臺北科技大學暨馬偕紀念醫院
學術合作專題研究計畫成果發表

Snail-Inspired Oral Repair Dressing Design: Conchiolin/Keratin/GelMA Composite

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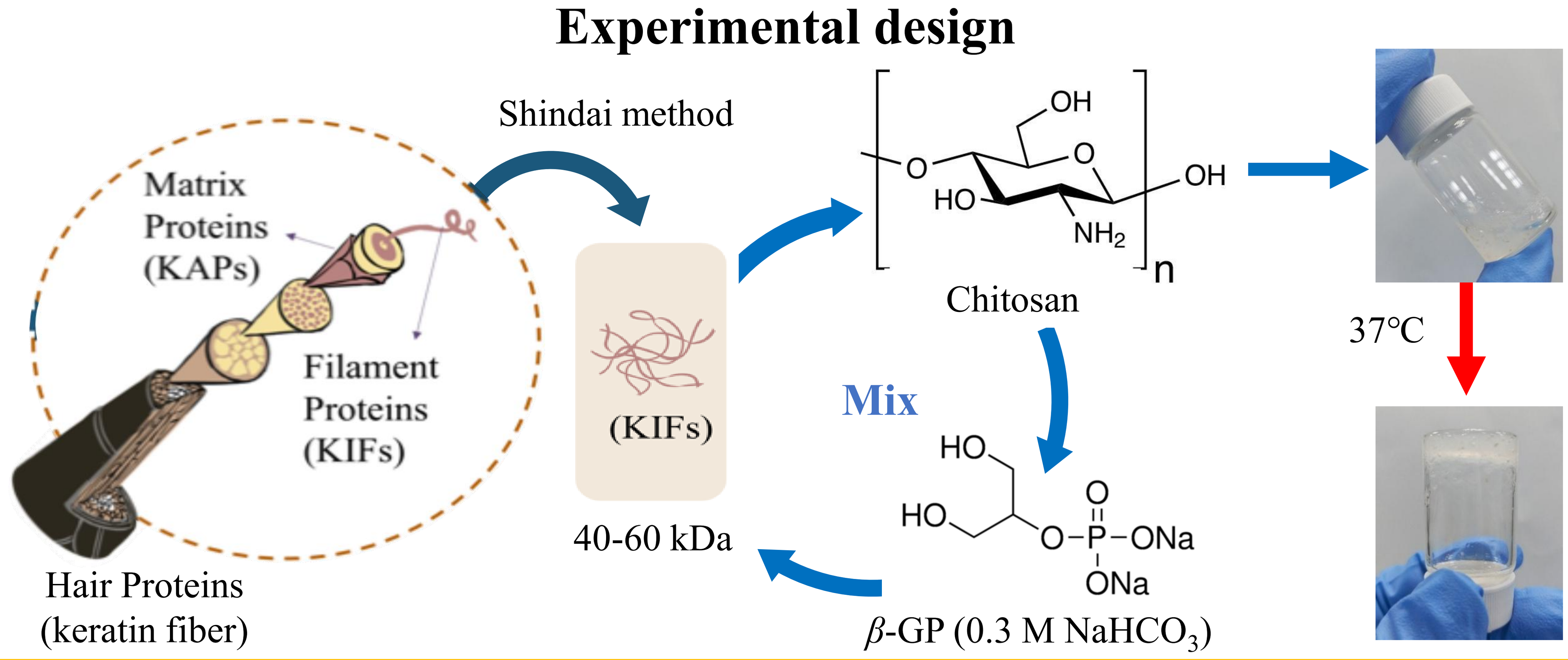
Abstract

Thermosensitive hydrogels offer promising solutions to a wide range of clinical challenges. Keratin serves as a natural cellular scaffold that promotes cell adhesion and proliferation. In this study, human hair–extracted keratin was incorporated with chitosan and β-glycerophosphate (β-GP) to fabricate thermosensitive hydrogels. These hydrogels gelled at 37°C and exhibited a porous structure, which is favorable for cell adhesion. Notably, keratin-incorporated hydrogels demonstrated approximately 100% cell viability, indicating favorable biocompatibility. These findings confirm that the incorporation of keratin improves the clinical applicability of these hydrogels. **Keywords:** Keratin; Chitosan; Thermosensitive hydrogel.

