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Heat-induced changes in physiochemical properties of coconut proteins in skimmed coconut milk

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Abstract

Coconut milk is a source of plant-based proteins, increasingly processed to form vegan-products. Heat treatments used during processing are likely to denature coconut proteins, leading to changes in their physiochemical properties that, in turn, affect the processing of coconut milk. A better understanding of heat-impacted changes in coconut milk proteins is crucial. Past research is largely restricted to studies of heat-induced behaviour of whole coconut milk that reflect the collective behaviour of proteins and fat during heating. Limited studies available on coconut protein denaturation have also been conducted using chemically extracted coconut proteins, which may have changed their conformation during extraction. Therefore, in this study, fat-depleted skimmed coconut milk (SCM) with 4.49% protein, 0.10% fat and 96.92% water was first produced using centrifugation to maintain the native protein structure. Then SCM was heat-treated in the range of 85 - 115^{o}C for 15 min using an oil bath. Visual observations revealed an increase in turbidity from 85^{o}C to 93^{o}C and from 100^{o}C to 105^{o}C, followed by aggregate formation at 95^{o}C and 110^{o}C, suggesting protein unfolding and aggregation. Bradford assay results showed a significant ($p<0.05$) reduction in protein solubility at elevated temperatures with two minima observed at 95^{o}C (46.65% solubility) and 110^{o}C (78.67% solubility) where aggregates formed. All thermal treatments significantly ($p<0.05$) increased the viscosity of SCM compared to that at room temperature (1.338 ± 0.003 mPa.s), with a maximum (1.622 ± 0.002 mPa.s) reported at 85^{o}C and two minima reported at 95^{o}C (1.369 ± 0.003 mPa.s) and 110^{o}C (1.347 ± 0.008 mPa.s). This study suggests that heat denaturation of coconut proteins indeed imparts physiochemical changes in SCM. The insights gained from this study will help manipulate operating conditions during coconut milk processing to obtain milk streams with desirable physiochemical attributes.

Keywords: Centrifugation, Coconut Protein, Heat treatment, Solubility, Viscosity

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