Photo-crosslinkable and temperature sensitive chitosan/pluronic nanogel for local drug delivery

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Statement of Purpose: We synthesized photo-crosslinkable temperature sensitive chitosan/pluronic nanogel for local drug delivery. Because of hydrophobicity of chitosan, hydrophobic drug can be easily loaded within the nanogel and it can be easily crosslinked in situ by UV irradiation.

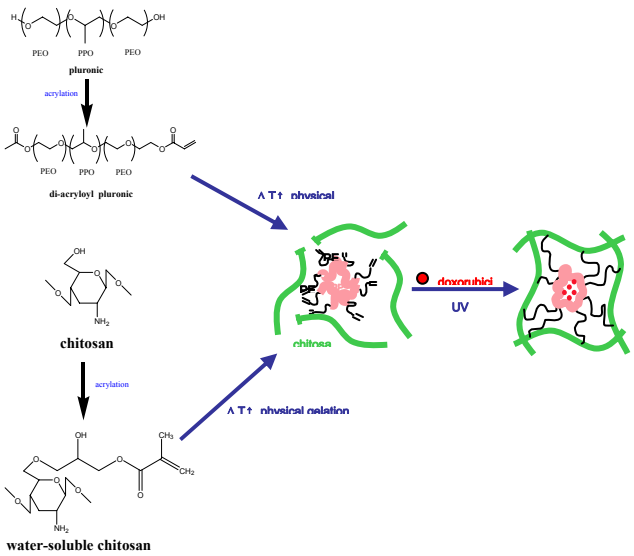

Fig 1. Schematic diagram of preparing photo-crosslinkable chitosan/pluronic nanogel

Methods: Pluronic F127 was acrylated with acryloyl chloride in the presence of trimethyamine at room temperature. Water-soluble chitosan was acrylated with glycidyl methacylate (GMA) at 40°C. The degree of acrylation was determined by 400Mhz NMR. Acrylated pluronic and chitosan were completely dissolved in water and photo-initiator (Irgacure 2959) was added. Physical nanogel was prepared by elevating temperature and the nanogel was crosslinked by applying UV light for 10-20min. Sol-gel transition temperature was measured by elevating temperatures by 2□C (5°C -70°C). The swelling ratio was measured by incubating dried and crosslinked nanogel in PBS for 12h.

Results/Discussion: Fig 1 shows a schematic diagram of preparing photo-crosslinkable chitosan/pluronic nanogel for local drug delivery. As shown in Fig 2, the degree of deacylation was measured, which were 33.6% and 16.0% for di-acrylated pluronic and methacylated chitosan, respectively. Di-acrylated pluronic and methacylated chitosan were photo-crosslinked after physical gel was formed (chitosan weight ratio: 0-15%). As the amount of chitosan increased, longer curing time was required. Fig 3 shows sol-gel transition temperatures according to chitosan weight ratio. Upon increasing chitosan weight ratio, sol-gel transition temperature increased. This could be attributed that chitosan decreased hydrophobic interactions between PPO blocks of pluronic, inhibiting a gel formation process of pluronic polymers.

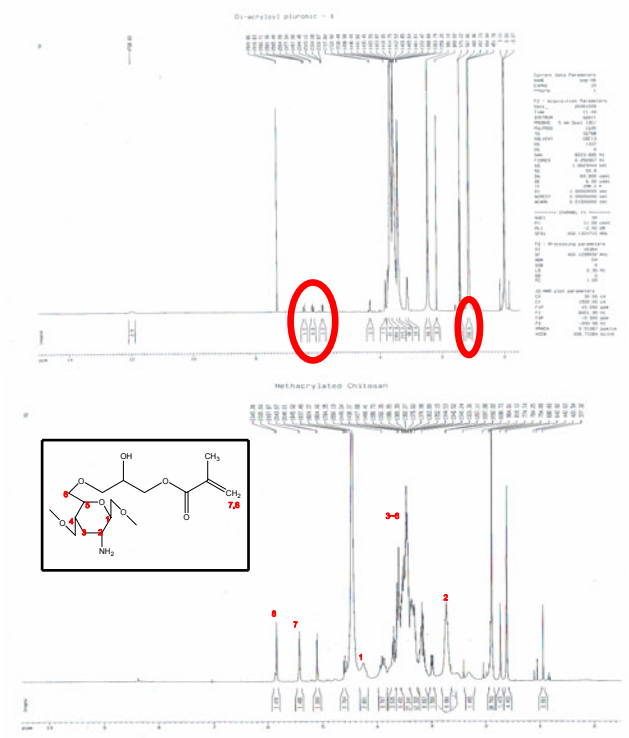

Fig 2. NMR spectroscopy of di-acrylated pluronic and methacylated chitosan

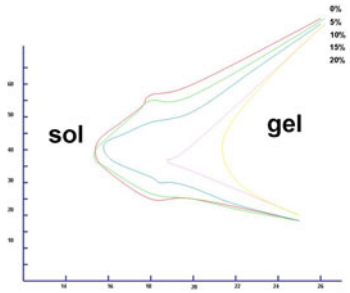

Fig 3. Sol-gel transition curve of photo-crosslinkable chitosan/pluronic nanogel according to the blend ratio of chitosan.

Conlusion: Photo-crosslinkable temperature sensitive chitosan/pluronic nanogel was successfully prepared and their physical characteristics were examined.