Gemini Amphiphilic Pseudopeptides for Encapsulation and Release of Hydrophobic Molecules

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Abstract:

Gemini amphiphilic pseudopeptides (GAPs) are non-biogenic peptide like molecules [1], able to self-assemble into well-ordered nanostructures through the cooperative action of polar (H-bonding and dipole-dipole) and non-polar (van der Waals) interactions [2-4]. In acidic medium, GAPs are able to form vesicles which have been studied in the solid state (SEM, TEM and AFM; Fig. 1) and in the liquid state (optical fluorescent microscope, Fig. 3). This vesicular morphology is attributed to the hydrophobic interactions which play a major role in the stability of the folding state [3]. In addition, GAPs provide o/w emulsion that remains stable for months and also shows good stability toward the acidic pH and centrifugation effect Fig. 3&2. The capability of this system to encapsulate hydrophobic molecules such as dimethylanthracene (DMA) and dansyldiethyl amine (DEA) was evaluated by fluorescence spectroscopy and microscopy respectively. The results showed that the DMA fluorescence was highly enhanced after 24 hours and I_1/I_3 fluorescence intensity ratio increased by almost 0.6 Fig. 4. Additionally, DEA was efficiently incorporated into the inner hydrophobic core of GAPs vesicles rendering green colored balls Fig 2. Ultimately, such system can be enzymatically disassembled resulting in the destruction of vesicles and release of its contents Fig. 5 [5]. Therefore, the GAPs here considered are promising system for drug delivery.

References:

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Figures:

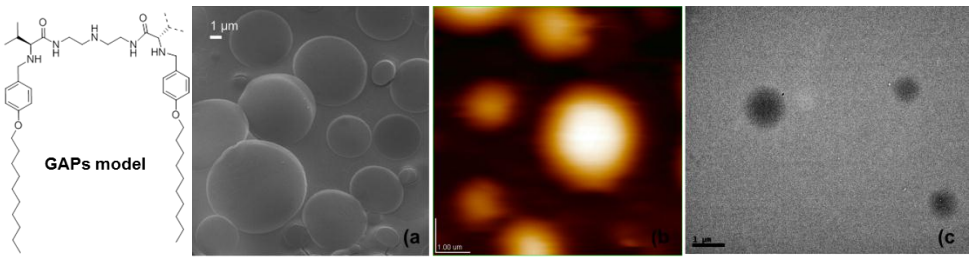

Fig. 1 Micrographs of GAPs model grown from 1:1 MeOH : H_2O + HCl captured by (a) SEM, (b) AFM and (c) TEM techniques.

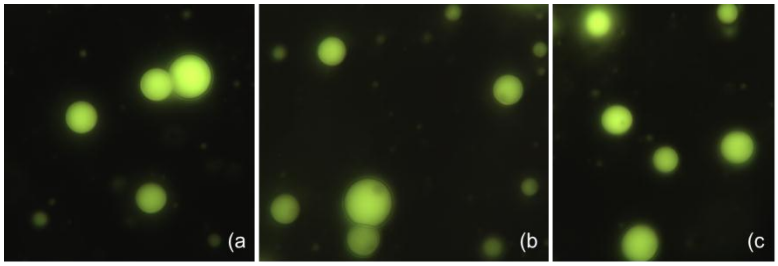

Fig. 2 Fluorescent microscope images of o/w GAPs encapsulated DEA emulsion; Long term stability (a) after 1 week, (b) after 1 month, (c) after 3 months.

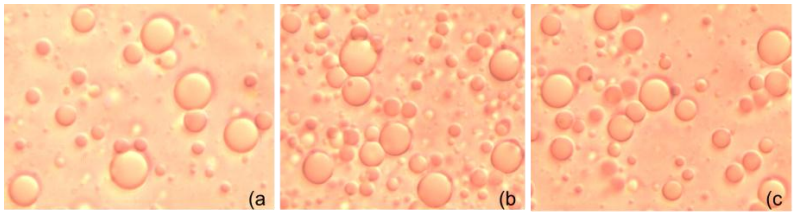

Fig. 3 Optical microscope images of o/w GAPs emulsion after centrifugation at 3000 rpm for 30 minutes; Mechanical stability test (a) 5 min, (b) 15 min, (c) 30 min.

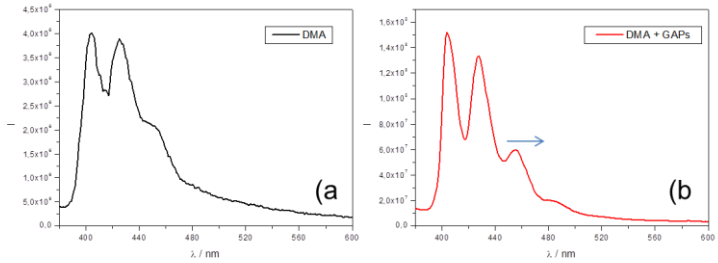

Fig. 4 Fluorescence spectroscopy of Dimethyl anthracene; (a) free DMA, (b) encapsulated DMA.

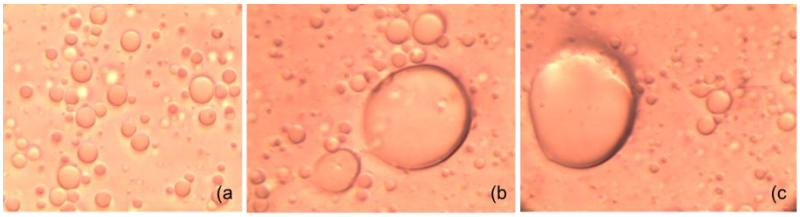

Fig. 5 Optical microscope images of o/w GAPs emulsion; (a) without thermolysin, (b,c) after adding 1.5 mg/mL thermolysin.