



Industrial Consultancy & Sponsored Research (IC&SR)

METHOD FOR PREPARING CALCIUM LACTATE NANOSTRUCTURES AND ITS APPLICATIONS THEREOF

IITM Technology Available for Licensing

PROBLEM STATEMENT

- **RNA interference (RNAi)** involves introducing a short dsRNA into cells to silence gene expression.
- The **RNA-induced silencing complex (RISC)** recognizes and binds to target mRNA, inhibiting translation or protein expression.
- Essential in **gene-based therapeutics for diseases** like cancer, microbial infections, neurological disorders, immune-mediated diseases, and genetic disorders.
- **Challenges include safe, efficient, and economical delivery of siRNA** molecules due to their anionic nature, low stability, and short half-life.
- **Need for improved calcium lactate nanostructure-based transfection** reagent for effective gene silencing and therapeutic applications.

TECHNOLOGY CATEGORY MARKET

Technology: Method for Preparing Calcium Lactate Nanostructures

Category: Biotechnology & Genetic Engineering

Industry: Biomedical

Application: Drug Treatment of cancer

Market: The global market size was valued at **USD 201.75 billion in 2023** and is projected to grow from **USD 220.80 billion in 2024 to USD 518.25 billion by 2032**, exhibiting a **CAGR of 11.3%** during the forecast period (2024-2032).

INTELLECTUAL PROPERTY

IITM IDF Ref. 1970, Patent No: IN 549708

TRL (Technology Readiness Level)

TRL-4, Experimentally validated in Lab;

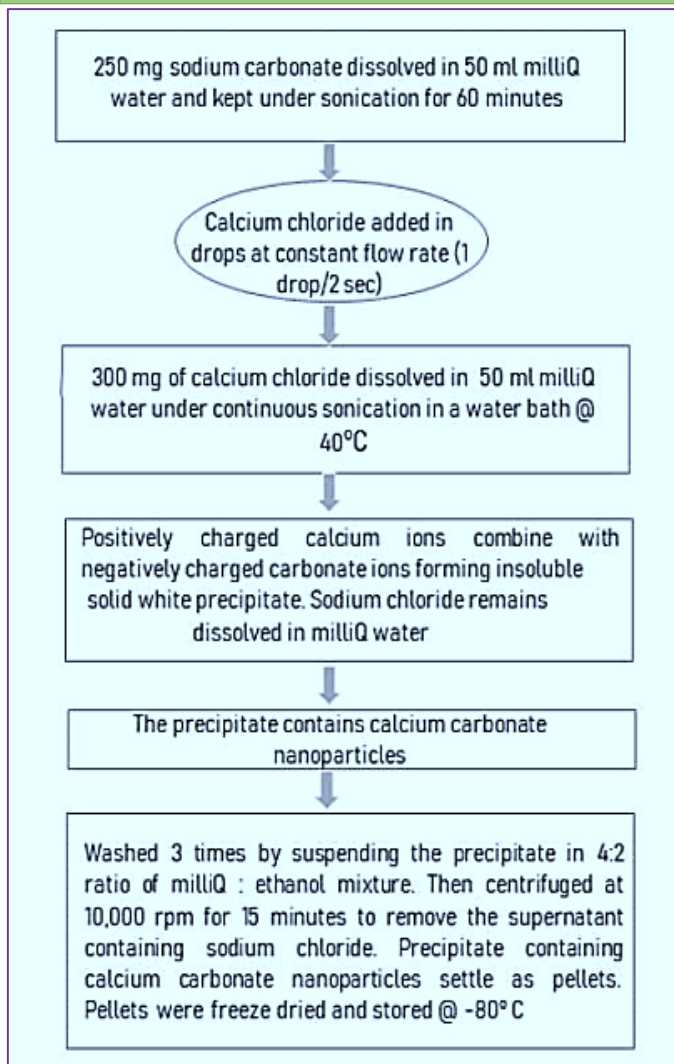
Research Lab

Prof. Mukesh Doble, Dept. of Biotechnology

TECHNOLOGY

A method for preparing calcium lactate nanostructures, which are used as siRNA delivery vehicles in various therapeutic applications, including RNAi-based therapeutics, targeted drug delivery, and combination therapy for various disease treatments.