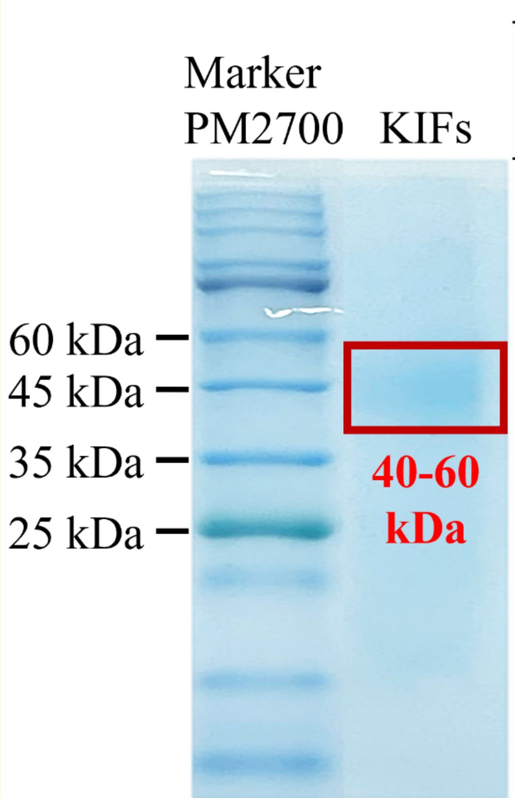
Introduction

Keratin is a fibrous structural protein, and its abundant cysteine contribute to enhanced mechanical stability of biomaterials. The Leu-Asp-Val (LDV) and Arg-Gly-Asp (RGD) peptide sequences of keratin promote cell adhesion and proliferation. Therefore, keratin was mixed with chitosan and β-GP to develop a thermosensitive hydrogel, aiming to enhance its potential for tissue engineering applications.

Experimental design



Results and Discussion



Protein ID	Acc. NO	MW (kDa)	Coverage (%)	Description
KRT33A_HUMAN	O76009	45.9	46	Keratin, type I cuticular Ha3-I
KRT33B_HUMAN	Q14525	46.2	49	Keratin, type I cuticular Ha3-II
KRT31_HUMAN	Q15323	47.2	49	Keratin, type I cuticular Ha1
KRT34_HUMAN	O76011	49.9	35	Keratin, type I cuticular Ha4
KRT35_HUMAN	Q92764	50.5	20	Keratin, type I cuticular Ha5
KRT83_HUMAN	P78385	54.2	13	Keratin, type II cuticular Hb3
KRT81_HUMAN	Q14533	54.9	13	Keratin, type II cuticular Hb1
KRT86_HUMAN	P78386	55.0	12	Keratin, type II cuticular Hb6

Fig. 1. SDS-PAGE analysis revealed that the molecular weight of human hair–extracted keratin ranged from 40 to 60 kDa. Mass spectrometry further confirmed that the composition was predominantly type I and type II keratins, with molecular weights of 45–55 kDa.

