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Short communication

Preparation and characterization of carboxymethyl guar gum nanoparticles

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ABSTRACT

Carboxymethyl guar gum nanoparticles (CMGGNPs) were synthesized by nanoprecipitation and sonication method. This method was used for the first time for the synthesis of carboxymethyl guar gum nanoparticles. It was found that the formation of nanoparticles might depend upon the sonication time, solvent, and stirring time. Nanoparticles were characterized by SEM, TEM, XRD and FTIR. The sizes of the particles in suspension have been found in the range 12–30 nm. It was concluded that such type of nanoparticles may be used in pharmaceutical and drug delivery.

1. Introduction

A lot of methods have been used for the synthesis of Nanoparticles, like precipitation, sonochemical, dialysis, coacervation, spray drying and a combination of these methods [1–3]. Nanoprecipitation has been found as a general route to prepare polymeric nanoparticles under mild conditions, especially for biological applications [4]. Nanoparticles have been used as potential carrier for different kinds of drug and cosmetics, especially carboxymethyl guar gum in pharmaceuticals [5,6]. Guar and its derivatives have been used in many applications like food, drug-delivery and health care products because of their natural abundance and their low cost and other desirable functionalities [7]. Guar gum is a natural non-ionic water soluble polysaccharide exhausted from refined endosperm of cluster bean seed. Carboxymethyl guar gum (CMGG) [14] is an anionic semi-synthetic guar gum derivative having same polysaccharide backbone similar to guar gum [8]. It is prepared by reacting guar gum with sodium monochlorate in the presence of sodium hydroxide. Carboxymethyl guar gum (CMGG) is a cheap and easily water soluble commercial polysaccharide. Among the guar gum derivatives, carboxymethyl guar gum (CMGG) is very important because it covers a wide range of industrial applications [9]. Little literature is available for the possibility of using guar gum nanoparticles in drug carrier. But carboxymethyl guar gum has been found suitable for [10] drug delivery systems. The ultimate aim of this article was to synthesize ecofriendly and cost-effective nanosized uncoated carboxymethyl guar gum NPs by nano precipitation and sonication method which might be used in different pharmaceutical industries.

2. Experimental

CMGG (carboxymethyl guar gum) powder has been obtained from Hariom Gum Industry, Gujarat, India. It has been used in the same way as for the synthesis of carboxymethyl guar gum nanoparticles, without any purification. For the synthesis of CMGG nanoparticles (NPs), a little fixed amount of carboxymethyl guar gum powder was added in 100 ml deionised (DI) water in a beaker. Then it was kept on stirring overnight. Thus we got a very clear and little viscous solution. Then this solution was sonicated for 1 h. After sonication, we got the suspended colloidal solution. Then acetone was added drop wise to this solution with continuous stirring; thus we get a whitish precipitate. Dry this to the 10–20° C and store in the desiccators. Crush this precipitate. Thus we obtain the carboxymethyl guar gum nanoparticles [11]. A diagrammatic presentation of carboxymethyl guar gum nanoparticles synthesis is shown in Fig. 4.

A little amount of these nanoparticles were suspended in the fix amount of DI water for testing these nanoparticles. The morphologies, particle size and structural studies have been investigated

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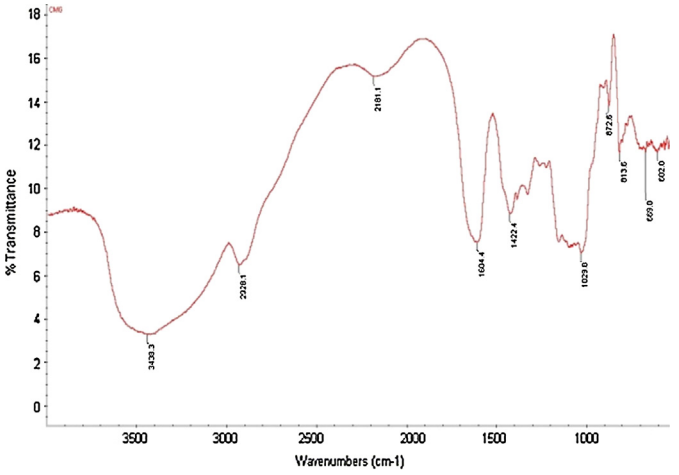

Fig. 1. FTIR of CMGG NPs.

