Gold Nanoparticles Microfluidics Encapsulation for Cancer Theranostics

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1. Introduction

Biodegradable polymeric nanoparticles have demonstrated to be and advantageous drug delivery system due to their biocompatibility, controlled release, prolonged blood circulation and potential applications for passive and active targeting[1]. This research aims to develop polymeric nanoparticles for the delivery of both drug and gold nanoparticles (GNPs) for cancer theranostics. By using the high X-ray absorption coefficient of GNPs and polymer functionalization, the goal is to improve imaging and radiotherapy efficacy in cancer treatments while minimizing side effects.

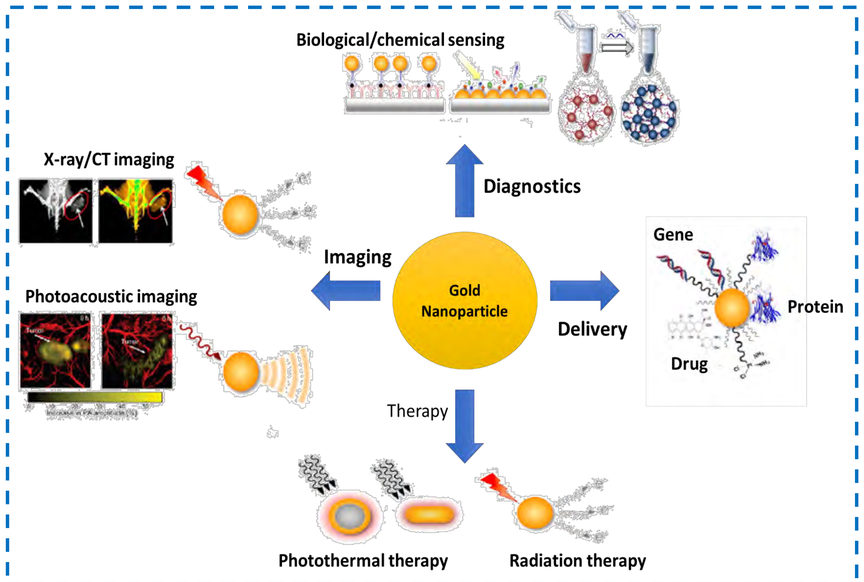
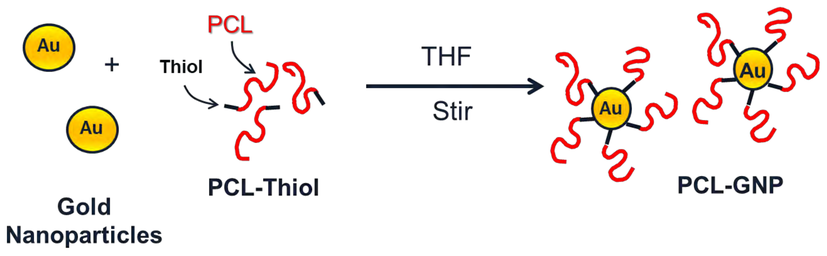


Figure 1. Versatility of gold nanoparticles biomedical applications[2].

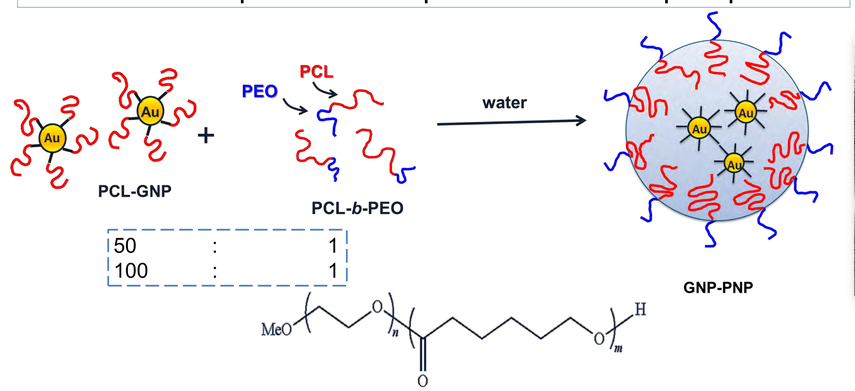
1. Kumari, A.; Yadav, S. K.; Yadav, S. C. Biodegradable polymeric nanoparticles based drug delivery systems. Colloids and surfaces B: Biointerfaces. **2010**, 75(1), 1-18.
2.Her, S.; Jaffray, D. A.; Allen, C. Gold nanoparticles for applications in cancer radiotherapy: Mechanisms and recent advancements. Advanced drug delivery reviews. **2017**, 109, 84-101.

