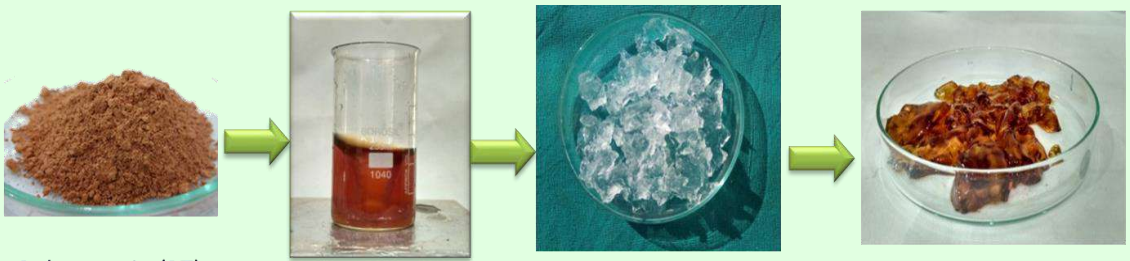
Natural gum based nanocomposite hydrogel having antibacterial and wound healing effects

Background information/ Reason for technology development:

Wound infections are a major barrier to healing, often requiring antibiotics, which can lead to resistance. The body's natural healing process can be slow and inefficient, especially in chronic wounds. Traditional wound dressings and drug delivery methods have many problems — they don't heal wounds effectively, release medicine too quickly, and need frequent use. Synthetic wound dressing materials can cause irritation or inflammation, while regular hydrogels are weak, and easily tear, making them difficult to handle and prone to detachment. Nanocomposite hydrogels are a new and better option. They are combination of natural and synthetic materials, can release drugs slowly and are helpful in treating chronic and diabetic wounds.



Palas tannin (PT) | Synthesis of PT based Silver nanoparticles (PT-AgNPs) | Incorporation of PT-AgNPs in the natural Gum hydrogel matrix | Synthesized Silver nano-composite hydrogel

Salient Features:

- **Natural Gum-Based Composition:** Developed using natural Gum Ghatti and Guar Gum-based hydrogels, Incorporating Palas tannin-mediated silver nanoparticles. Natural materials such as chitosan and cellulose make the hydrogel safe for the body and help new tissue grow.
- **Antimicrobial properties:** Nanoparticles like silver (AgNPs), copper oxide (CuO NPs), and zinc oxide (ZnO NPs) exhibit strong antimicrobial properties, effectively inhibiting bacteria growth and promoting a clean wound environment.
- **Antibacterial and Antibiofilm Properties**: The NC hydrogel exhibited efficient release kinetics of nanoparticles in targeted biological media, which in turn triggered antibacterial, antibiofilm activities against Gram-positive (***Streptococcus aureus***) and Gram-negative (***Pseudomonas aeruginosa***) bacteria, even at sub-MIC doses**.**
- **Biocompatibility:** The synthesized NC hydrogel was biocompatible and it showed zero cytotoxic effect with Peripheral Blood Mononuclear Cells (PBMC) lines**,** confirming its safety for biomedical use.

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- **Efficient Nanoparticle Release:** The hydrogel showed controlled and targeted release of silver nanoparticles in biological media.
- **Wound Healing Efficacy:** NC hydrogel has significant wound healing performance in murine model as compared to control.

Benefits:

- **Green Synthesis of Nanoparticles:** Incorporates Palas tannin-mediated silver nanoparticles**,** synthesized through an environmentally safe (green) route.
- **Safe for Clinical Use:** Non-toxic and biocompatible, suitable for direct application on wounds.
- **Sustained Antimicrobial Action:** Controlled release of silver nanoparticles ensures long-lasting antibacterial protection**.**
- **Promotes Faster Wound Healing:** Enhances tissue regeneration and repair, reducing healing time in chronic or infected wounds.
- **Sustainable:** The product is based on natural gum hence biodegradable and safe for application as wound care formulation.

Target market/Potential clients:

- The target market for nanocomposite hydrogels in wound healing is broad and encompasses various stakeholders in the healthcare sector like hospitals, clinics, wound care centres, and burn centres.
- Patients suffering from chronic wounds such as diabetic ulcers and pressure sores.
- Post-surgical patients and burn victims needing advanced wound healing solutions.
- Veterinary sector, as hydrogels can also be adapted for animal wound care.

Potential Clients / Investors:

- Pharmaceutical companies working in wound care or drug delivery products.
- Public health organizations and research institutions supporting clinical trials for new wound healing technologies.

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