PROCESS FOR PRODUCING HYDROGEL FROM CYCLIC BETA GLUCAN AND CARRAGEENAN FOR USE IN COSMETIC AND FOOD APPLICATIONS

IITM Technology Available for Licensing

Problem Statement

- **Hydrogels** hold enormous promises in **healing wound, injuries, aging etc.** by acting as a **functional tissue that mimics the cellular microenvironment** and complex tissue architecture.
- Traditional hydrogels often **require synthetic additives for structural and functional properties** that limits the biocompatibility.
- Moreover, conventional hydrogels **depend on chemical preservatives** as they are prone to germ buildup and are **limited in their adaptability** and physico-chemical properties.
- There is a need for an organic, customizable hydrogel that is biocompatible and suitable for diverse applications without heavy reliance on synthetic chemicals.

Intellectual Property

- IITM IDF Ref 1304
- **IN 404189 Patent Granted**

TRL (Technology Readiness Level)

TRL 4 Technology Validated in Lab

Technology Category/ Market

Category- Drugs & Pharmaceutical Engineering
Industry Classification:
Pharmaceuticals; Food & Beverages; Cosmetics
Applications:
Medical use- Tissue engineering, regenerative medicine, plastic surgery, wound treatment,
Cosmetic use- Removal peels or moisturizing packs, delivering antioxidants, whitening agents, anti-aging, and anti-inflammatory substances while rejuvenating and hydrating skin.
Food use- Smart food packaging, encapsulating flavors, enzymes, stabilizers, essential oils, and delivering probiotics in nutraceuticals.
Drug delivery- Smart carriers for delivering drugs and active molecules in various forms, such as nano-gels, 3D sponges, films, beads, and nanofiber
Market report:
The Global Hydrogel Market was valued at USD 28.4 billion in 2023, and is expected to reach USD 50.0 billion by 2032 with a CAGR of 6.5%

Research Lab

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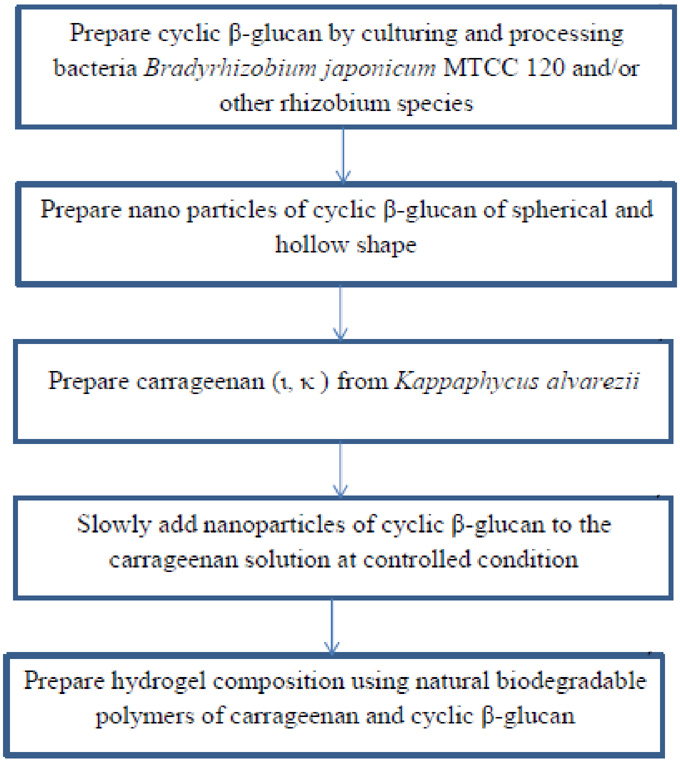

Figure: A high level flow chart of operation, illustrating logical operations of an improved process for producing hydrogels using natural biodegradable polymers comprising carrageenan and cyclic β-glucan.

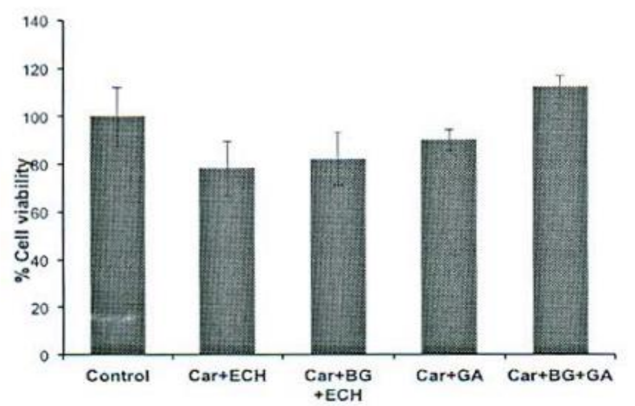

Figure: An illustration of a method of preparing a mono-disperse emulsion using a modular microfluidic device

