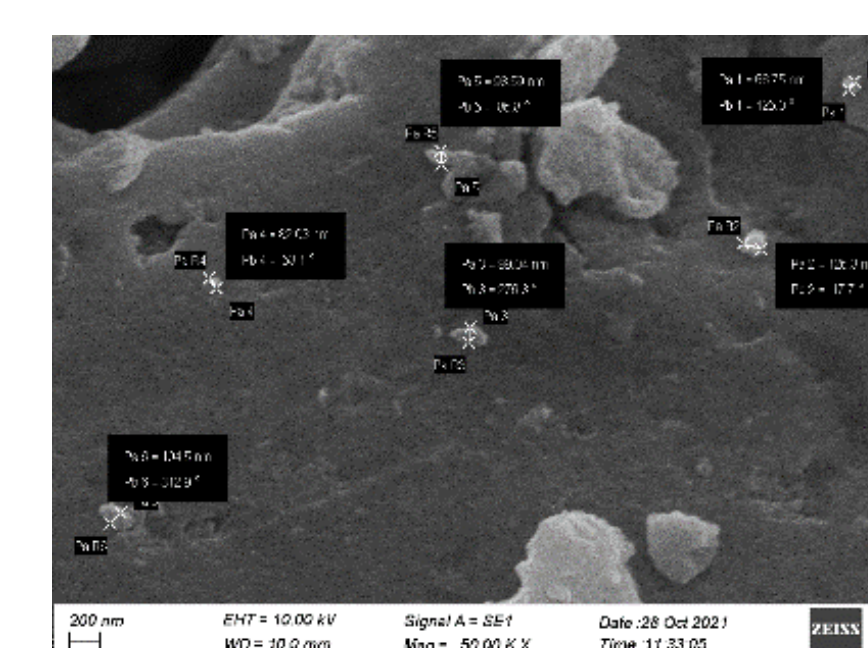
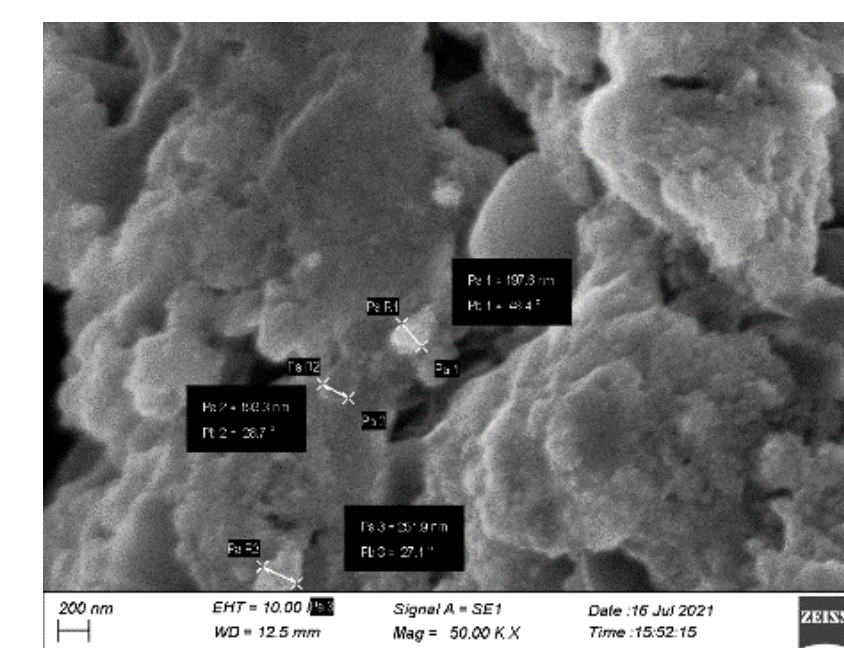
FT-IR spectra revealed the isolation of pure CNCs.



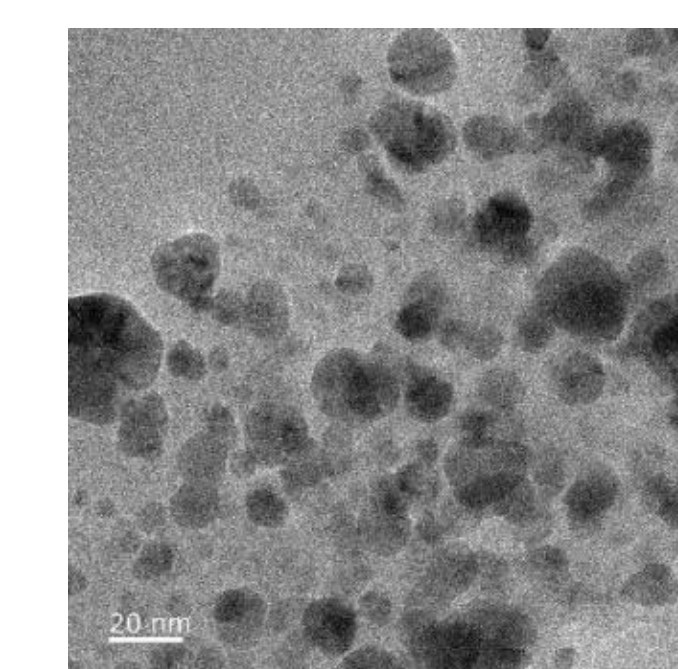
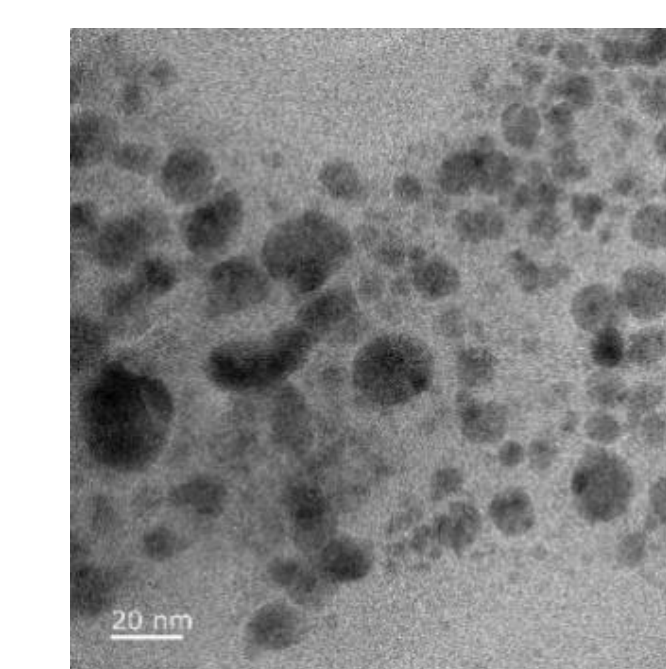
XRD spectra confirmed the formation of FCC spherical AgNPs.



