

Effect of ball milling and ultrasonication on particle size of chitosan nanoparticle for potential nanofiller in food packaging application

ABSTRACT

Incorporation of chitosan nanoparticle (CNP) into food packaging film is very promising due to the many advantages such as improving mechanical and barrier properties of the film. Recently, ionic gelation of chitosan with addition of sodium tripolyphosphate (TPP) has been a popular method to synthesize chitosan nanoparticle (CNP). This study aims to investigate the effect of ball milling and ultrasonication on CNP particle size produced using ionic gelation method. Ball milling time (0, 12, 18 h) and ultrasonication time (15, 30 min) were varied. Combination of ball milling and ultrasonication were found to produce smaller and more uniform size of CNP compared to ball milling or ultrasonication alone. It was found that particle sizes of CNP that underwent ultrasonication decreased with the increase in ball milling time. This may be due to the shear stress during ball milling which led to fragmentation of CNP into smaller and uniform particle size. Meanwhile, particle sizes of CNP underwent ultrasonication without ball milling decreased with the increase in ultrasonication time due to the longer exposure time to cavitation effect produced by ultrasonic probe. The optimum ball milling and ultrasonication time were found to be 18 h and 15 min, respectively.

Keyword: Chitosan nanoparticle; Food packaging film; Freeze drying; Ionic gelation; Particle size distribution; Sodium tripolyphosphate