2. Methodology

2.1. Gold nanoparticles functionalization



2.2. Gold nanoparticles encapsulation via nanoprecipitation



3. Results

3.1. Gold Nanoparticles size and functionalization

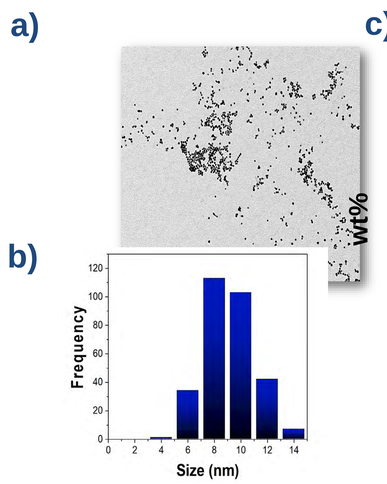


Figure 2.a) Transmission electron microscopy (TEM) of GNPs before functionalization and its b) histogram; c) thermogravimetric analysis of GNPs functionalization before and after washing polymers in solution

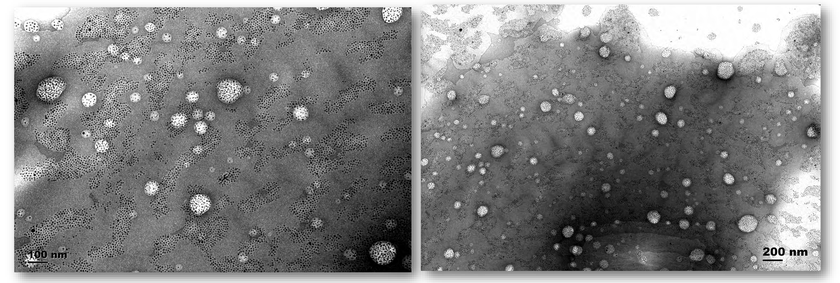


Figure 4. TEM analysis of 50:1 gold to polymer ratio at 100k (left) and 50k (right) magnification.

3.2. GNPs encapsulation

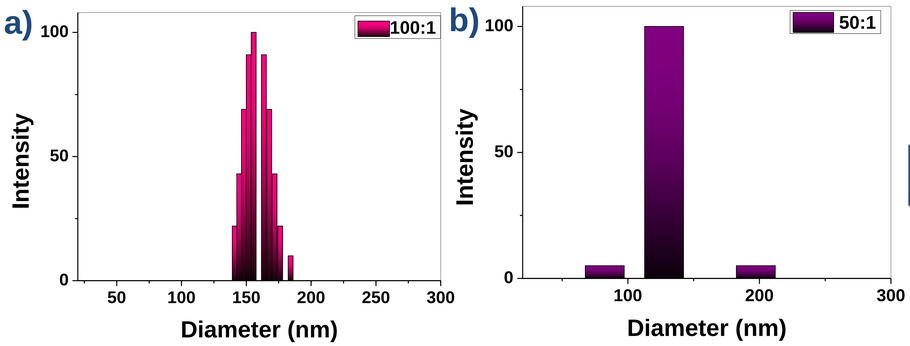
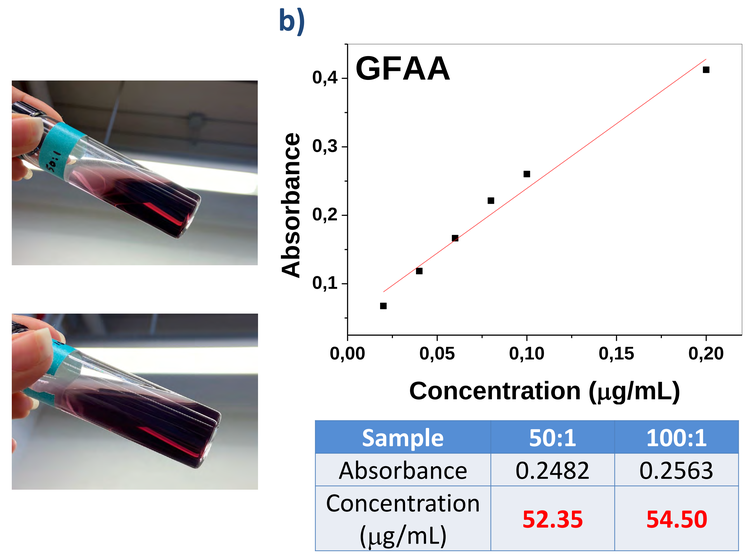


Figure 3. Dynamic light scattering (DLS) analysis for a) 100:1 and b) 50:1 gold to co-polymer ratios



Sample	50:1	100:1
Absorbance	0.2482	0.2563
Concentration (µg/mL)	**52.35**	**54.50**

Figure 5. a) GNPs encapsulated solution in water of 100:1 (top) and 50:1 (bottom) and b) graphite furnace atomic absorption (GFAA) with measured gold concentrations of each sample.

4. Future work

- Try different experiment variables to increase gold concentration in the samples in order to image them on CT.
- Once, the optimum condition is found, drug will be co-encapsulated with GNPs and cytotoxic experiments will be carried out.

Acknowledgements

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