IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
TTO - IPM Cell

Industrial Consultancy & Sponsored Research (IC&SR)

MULTIFUNCTIONAL HYDROGEL FOR WOUND HEALING

IITM Technology Available for Licensing

Problem Statement

- Current wound care lacks optimal solutions, with traditional dressings often ineffective for proper healing, necessitating advancements in wound care technology.
- Injectable hydrogels show promise for wound dressings but suffer from limitations such as fragility and complexity in composition, hindering widespread adoption and efficacy.
- There is a need for a **pH-responsive self-healing, injectable, multifunctional hydrogel** that addresses the complexities of wound healing.

Intellectual Property

- IITM IDF Ref. **2780**
- **IN 202441004292**

Technology Category/ Market

Category - Advanced Wound Care
Applications - Chronic Wound Management, Acute Wound Healing, Dermatology and Cosmetic Applications.
Industry - Healthcare and Medical Devices, Pharmaceuticals and Biotechnology

Market- Advance wound care market is expected to be valued at US$ 14,667.7 million by 2034 with a growth at a **CAGR of 2.4%.**

TRL (Technology Readiness Level)

TRL-4, Technology validated in relevant environment.

Research Lab

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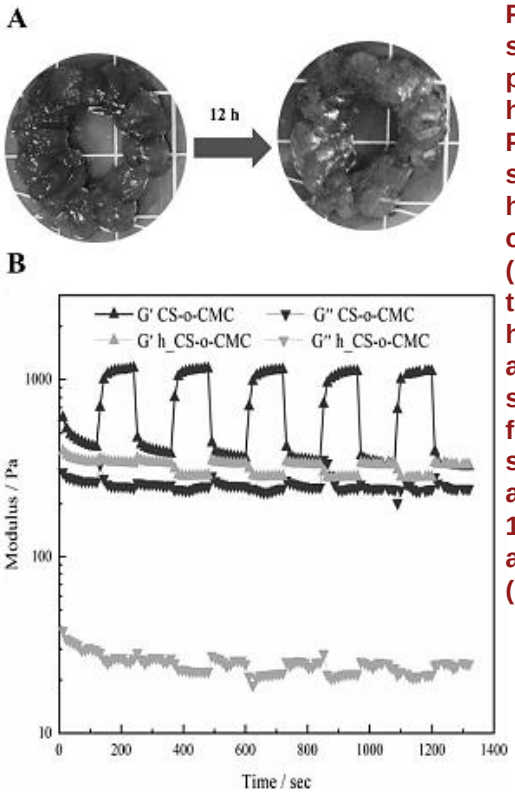

FIG. 1 illustrates self-healing potential of hydrogel (A) Photograph showing the self-healing efficiency of the hydrogels. (B) G′ and G″ of the CS-o-CMC hydrogels when alternate step strain switched from a small strain (γ = 10%) to a large strain (γ = 100%) at a fixed angular frequency (10 rad/s).

Technology

- The present invention pertains to **a pH-responsive, self-healing and injectable hydrogel for wound healing,** comprising a combination of polysaccharides and a biomolecule, specifically:
  - **Chitosan**, facilitating cell proliferation support;
  - **Oxidized carboxymethyl cellulose**, enhancing rheological behavior; and
  - **Lauric acid**, imparting immunomodulatory properties.
- The hydrogel demonstrates self-healing capabilities, achieved through the formation of Schiff base and electrostatic interaction.
- The Schiff base bonds resulting from a chemical reaction between the amine of chitosan and the aldehyde of oxidized carboxymethyl cellulose.
- The electrostatic interaction forms between the free amine group of chitosan and β-glycerol phosphate.

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Method

1. •Uniformly mixing chitosan, oxidized carboxymethyl cellulose, and lauric acid using luer-lock syringe;
2. •Allowing the formation of Schiff base bonds through a reaction between the amine of chitosan and the aldehyde of oxidized carboxymethyl cellulose;
3. •Allowing the formation of electrostatic interaction at 37 °C using a cross-linker, specifically 40-50% β-glycerol phosphate to enhance stability and gelation time; and
4. •Utilizing a solvent, including MilliQ water or PBS or a combination of both, for dissolving the polymers.

