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Biosynthesis of antibacterial peptide hydrogels/titania nanoparticles composites

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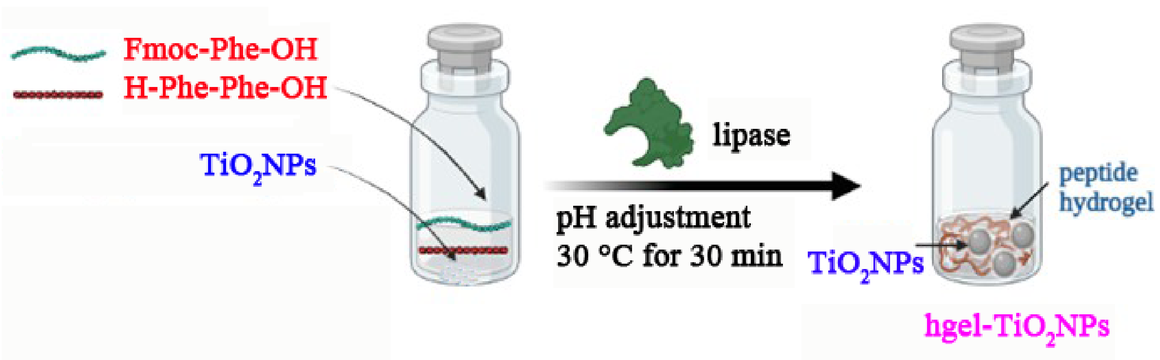
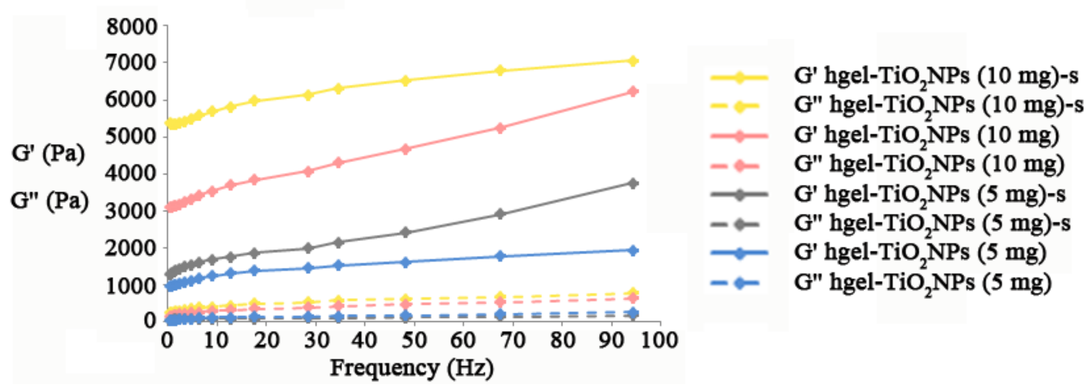
1. Introduction

Photo-antibacterial properties of TiO_2NPs have attracted much interest. However, the problem of liquid-solid separation of their suspension is a limiting factor. In this study, we report on the encapsulation of TiO_2NPs within self-assembling tripeptide (Fmoc-Phe_3) hydrogel (hgel-TiO_2NPs) as a scaffold to form a novel composite with significant photo-antibacterial properties. Two different concentrations of TiO_2NPs were hired to investigate their effect on some hydrogel parameters such as swelling ability, mechanical strength, and antibacterial properties. It was shown that by increasing the concentration of TiO_2NPs, the mechanical stability of the gel increases while the swelling ability obeys the reverse trend. In this paper, the effect of ultrasound waves on the above composite parameters was also studied.