FIG. 1 illustrates a flowchart illustrating steps for preparing calcium carbonate nanoparticles



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FIG. 2 illustrates a flowchart illustrating method for synthesis of calcium lactate nanostructures for employing as siRNA delivery vehicles in therapeutic applications including, but not limited to, RNAi based therapeutics, targeted delivery of drugs, combination therapy for treatment of various diseases

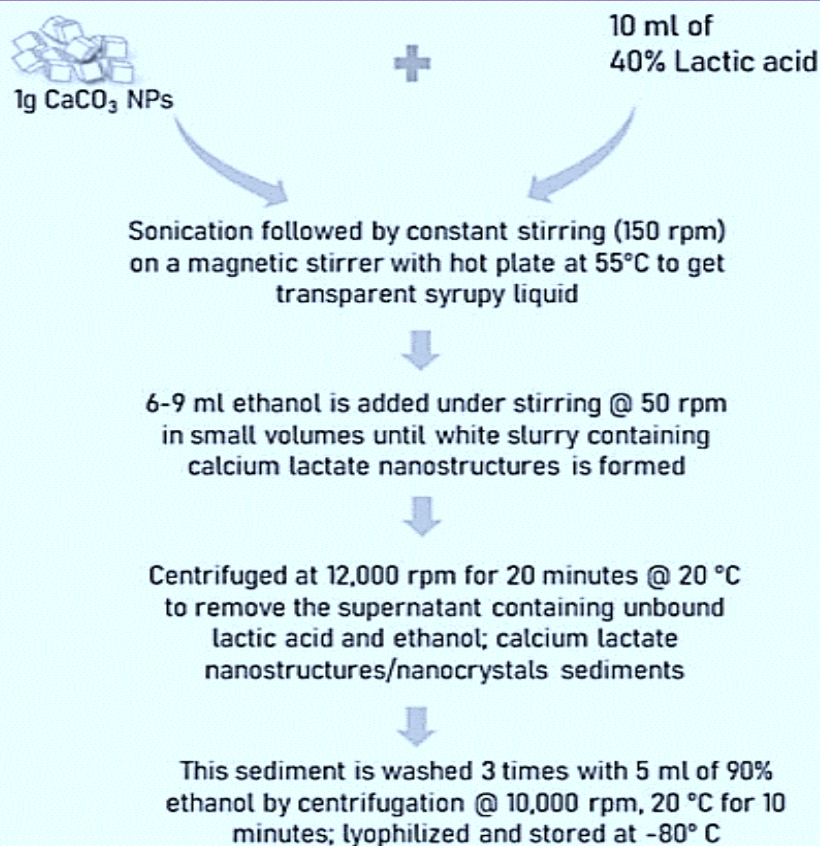


FIG.3 shows the shows particle size distribution, SEM image of CaLNSs loaded RESV

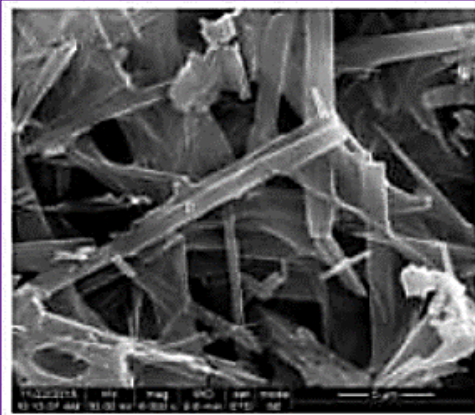


FIG. 4 shows the combinatorial effect of (CaLNSs-NCLX) – RESV treatment on viability of HeLa cells