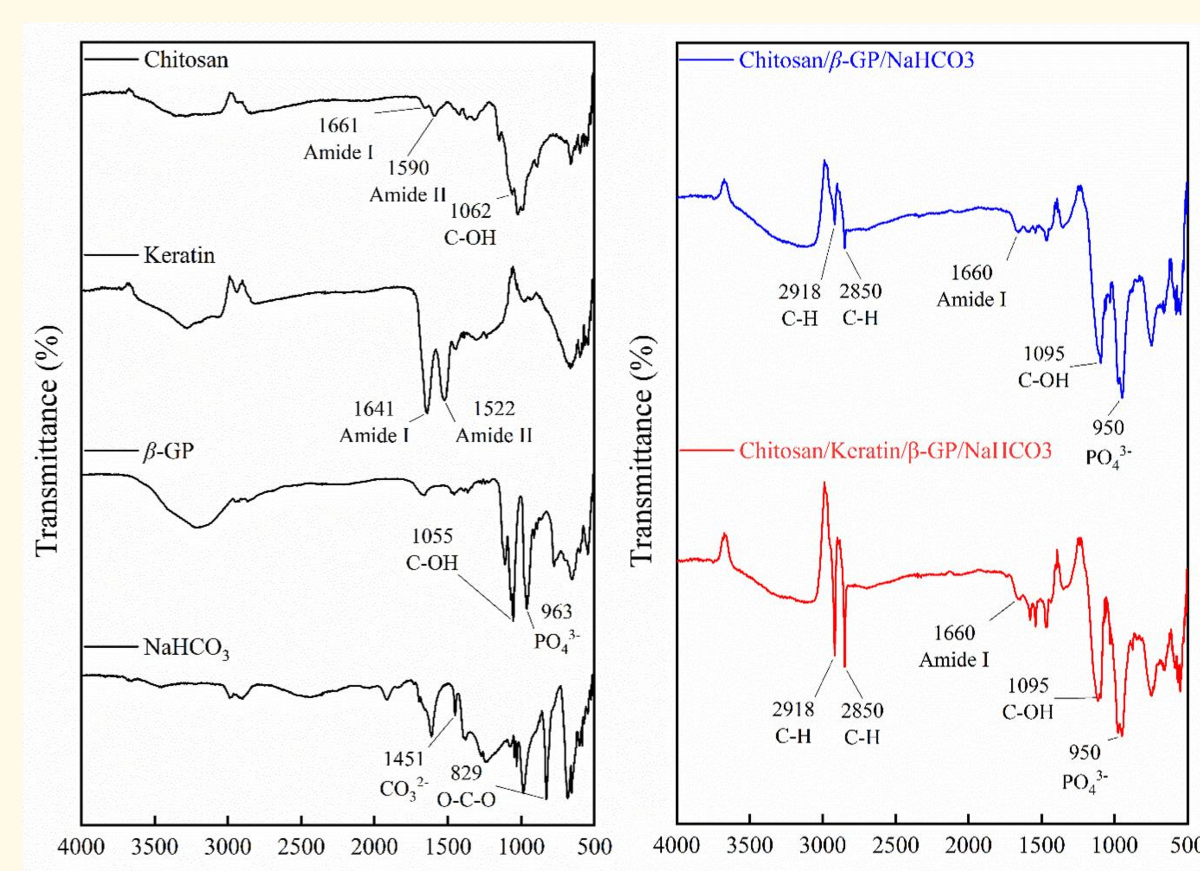


Fig2. FTIR results showed enhanced C–H, C–OH, phosphate, and Amide I signals, suggesting molecular interactions among chitosan, β-GP, and keratin.

