IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
TTO – IPM Cell

Industrial Consultancy & Sponsored Research (IC&SR)

METAL-FREE POLYESTER BASED NANO-DRUG CARRIER

IITM Technology Available for Licensing

Problem Statement

- Polymeric nanomaterials, synthesized through ring-opening copolymerization (ROCOP) reactions using metal catalysts, have gained widespread use in biomedical applications.
- However, the conventional metal catalysts employed in this process pose significant safety and environmental concerns such as Accumulation of Metal Contaminants

Intellectual Property

- **IITM IDF Ref. 1683**
- **IN475521-Granted**

Technology Category/ Market

Category – Advanced materials/ Drugs & Pharmaceutical Engineering
Applications -Drug delivery, Tissue engineering, biosensor, biomedical applications
Industry – Healthcare, Nano materials
Market -The Global Nano-polymers Market size is USD 9.97 billion in 2023 and is estimated to grow to **USD 31.48 billion by 2030**. This market is witnessing a healthy **CAGR of 17.85% from 2024 - 2030.**

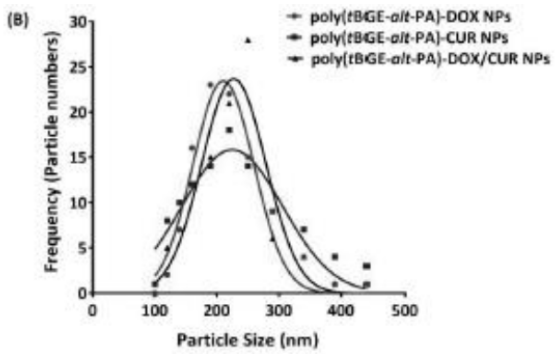

FIG. 1 illustrates particle size distribution analysis of nano-drug carriers composed of poly(*t*BGE-*alt*-PA) copolymer loaded with doxorubicin (DOX), curcumin (CUR) and their combination (DOX/CUR) formulations using Gaussian fitting

Technology

The present invention discloses **a method for developing metal-free poly(*t*BGE-*alt*-PA)** copolymer based nano- drug carriers for **combinatorial cancer therapeutics**

Synthesising poly(tBGE-alt-PA) copolymer *via. ROCOP reaction using B(C2H5)3/ PPNCl–based Lewis Pair (LP) as catalyst in order to obtain a metal-free polyester*

Developing nano-drug carrier composed of poly(tBGE-alt-PA) copolymer *loaded with doxorubicin (DOX), curcumin (CUR) and their combination (DOX/CUR)*

Converting DOX-HCL into its free base form *before loading and preparing blank poly(tBGE-alt-PA), poly(tBGE-alt-PA)-DOX, poly(tBGE-alt-11 PA)-CUR, and poly(tBGE-alt- PA)-DOX/CUR NPs by dialysis method (72 hours)*

Collecting each NP solution and kept for freeze drying *up to 48 hours in a lyophilizer to get obtain the powdered form.*

- ❑ TEM images showed the spherical shape for all drug loaded NPs.
- ❑ The internal morphology of NPs displayed core-shell structure, further polydispersity was observed in NP's size

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Images

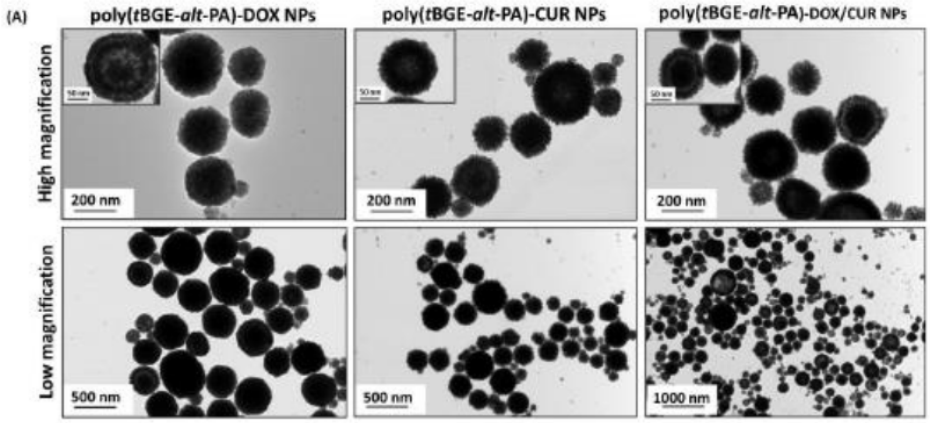

FIG. 2 illustrates High Resolution-Transmission Electron Micrograph (HR-TEM) images recorded at higher and lower magnification for nano-drug carriers composed of poly(*t*BGE-*alt*-PA) copolymer loaded with doxorubicin (DOX), curcumin (CUR) and their combination (DOX/CUR) formulations respectively, in accordance with the disclosed embodiments

Key Features / Value Proposition

Technical Perspective

- **Poly(*t*BGE-*alt*-PA) copolymer** is synthesised initially via. ROCOP reaction using B(C2H5)3/PPNCl–based Lewis Pair (LP) as catalyst in order to obtain a **metal-free polyester.**
- Said nano-drug carriers composed of poly(*t*BGE-15 *alt*-PA) copolymer proposed displays **high encapsulation and drug loading efficiency and exhibited sustained drug release behaviour** with anomalous transport at defined physiological environment.

User Perspective

- It provides an provide for an **improved metal-free synthesis of Polyesters for use in biomedical applications**
- The co-delivery mechanism of both drugs **doxorubicin (DOX), curcumin (CUR**) and their **combination (DOX/CUR**) with drug loaded nanoparticles displays **maximum anti-cancerous therapeutic effect on several cancer lines of different origins.**

TRL (Technology Readiness Level)

TRL-4,Technology Validated in Lab

The percentage of **apoptotic cells** in DOX, CUR, poly(tBGE-alt-PA)-DOX, 33 poly(tBGE-alt-PA)-CUR, and **poly(tBGE-alt-PA)-DOX/CUR NPs** treated MIA 34 PaCa-2 cells were found to be 6.80, 6.60, 13.05, 29.50, and **85.85 %** respectively**.**

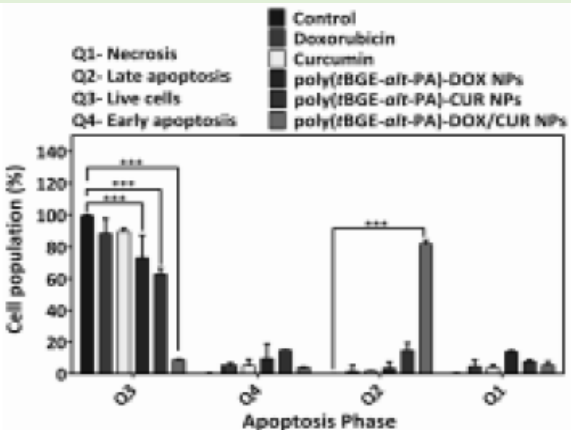

FIG. 3 illustrates Annexin V-FITC/PI apoptosis assay in MIA PaCa-2 cells treated with ½ IC50 values of DOX, CUR and different nano-drug formulations

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