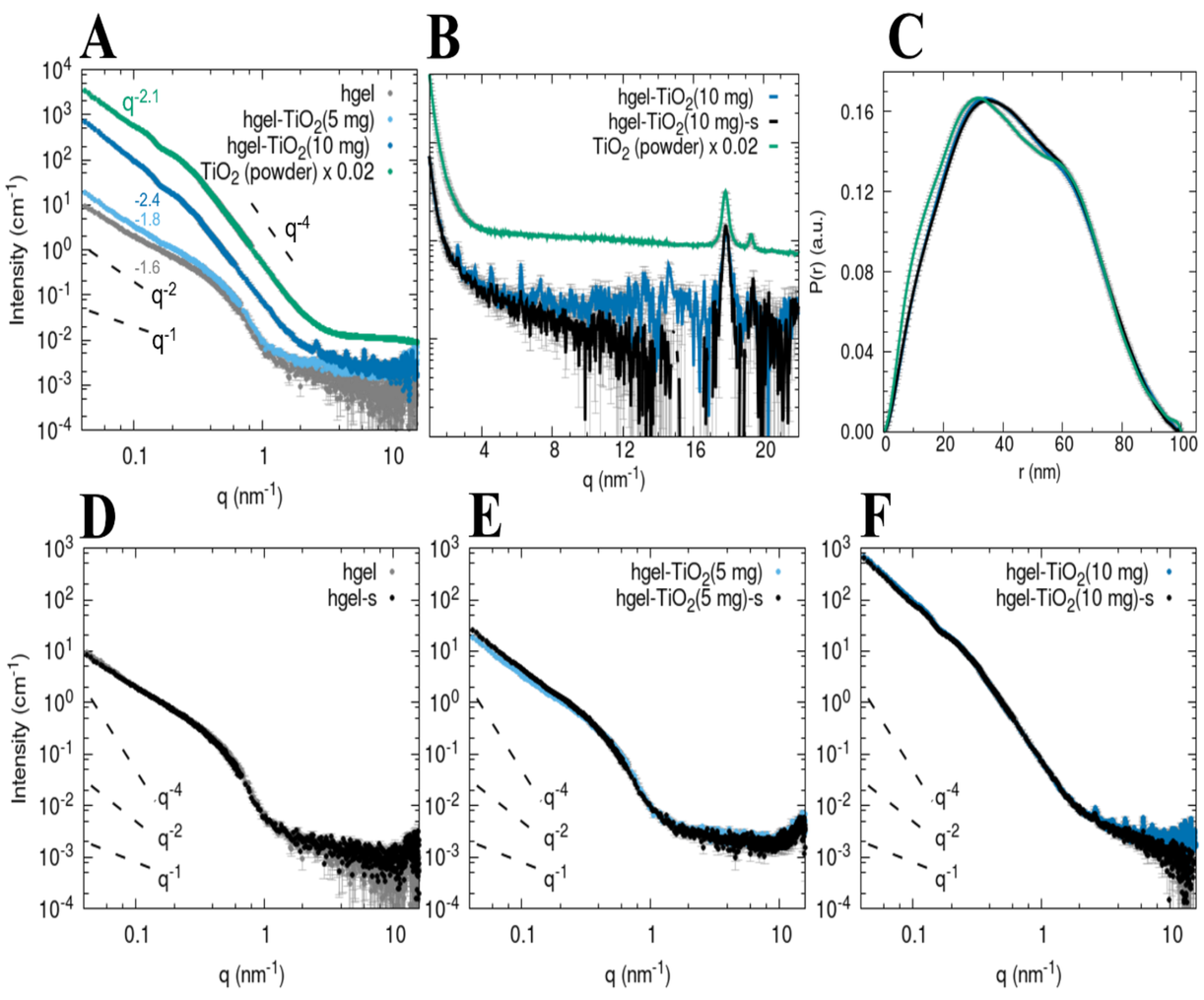
2. Synthesis of nanohybrid

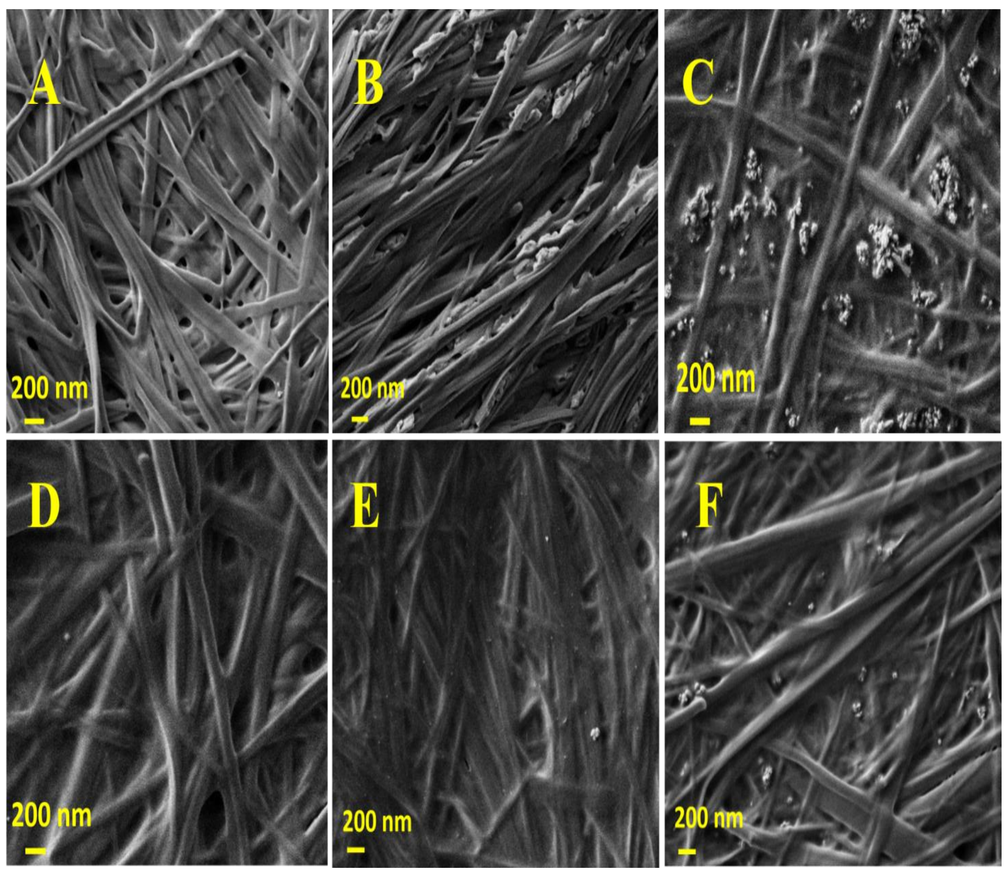


3. Rheological studies



3. SAXS and FESEM





4. Discussion

In this study, we synthesized a novel scaffold for not only stabilizing the TiO2NPs but also as a biomaterial to increase its anti-bacterial property. The results of SEM demonstrated that this highly aromatic tripeptide hydrogel was able to stabilize TiO2NPs at two different concentrations. We also applied the ultra-sound waves on these composites before gel formation and based on SEM and SAXS results investigated that sonication did not have any effect on the fibrillary structure of the hydrogels but more dispersion on nanoparticles was observed. The results of rheology revealed that by increasing the concentration of nanoparticles the mechanical strength increases. In addition, ultra-sound waves have positive effect on tensile strength while the results of swelling ability obeys the reverse trend.

5. Reference

[1] Roya Binaymotlagh et al., *Peptide-Based Hydrogels: New Materials for Biosensing and Biomedical Applications*, Materials, **2022**, 15, 5871.
[2] Roya Binaymotlagh et al., *Green In Situ Synthesis of Silver Nanoparticles-Peptide Hydrogel Composites: Investigation of Their Antibacterial Activities*. Gels **2022**, 8, 700.