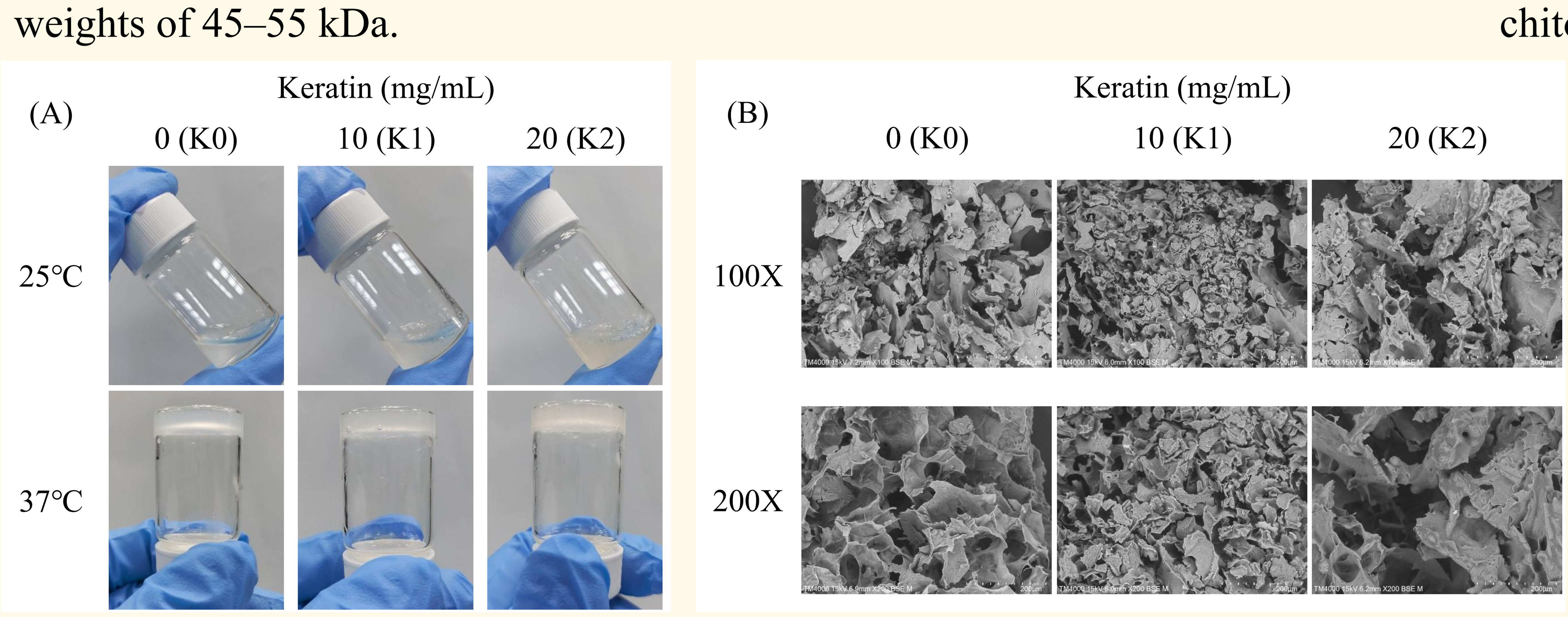


Fig. 3. (A) 2% Chitosan, keratin (0, 10, 20 mg/mL), and 50% β-GP (in 0.3 M $NaHCO_3$ solution) were mixed at a 5:1:1 ratio to prepare thermosensitive hydrogels, which gelled within 3 min at 37°C. (B) SEM analysis revealed that these hydrogels exhibited a porous structure, which is favorable for cell adhesion.

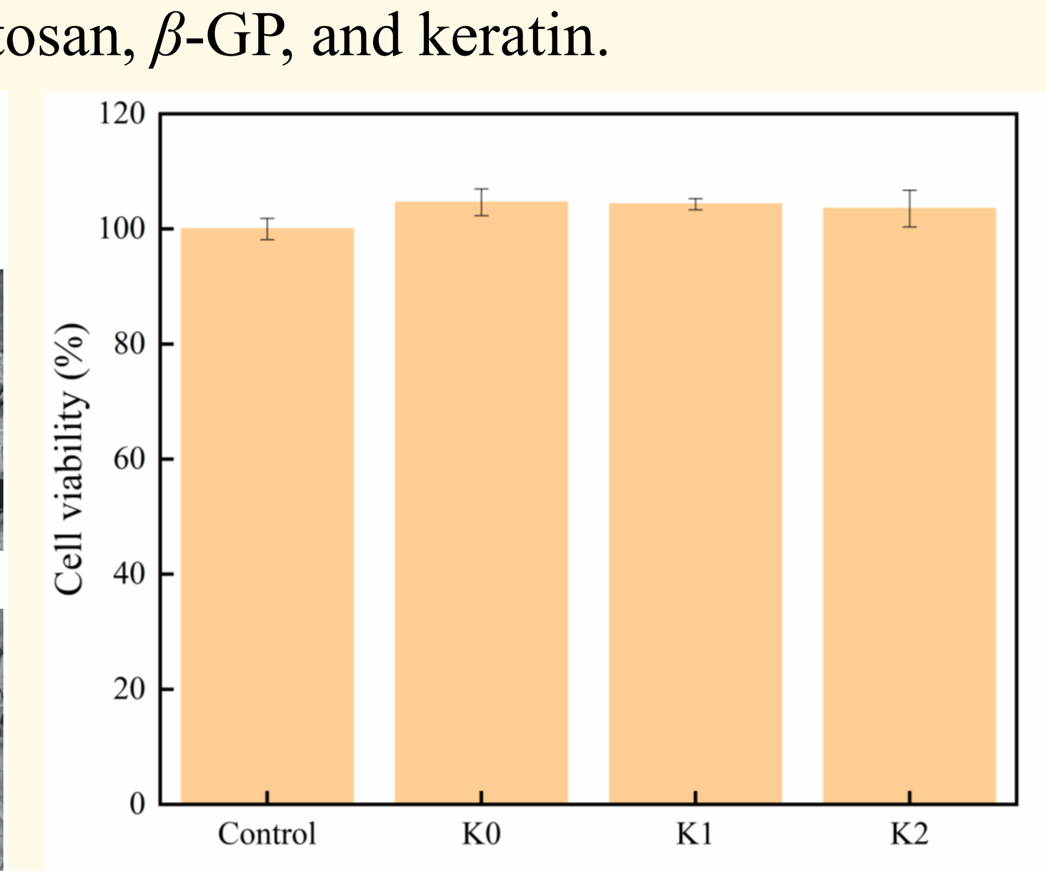


Fig. 4. These hydrogels resulted in cell viability above 100%, indicating excellent biocompatibility. ($p < 0.05$, n=3).

Conclusion

The keratin-incorporated thermosensitive hydrogel gelled at human body temperature and exhibited a porous structure and excellent biocompatibility. It shows potential as an injectable thermosensitive biomaterial; further drug-loading and release studies are needed to confirm its use as a drug delivery carrier.