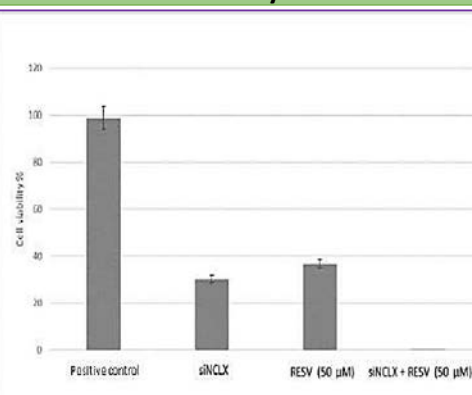
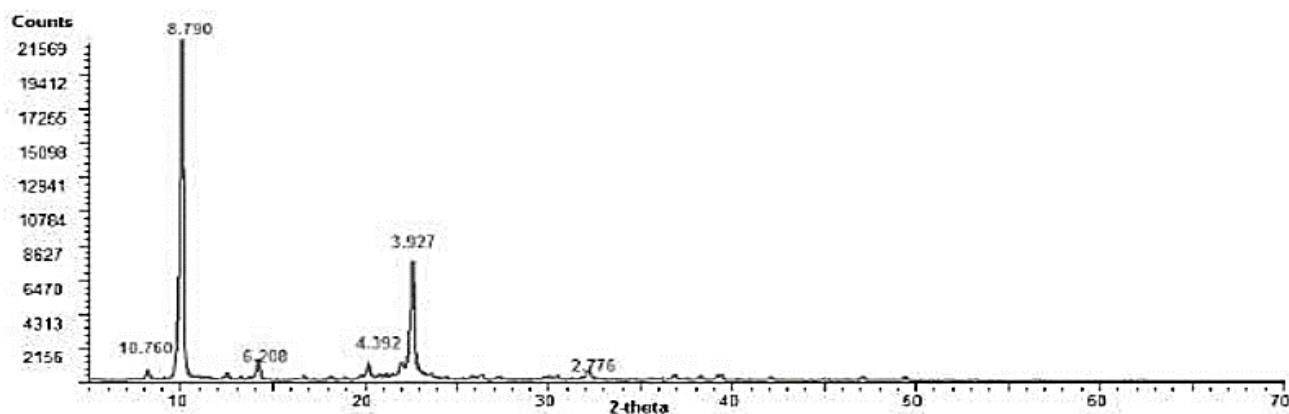


FIG. 5 depicts Powder X-ray diffraction pattern of CaLNSs



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Key Features / Value Proposition

Preparing Calcium Lactate Nanostructures for Therapeutic Delivery

- Addition of calcium carbonate nanoparticles to 40% lactic acid for sonication and stirring.
- Addition of ethanol to the syrupy liquid to form a white slurry with calcium lactate nanostructures.
- Centrifugation at 12000 rpm for 20 minutes at 20°C to retain sediment and remove supernatant.
- Washing of sediment with 90% ethanol for obtaining calcium lactate nanostructures.
- Lyophilization and storage at -80°C for obtaining nanostructures.
- Nanostructures are crystalline nanostrip, nanobelt, nanowire, nanorods with positive zeta potential.

Calcium Lactate Nanostructure Complexation Method

- Complexes calcium lactate nanostructure with at least one siRNA.
- Complexing occurs at pH 5-8, temperature 15-37°C, and incubation period ranging from seconds to 10 minutes.
- CaLNS-siRNA complex inhibits target gene expression via RNA interference.

Calcium Carbonate Nanoparticle Preparation Method

- Dissolve 250 mg sodium carbonate in 50 ml milliQ water.
- Dissolve 300mg calcium chloride in 50 ml milliQ water under continuous sonication at 40°C.
- Add calcium chloride to sodium carbonate under sonication for 60 minutes.
- Wash the precipitate three times in a 4:2 milliQ water:ethanol mixture.
- Centrifuge at 1000 rpm for 15 minutes to precipitate calcium carbonate.
- Store freeze-dried and stored at -80°C.

"SiRNA Delivery Method"

- Transfecting cells with CaLNS-siRNA complex.
- Incubation of cells for 30-12 hours.

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