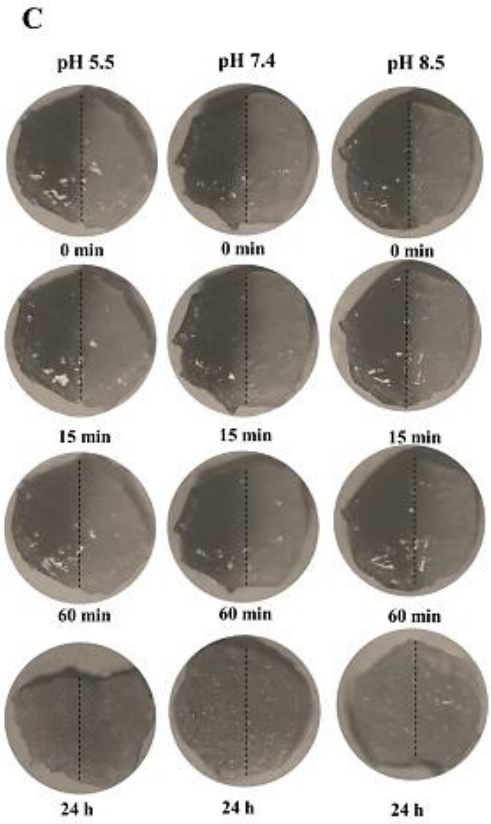

FIG. 1 (C) Diffusion of dynamic covalent imine bond in different pH medium at different time interval.

Key Features / Value Proposition

1. Versatile Cross-Linking:
Double cross-linking such as Schiff base and β-glycerol phosphate offers versatility and stability of hydrogel in different wound environment. Importantly, pH of the formulation is intrinsically raised to 7.0-7.4.

2. pH Responsive self-healing:
Alkaline pH-responsive self-healing provides efficient scaffolding system for the migration of cells and ensures the stability of hydrogel without breaking during wear and tear condition at the wound site.

3. Controlled Drug Release:
Controlled release of immunomodulatory molecule in pH 8.5, aids in inflammation control and immune response modulation

4. Enhanced Healing:
Injectable, self-healing hydrogel formulation accelerates wound healing by reducing inflammation, which promotes granulation tissue maturation, and re-epithelialization.

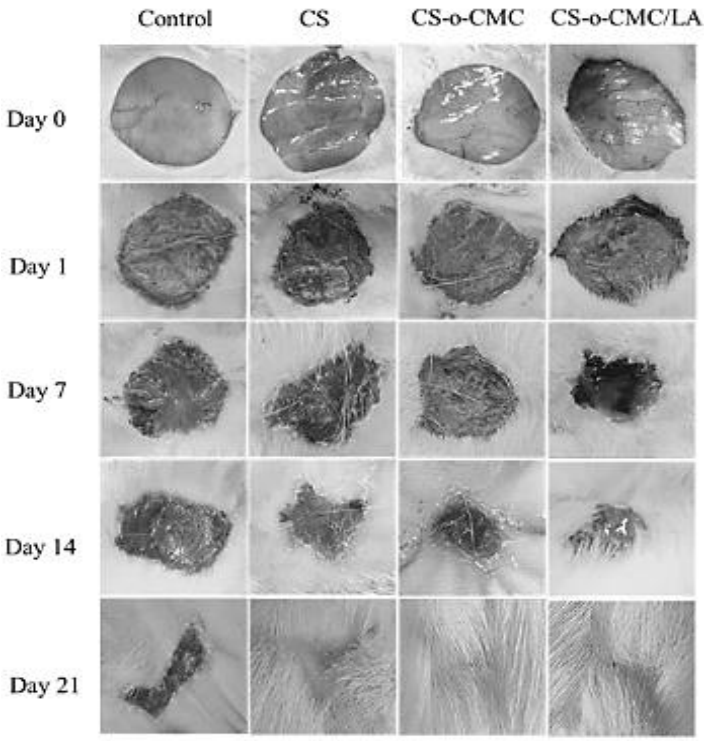

FIG. 2 illustrates in vivo wound healing potential of hydrogel. Photographs of wound contraction upon treatment with hydrogels at different time interval.

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