









Hydrogel-based wound dressings containing ZnO nanoparticles and honey for diabetic wound treatment

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The rising global prevalence of diabetes, largely due to aging and obesity, has intensified public health

concerns, especially regarding diabetic wounds. Many of these wounds are chronic, which turns them prone

This study focuses on creating a novel hydrogel-based

to infection, and can lead to severe outcomes like necrosis, amputation, or death. Existing treatments often fall

short, since healing is impaired by high levels of reactive oxygen species (ROS), ongoing inflammation, and

recurrent infections. This highlights the urgent need for more effective, multifunctional wound dressings.

wound dressing that incorporates natural bioactive agents -

manuka honey and zinc oxide nanoparticles (ZnO) -

leveraging their well-known antimicrobial and tissue-

regenerative properties.



ZnO nanoparticles characterization

Hydrogels characterization

120 ZnO [Transmittance (%) **80** ZnO; 40-3000 2000 1000 4000 Wavenumber (cm⁻¹)

ATR-FTIR

✓ Characteristic bands of oxide, showing the presence of functionalized ZnO nanoparticles









PHYSICAL PROPERTIES

	Blank	ZnO + Manuka honey
Swelling Ratio (%)	279.+6 ± 22	235.6 ± 39.7
Equilibrium water Content (%)	79.8 ± 1.1	73.3 ± 3.0
Tensile Strength (kPa)	66 ± 4.2	40 ± 4.5
Contact Angle (°)	46.1 ± 1.4	45.8 ± 2.3
Max mucoadhesion force (N)	2.98 ± 0.04	41.3 ± 3.8

Suitable physical properties for wound dressing application.





Diffraction peaks coincident with ZnO standards





 \checkmark TEM results confirm the round shape morphology and polycrystalline wurtzite structure of the ZnO NPs



✓ Increase of antioxidant activity with addition of ZnO and Honey in the formulation

Conclusion

(%)

Effect



✓ Formulation with ZnO+Honey with highest antibacterial activity for S.aureus, MRSA and E.Coli.

The hydrogels showed suitable properties. ZnO+Honey formulation fulfilled the required physical characteristics for wound dressings and exhibited antibacterial activity, alongside with a significant antioxidant activity (29 % scavenging effect). This highlights its potential as a multifunctional dressing for diabetic wound care.

80

70

60

50

(%)

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300um

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