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SUPRAMOLECULAR ASSEMBLED NANOGEL MADE OF MANNAN

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KEYWORDS

Mannan, nanogel, supramolecular assembly, Michael addition.

INTRODUCTION

The supramolecular assembled nanogel made of mannan was synthesed and characterized with the purpose to obtain a potential pharmaceutical delivery system able to work both as a therapeutic and prophylactic vaccine adjuvant and antigen carrier. These systems are expected to perform as carriers for proteins and peptides, acting like antigens, optimizing delivery to antigen-presenting cells, by targeting their mannose receptors. Immunity might be improved conjugating this system with other immune response modifiers.

MATERIALS AND METHODS

The supramolecular assembly of amphiphilic mannan (mannan-C_{16} or MVC_{16}), synthesized by the Michael addition of hydrophobic 1-hexadecanethiol (C_{16}) to vinyl methacrylated mannan (VMA), originates in aqueous medium the formation of a nanogel, stabilized by hydrophobic interactions among alkyl chains.

The physic-chemical properties of the resulting nanogel were characterized - size, shape, charge and stability during storage - using fluorescence spectroscopy, cryo-field emission scanning electron microscopy (cryo-FESEM) and dynamic light scattering (DLS).

RESULTS AND DISCUSSION

The biopolymeric low cost and simple macromolecular micelles were easely produced by the Michael addition of hydrophobic C_{16} to vinyl methacrylated mannan (Figure 1). The critical aggregation concentration (cac), calculated by fluorescence spectroscopy ranged between 0.002 and 0.01 mg/mL, depending on the polymer degree of substitution. The cryo-FESEM showed spherical macromolecular micelles with diameters between 100 and 500 nm (Figure 2).

The DLS analysis revealed a nearly neutral negatively charged and polydisperse colloidal system, stable over a six months storage period, with mean hydrodynamic diameter between 50 and 140 nm, depending on the polymer degree of substitution (Figure 3 and 4).

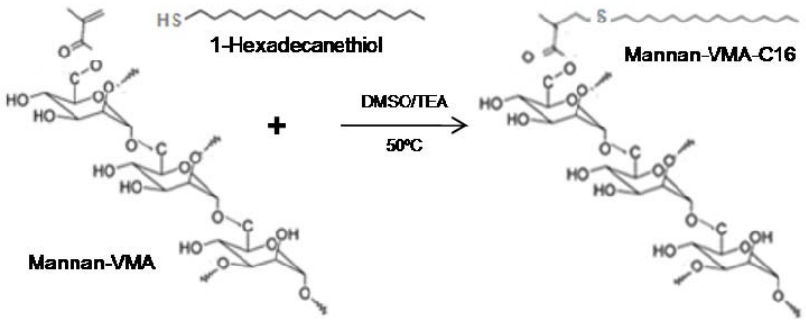

Figure 1: Synthesis of mannan-C_{16}

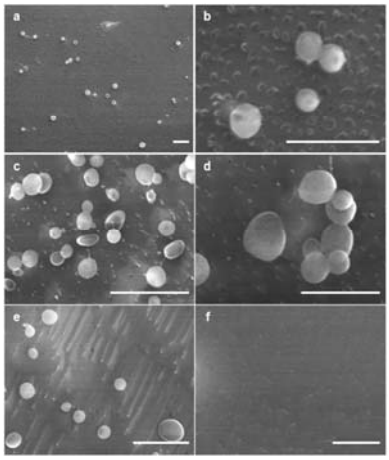

Figure 2: The cryo-FESEM negatively stained micrographs of mannan-C_{16} (scale bar = 1µm): (*a, b)* MVC_{16}-20-8, (*c, d*) MVC_{16}-20-11, (*e*) MVC_{16}-20-16 and (*f*) solvent

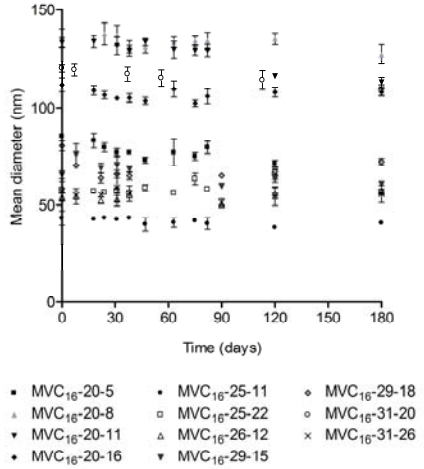

Figure 3: The size of mannan-C_{16} water dispersions (1 mg/mL) over a six months storage period, at room temperature (25 °C), measured periodically by DLS (mean ± S.D., n= 10)

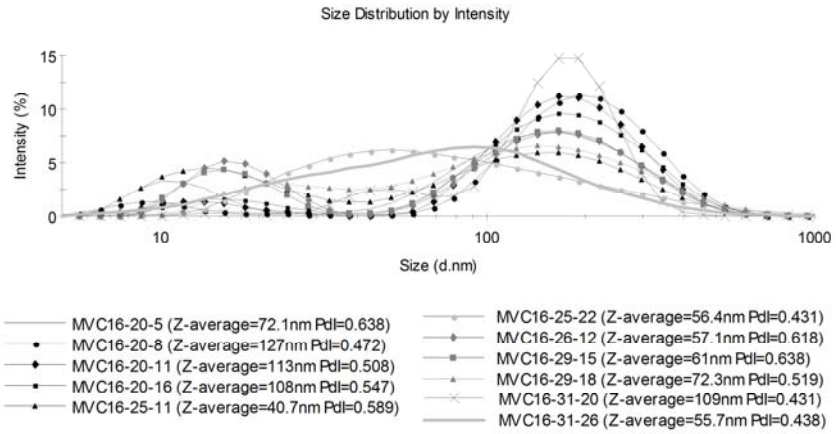

Figure 4: The size distribution by intensity, z-average and PdI of the mannan-C_{16} water dispersions (1 mg/mL) measured by DLS (mean ± S.D., n= 10) after a six months storage period, at room temperature (25ºC)

CONCLUSIONS

The supramolecular assembled amphiphilic nanogel made of mannan was designed with a versatile, easy, reproducible and low-cost method. Above the cac, spherical polydisperse macromolecular micelles revealed long-term stability in aqueous environment, with mean hydrodynamic diameter ranging between 50 and 140nm and nearly neutral negative surface charge.

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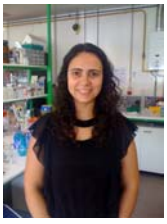
AUTHOR BIOGRAPHIES



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