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Development of Carboxymethyl-Sagocellulose-Stabilized Fe3O4 Nanoparticles Conjugated with 5-Fluorouracil for Targeted Photothermal Therapy in Cancer Treatment

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We use this protocol and it's working

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Abstract

To develop and evaluate carboxymethyl-sagocellulose-stabilized Fe3O4 nanoparticles conjugated with 5-fluorouracil (5-FU) for targeted photothermal therapy (PTT) in cancer treatment, enhancing drug delivery and therapeutic efficacy.

Materials

Materials -
Sodium hydroxide 10 g
Sodium monochloroacetate 5 g
Sodium chlorite 5 g
Acetic acid 50 mL
Ethylene glycol 40 mL
Ferric chloride hexahydrate 1.08 g
5-Fluorouracil 1 g
EDC 0.025 g/mL in buffer A
Sulfo-NHS 0.025 g/mL in buffer A
Phosphate buffer solution 200 mL

Reagents -
Sodium hydroxide
5-Fluorouracil

Safety warnings

Handle all chemicals with appropriate personal protective equipment (PPE). Dispose of waste according to local regulations. Be aware of potential hazards associated with nanoparticles.

Synthesis of Fe3O4 Nanoparticles

1 Dissolve 1.0 g of PSSMA, 1.08 g of FeCl3·6H2O, and 3.0 g of NaOAc in 40 mL of ethylene glycol.

2 Homogenize the solution and transfer it to an autoclave.

3 Heat at 200 °C for 10 hours.

4 Collect the black precipitate, wash with deionized water, and dry at 30 °C overnight.

Surface Modification of Fe3O4 Nanoparticles

5 Disperse 0.60 g of Fe3O4 nanoparticles in 350 mL of ethanol and 3 mL of deionized water.

6 Add 4 mL of APS and stir for 12 hours under nitrogen atmosphere.

7 Collect the precipitate, wash with deionized water, and dry at 30 °C overnight.

Conjugation of CMSC and 5-FU

8 Dissolve 1 g of CMSC in 200 mL of phosphate buffer (pH 7.0).

9 Add EDC and sulfo-NHS at a molar ratio of 0.5 relative to carboxyl groups.

10 Stir for 12 hours in the dark.

11 Add 5-FU solution and stir for an additional 12 hours.

12 Recover the nanoparticles using a magnet, wash, and vacuum-dry overnight.

Evaluation of Photothermal Effect

13 Prepare Fe3O4-CMSC-5FU nanoparticles at various concentrations (30, 75, 175, 350 mg/mL).

14 Irradiate with an 808 nm laser at a power density of 600 mW/cm² for 15 minutes.

15 Measure temperature increase using a thermocouple.