Nano-mechanical characterisation of pea protein shell encapsulates produced via ultrasound

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Microcapsules produced via a one-step ultrasonic method are of particular interest in industry due to the simplicity of production of these capsules, and can be used in the food and personal care products. Our study investigated the ultrasound synthesis of microcapsules consisting of a pea protein isolate shell and a tetradecane core using high intensity ultrasonication at 20 kHz to form the m emulsion and crosslink the shell. The pea protein isolate was denatured via sonication in either PBS buffer at pH 7.4 or Tris/HCl buffer at pH 8. It was found that the sonication increased the solubility of the pea protein, which was confirmed by the sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) analysis. This analysis also showed that the increase in solubility due to using Tris instead of PBS stems from PBS indiscriminately shielding the exposed charged groups in the proteins, and preventing charged interactions and hydrogen bonding.

The microcapsules made from the denatured pea proteins were compressed using Atomic Force Microscopy (AFM) and analyzing the force spectra via Reissner's model. This showed that the strongest capsules were made with the Tris buffer, with a stiffness ranging from 9.9 to 18.2 mN/m, and a Young's modulus of 1.19 to 2.35MPa. The weaker PBS buffered capsules became weaker as further denaturation occurred as expected from our mechanism, with stiffness ranging from 9.5 to 22nN/M and Young's modulus ranging from 1.2 to 0.58MPa. The PBS produced thicker shells of the same stiffness. The shells were also tested for their stability, where both systems were stable for 1 month at 4°C.