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Rheological Properties of African Yam Bean (*Sphenostylis stenocarpa* Hochst. Ex A. Rich.) calcium proteinate and isoelectric protein isolates

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Abstract

The rheological characterizations of African yam bean (*Sphenostylis stenocarpa*) protein dispersions were investigated. Isoelectrically precipitated protein-IP_{alk} and IP_{salt} isolates obtained from alkaline and salt extractions respectively were more soluble than calcium precipitated proteins (CaP_{alk} and CaP_{salt}) at pH 3, 7 and 8. Regression analysis showed that Power law, Casson and Bingham rheological models adequately described rheological behaviors of *S. stenocarpa* protein dispersion. However, Power law gave the best fit. The flow behavior indices (*n*), at different ionic strength, pH, and temperature media were less than unity, indicating that *S. stenocarpa* protein dispersion exhibited pseudoplastic behaviors under the conditions tested. Salt extracted proteins were more pseudoplastic than alkali extracted counterpart with *n* for salt extracted proteins (IP_{salt} & CaP_{salt}) lower than that of alkali extracted protein (CaP_{alk} & CaP_{salt}). This is a numerical indication that salt extracted *S. stenocarpa* proteins were of larger shear-thinning tendency than the alkali extracted proteins. The consistency coefficients, *k* of isoelectrically precipitated protein (0.305–0.327 Pas^n) were significantly ($P < 0.05$) higher than that of calcium proteinates in the range ranged 0.167–0.180 Pas^n. Both isoelectrically precipitated proteins and calcium proteinates exhibited yield stress, however, isoelectrically precipitated *S. stenocarpa* protein exhibited significantly ($P < 0.05$) higher yield stress (0.275–0.308 Pa) than the calcium proteinates (0.148–0.165 Pa). The effect of temperature on apparent viscosity of the proteins was evaluated using an Arrhenius-type equation. The activation energies (E_a) obtained were in the range 33–51.2 and 42.6–55.5 $Jmol^{-1}$ for calcium proteinate and isoelectrically precipitated protein respectively.

Keywords: *S. stenocarpa*; Electrophoresis; Apparent viscosity; Flow behavior; Consistency index; Yield stress