PREPARATION OF NANO COMPOSITE FROM SOYBEAN PROTEINS

By

DINA EL-SAYED HELMY AZAB

B.Sc. Agric. Sc. (Food Technology), Cairo University, 2004

M.SC. Agri. Sci. (Food Science), Ain Shams University, 2011

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ABSTRACT

Dina El-Sayed Helmy Azab: Preparation of Nano Composite From Soybean Proteins. Unpublished PH.D. Thesis, Department of Food Science, Faculty of Agriculture, Ain Shams University, 2019.

This study aimed to produce soy protein isolate and glycinin nanoparticles using High Intensity Ultrasonic. The obtained nanoparticles were characterized by TEM, FTIR, Zeta potential, XRD and particle size distribution and hydrophobicity, as well as by their functional properties such as water holding capacity, oil holding capacity, emulsifying properties and protein solubility. Also, the utilization of these nano proteins in production of some food products such as beef burger, mayonnaise and apple chips and study the functional characteristics of these products during storage were investigated.

The protein content in the soybean protein isolate was 90.4%, while it was 91.3 % in glycinin. Soy protein isolate and glycinin were subjected to ultrasonic treatment at 25 ± 2 °C, frequency 400 watt for 50 min to produce nano particles. The results of particle size distribution showed a poly dispersion index for soybean protein isolate, nano soy protein, glycinin and nano glycinin in the range of 0.462, 0.414, 0.79 and 0.567, respectively.

Zeta potential showed a difference in the charge on soybean protein molecules after treatment with ultrasonication. The values were (-27.3), (-34.3), (-25.1) and (-25.5) for soy protein, nano soybean protein, glycinin and nano glycinin, respectively. There were no changes in the pH for NSPI and NGLY supplemented burgers. These results may be as a result of water and oil binding properties of nano proteins as shown in results of water and oil holding capacity of treated and non-treated proteins. X-ray diffraction showed a decrease in 2θ from 20.8° for SPI to 19.8° for NSPI, while 2θ of NGLY was increased from 19.7 °for GLY to 19.9°

The samples of the processed burger using nano soybean protein isolate and nano glycinin showed high quality attributes. Addition of nano soybean protein to the batter of beef burger reduced the cooking loss as a result of better blending of nano SPI and glycinin particles with meat protein increasing its ability to retain water and fat structure. An increase in the percentage of cooking loss after 3 months of freezing storage occurred as a result of the formation of ice crystals in the burger and also reducing its ability to retain water and therefore low cooking characteristics of the burger.

Incorporation of nano soy protein isolate and glycinin in mayonnaise formula, resulted in a slight decrease in pH-values after 3 months of frozen storage compared with control samples. On the other side, nano soy protein particles produced mayonnaise with compacter size distribution, more viscous emulsion with higher values for consistency coefficient and yield stress which improving its use as salad dressing.

The best sensory acceptance of mayonnaise was for both samples containing soybean protein nano particles and nano glycinin protein when replacing 0.5% of the nano protein as an emulsifier substitute for 50% of egg yolk compared with other tested samples

Application of SPI and GLY nano particles in coating of apple chips produced dry products with better values of color attributes (L, a and b), lower values of browning index, lower equilibrium moisture content under different water activity (relative humidity) values of storage and increased mono-layer moisture content compared with the control or normal SPI and GLY coated samples. These values give indicator for better stability of NSPI and NGLY coated dried apple chips during storage.

Key Words: Soy protein isolates, glycinin, nanotechnology, beef burger, apple chips and mayonnaise.

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