CTS-mPEG/MMT Coated Nanoparticles for Treating *Helicobacter pylori*-Induced pH Dependent Gastritis

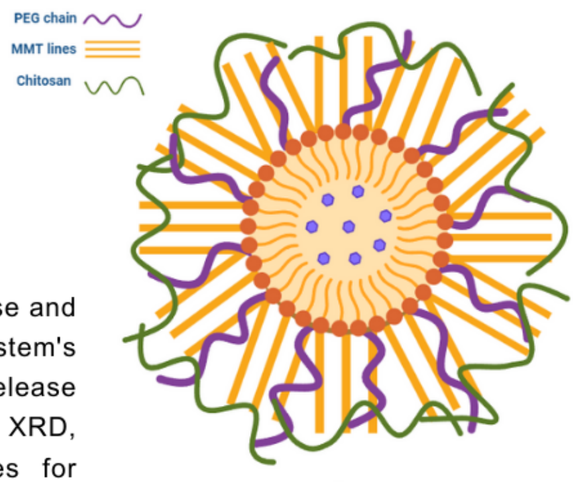
Ayşenur Saytaş, Beril Akgöl, Aysel Sağlam, Berfin Ezgi İlhan, Esin Üsküplü, Helin Aydemir, Pamir Batu Kıray, Özge Belgin Kutlu, Ahmet Kağan Korucu
Yildiz Technical University - Biotechnology and Genetics Club - Team: Origins of Life (TOOL)

ABSTRACT

This project aims to develop a droplet-based drug delivery system to enhance the stability, efficacy, and bioavailability of eupatilin— a flavone that is plays a protective role against CagA-positive *Helicobacter pylori*-induced gastritis. Using Poly(lactic-co-glycolic acid) (PLGA), the system enables controlled release of eupatilin-encapsulated chitosan-mPEG/MMT nanoparticles.

Chitosan modified with polyethylene glycol (PEG) and montmorillonite (MMT) enhances mechanical stability, biocompatibility, and targeted delivery in the acidic gastric environment. Microfluidic techniques optimize encapsulation, ensuring uniform particle size and high drug-loading efficiency.

The nanoparticle coating provides sustained release and protects against gastric acid degradation. The system's cytotoxicity, surface morphology, and drug release kinetics will be characterized using SEM, FTIR, XRD, and MTT assays, advancing targeted therapies for gastric diseases.



Nanoparticle coated with CTS-PEG/MMT

AIM OF THE PROJECT

Design and optimize a droplet-based nanoparticle system capable of delivering therapeutic agents to treat *H. pylori*-induced gastritis.

- Create uniform nanoparticles
- Clarify the dosage
- Optimize the encapsulation of eupatilin
- Efficacy of a single drug

- Improve mechanical properties, biocompatibility, and drug release control.
- Ensure that delivers the drug to the target site in a controlled manner under acidic pH conditions.
- Enhance the structural integrity of the coating under acidic conditions.

Enhance the stability and functionality of the nanoparticles through a chitosan-based coating.

Ensure the nanoparticle system is safe for biological applications.

- Extending the drug's half-life
- Verify the system's surface properties, chemical stability, and nanocomposite structure
- Reducing potential toxic effects on cells

METHODS

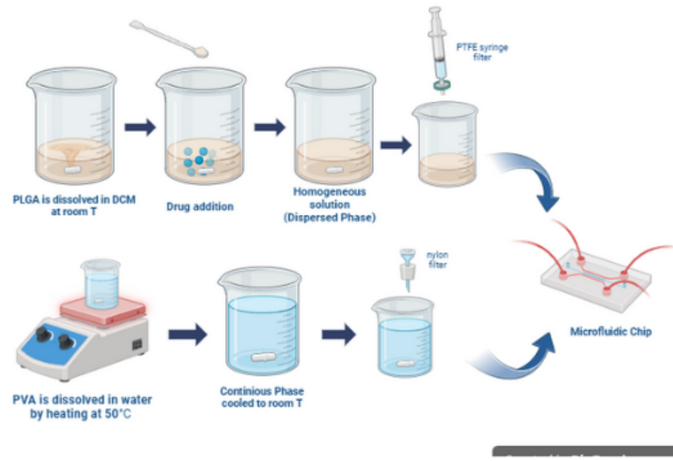
1. The preparation of the dispersed phase starts with dissolving PLGA in DCM with addition of eupatilin extract.

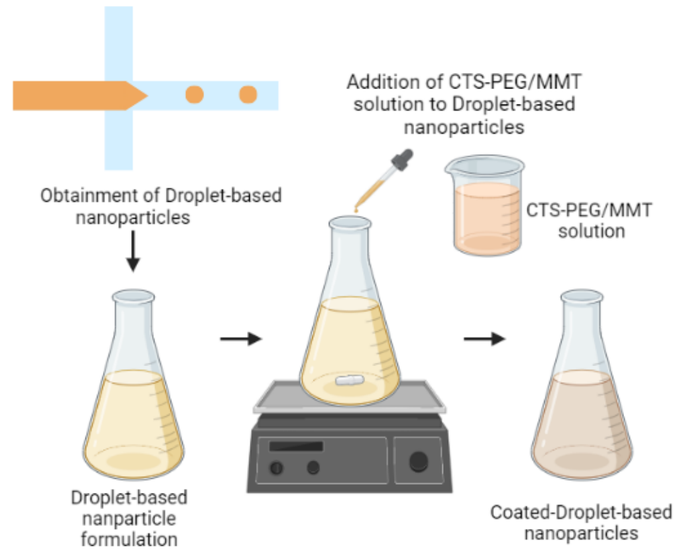
2. The continuous phase consists of PVA dissolved in Milli-Q water under constant stirring at 50°C.

3. The proposed droplet formation process employs a micro-fluidic chip, where the dispersed and continuous phases are introduced at optimized flow rates to achieve uniform droplet sizes through flow focusing.

4. These droplets are intended to be collected in an aqueous PVA solution for stabilization, followed by solvent evaporation to solidify the particles. Additionally, a CTS-mPEG/MMT coating process is suggested to enhance particle stability, with cross-linking performed using TPP.

5. Characterization methods such as SEM, FTIR, and DLS are proposed to evaluate particle size, encapsulation efficiency, and surface morphology, ensuring the suitability of the system for drug delivery applications.



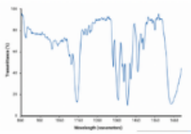


EXPECTED RESULTS AND CONCLUSION

Biocompatibility and Cytotoxicity
On the L929 fibroblast cell line:

- MTT Assay
- Lactate Dehydrogenase (LDH) Assay

Characterize the Chemical Structure



- Fourier-Transform Infrared (FTIR) spectroscopy

- Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM)
- X-ray Diffraction (XRD) analysis
- Thermogravimetric Analysis (TGA)

REFERENCES