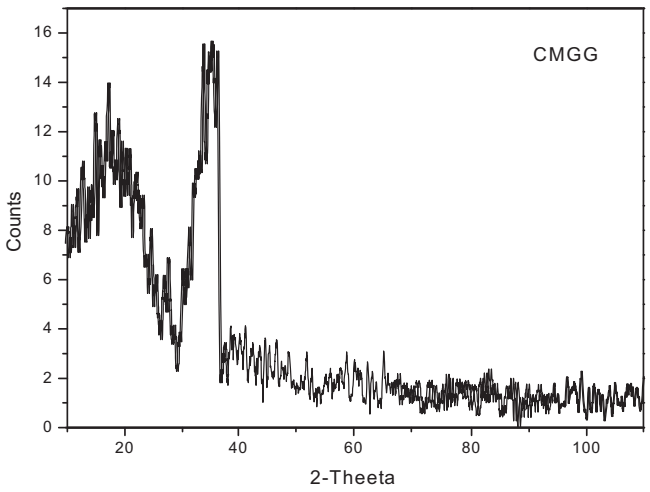

Fig. 2. XRD pattern of CMGG NPs.

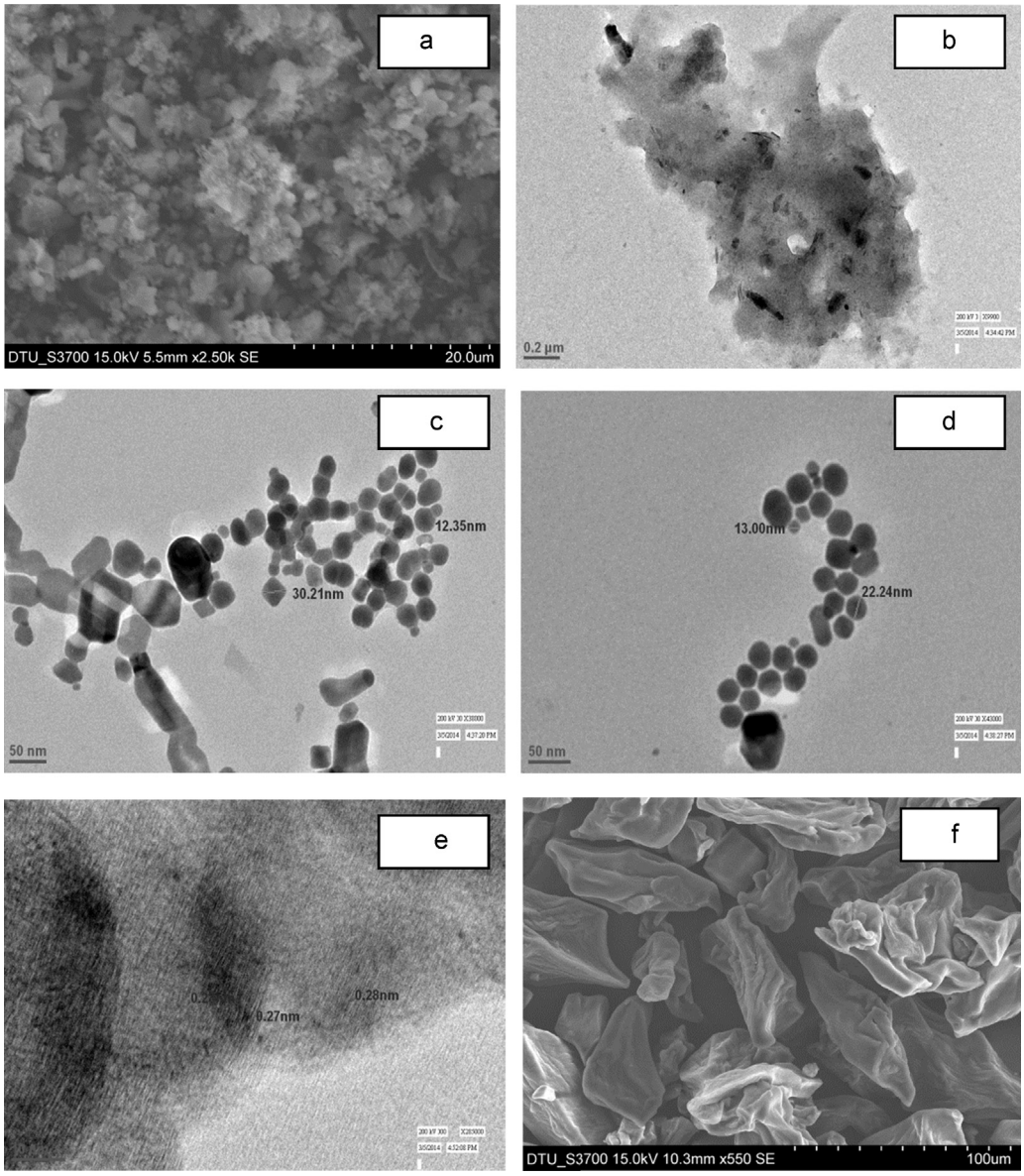

Fig. 3. (a) SEM micrograph of CMGG NPs. (b–d) TEM images of CMGG NPs. (e) High resolution TEM image of CMGG NPs showing the lattice fringes in the (1 1 1) plane of the particles (indicated on one particle by white bars) and measured lattice *d*-spacing. (f) SEM image of CMGG powder obtained from industry.