UV- Vis spectra indicate the formation of Ag-CNCs absorption appeared in the range of 450 to 455 nm.



Both peel-mediated AgNPs were spherical, (SEM analysis)

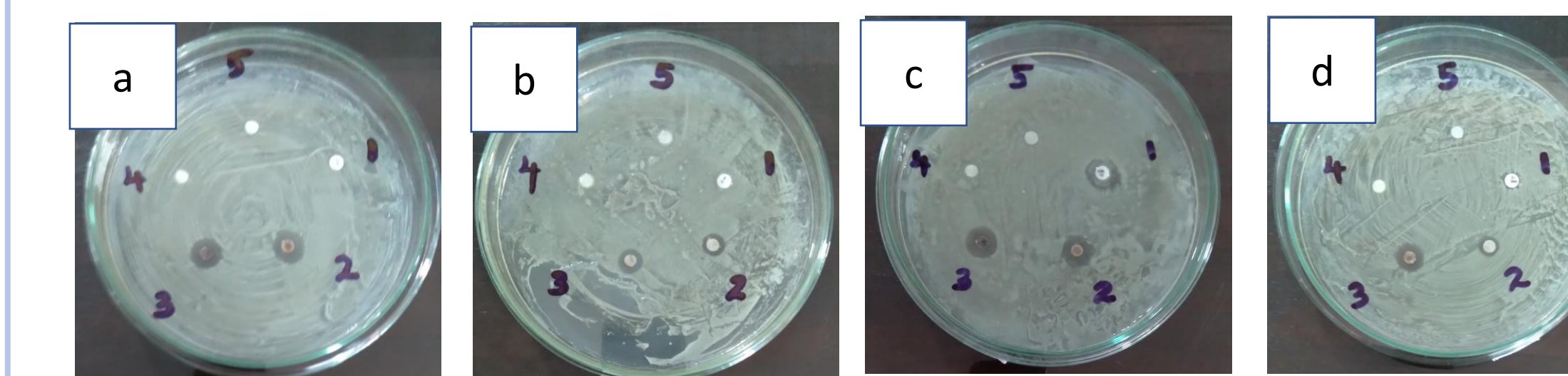


TEM analysis
(a) MP-mediated Ag NPs (12.58 nm)
(b) KP-mediated AgNPs (11.48 nm)

Bacteria species

Diameters of zones inhibition (in cm)

Bacteria species	1000 ppm				10 -15 µg
	MP- Ag NPs	MP- Ag/CNC	KP-Ag NPs	KP- Ag/CNC	
<i>E. coli</i>	2.00	1.70	1.80	1.60	0.90
<i>S. aureus</i>	2.20	1.90	2.10	1.60	2.50



1. Positive control
2. Ag NPs
3. Ag-CNCs
4. Cellulose
5. negative control

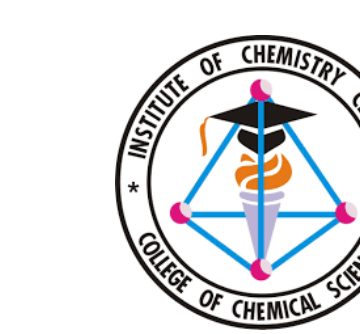
a, b *E.coli* MP and KP
b, c *S.aureus* MP and KP

Conclusion

- The antibacterial activities of AgNPs and Ag-CNCs NCs prepared from both peel extracts against both bacteria decreased as;

MP-AgNPs > KP-AgNPs > MP Ag-CNCs NCs > KP Ag-CNCs NCs.

- Phytogenic Ag-CNCs NCs thus have potential application in antibacterial activities in wastewater treatment as a nanofilm.



Acknowledgment

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References

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- [2] S. Kwon, W. Lee, J. W. Choi, N. Bumbudsanpharoke, and S. Ko, "A Facile Green Fabrication and Characterization of Cellulose-Silver Nanoparticle Composite Sheets for an Antimicrobial Food Packaging," *Front. Nutr.*, vol. 8, no. December, pp. 1–8, 2021, doi: 10.3389/fnut.2021.778310.
- [3] M. Mahardika, H. Abrial, A. Kasim, S. Arief, and M. Asrofi, "Production of nanocellulose from pineapple leaf fibers via high-shear homogenization and ultrasonication," *Fibers*, vol. 6, no. 2, pp. 1–12, 2018, doi: 10.3390/fib6020028.