

Applications of High Intensity Ultrasound to Modify Millet Protein Concentrate Functionality

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Abstract : Millets as a new source of plant protein were not used in food applications due to its poor functional properties. In this study, the effect of high intensity ultrasound (frequency: 20 kHz, with contentious flow) (US) in 100% amplitude for varying times (5, 12.5, and 20 min) on solubility, emulsifying activity index (EAI), emulsion stability (ES), foaming capacity (FC), and foaming stability (FS) of millet protein concentrate (MPC) were evaluated. In addition, the structural properties of best treatments such as molecular weight and surface charge were compared with the control sample to prove the US effect. The US treatments significantly ($P < 0.05$) increased the solubility of the native MPC (65.8%±0.6%) at all sonicated times with the maximum solubility that is recorded at 12.5 min treatment (96.9%±0.82 %). The FC of MPC was also significantly affected by the US treatment. Increase in sonicated time up to 12.5 min significantly increased the FC of native MPC (271.03±4.51 ml), but higher increase reduced it significantly. Minimal improvements were observed in the FS of all sonicated MPC compared to the native MPC. Sonicated time for 12.5 min affected the EAI and ES of the native MPC more markedly than 5 and 20 min that may be attributed to higher increase in proteins tendency to adsorption at the oil and water interfaces after the US treatment at this time. SDS-PAGE analysis showed changes in the molecular weight of MPC that attributed to shearing forces created by cavitation phenomenon. Also, this phenomenon caused an increase in the exposure of more amino acids with negative charge in the surface of US treated MPC, that was demonstrated by Zetasizer data. High intensity ultrasound, as a green technology, can significantly increase the functional properties of MPC and can make this usable for food applications.

Keywords : functional properties, high intensity ultrasound, millet protein concentrate, structural properties

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