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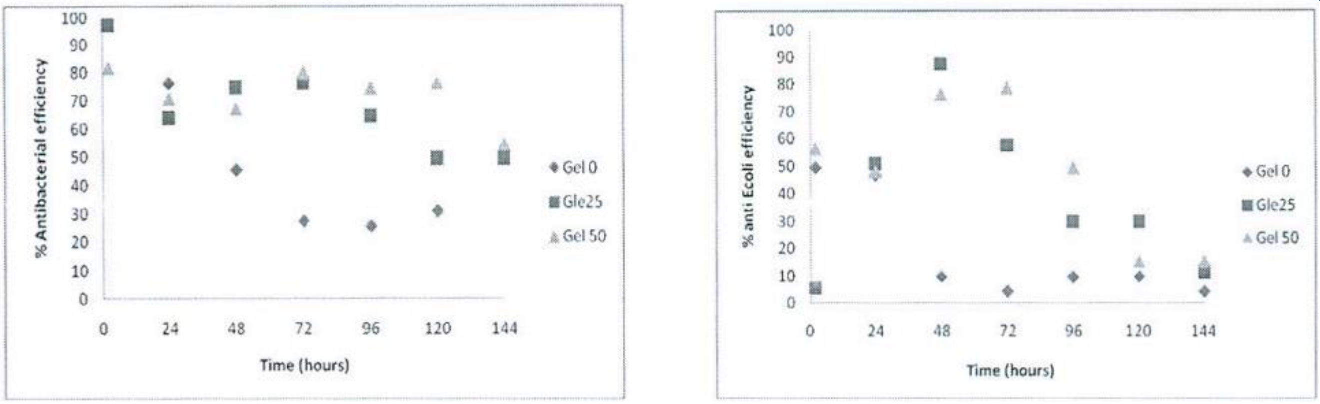

Figure: Percentage anti-bacterial efficacy of the hydrogels on (a) *S.aureus* and (b) *E.Coli.* Cylic-β Glucan (BG) and carrageenan (Car) in different ratios (5:95 (Gel 5), 25:75 (Gel25), 50:50 (Gel 50)). Ciprofloxacin encapsulated hydrogels showed good antibacterial activity against E.coli and S.aureus. The hydrogels were able to maintain the antibacterial activity for 72 hours indicating controlled drug release.

Technology

- The technology utilizes natural, biodegradable polymers—carrageenan and cyclic β-glucan—forming hydrogels with hydrophobic pockets within a hydrophilic gel, ensuring high biocompatibility, biodegradability, and moderate water absorption.
- The hydrogels can be fabricated into versatile forms, including 3D sponges, films, beads, nanogels (10–1000 nm), and nanofibers, catering to diverse industrial and medical applications.
- Cyclic β-glucan is synthesized via Bradyrhizobium japonicum MTCC 120 cultures, while carrageenan is extracted from Kappaphycus alvarezii under controlled conditions, ensuring reproducibility and scalability.
- The hydrogels serve in cosmetics (anti-aging, whitening agents), food packaging (encapsulating flavors, enzymes), and medical fields like wound care, tissue engineering, and regenerative medicine.
- With antioxidant encapsulation, controlled molecule delivery, and excellent swelling capacity, the hydrogels excel as carriers for drugs, cosmetics, and probiotics in nutraceuticals, adding significant value to industries.

Key Features / Value Proposition

- Superior biocompatibility and biodegradability, ensuring safer use across cosmetics, pharmaceuticals, food, and medical applications compared to existing synthetic alternatives.
- The invention supports multiple forms—3D sponges, films, nano-gels, and fibers—tailored to specific uses, outperforming conventional hydrogels with limited adaptability.
- Acts as a carrier for antioxidants, probiotics, drugs, and active molecules, enabling advanced applications in skin care, nutraceuticals, and therapeutic delivery, unlike standard hydrogel systems.
- Offers utility in tissue engineering, regenerative medicine, smart food packaging, and cosmetics, leveraging natural, biodegradable materials, addressing limitations of synthetic and less versatile hydrogels..

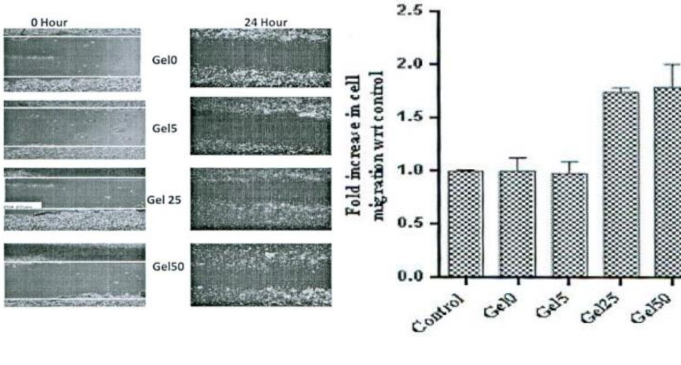

Figure: Scratch assay is used to check the wound healing ability. Cell adhesion and proliferation was faster with high amount of cyclic β- glucan and the cell morphology was maintained. The cell migration or wound healing was quicker than control with no glucan.

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