Nanoparticles from ultrasound-processed chitin.

E. V. R. Almeida, M. S. Mariano, S. P. Campana-Filho
Universidade de São Paulo – Instituto de Química de São Carlos – BRAZIL

Recently, the ultrasound irradiation has been successful applied as a top-down method for producing nanoparticles and nanofibers from polysaccharides, such as chitin, potentially applicable as components of biodevices and as scaffolds for tissue engineering [1]. The aim of this work was to produce ultrasound-processed stable aqueous suspensions of beta-chitin (from *Loligo sp.*) to investigate the effects of high intensity ultrasound irradiation on the particles dimensions. Beta-chitin was extracted from squid pens, by carrying out a mild deproteinization procedure as described in the literature [2]. The beta-chitin was ground and the fraction of the particles with average dimensions in the range 75µm<ρ<125µm was used in the subsequent experiments. The beta-chitin suspension (0.4 g/L<Cp<1.6 g/L) was submitted to the high intensity ultrasound irradiation by using a Branson Sonifier Model 450 (ν=20 kHz) coupled to a ½' stepped probe. The duration of the ultrasound treatment ranged as 5min<t<30min and the temperature was maintained at 67±2 ^{o}C. The resulting suspensions were analyzed by light scattering in an Appliance Zeta Trac to determine the average size and the conductivity of the suspended particles. The ultrasound-processed suspensions of beta-chitin were more stable the longer the treatment duration and the higher the concentration of chitin in the suspension, Indeed, the less concentrated suspensions (Cp<1.0 g/L) and those which were submitted to short sonication time (t<20 min) were not sufficiently stable while the more concentrated suspensions (Cp>1.0 g/L) and those which were submitted to long sonication time (t>20 min) were stable as the particles remained in suspension even after several days. Such a behavior of the ultrasound-processed suspensions of beta-chitin is attributed to the reduction of the particles size and the development of superficial charges due to the occurrence of cavitation during the ultrasound treatment. In fact, the measurements of zeta potential confirmed that the more concentrated the beta-chitin suspension and the longer the sonication time, the higher the particles superficial charge. The light scattering measurements also allowed the determination of the average diameter of the beta-chitin particles in the swollen state. Although there are no simple relationship between the sonication time and the average size of the beta-chitin particles these data show a remarkable reduction of the particle dimensions since it ranged as 75µm<ρ<125µm for the parent particles and it changed to 300 nm<ρ<700 nm in the case of the ultrasound-processed particles. Actually, regardless of the concentration of the beta-chitin suspension a sonication time as short as 5 min already provoked the reduction of the particles size to 425 nm<ρ<485 nm (Figure 2), the prolongation of the treatment leading to a complex pattern which seems to depend on the swelling capacity of the particles and on its tendency to aggregate.

Keywords: Nanoparticles, chitin, ultrasound

Work supported by CAPES, CNPq and FAPESP.

[1] Y. Fan, T. Saito, A. Isogai. *Biomacromolecules*. **9**, 1919 (2008).
[2] G. Chaussard, A. Domard. *Biomacromolecules*. **5**, 559 (2004).
erikavi@iqsc.usp.br, Av. Trab. São-carlense, 400, CP 780, São Carlos – SP. CEP: 13560-970