Factors affecting the viscosity increase of soymilk by two-step heating

SHIMOYAMADA M. (1), KONDA R. (1), YOSHIDA Y. (1), MURAKAMI K. (1), MATSUNO M. (1,2), EGUSA S. (3)
1 University of Shizuoka, Shizuoka, Japan
2 Industrial Research Institute of Shizuoka Prefecture, Shizuoka, Japan
3 Marusan-ai Co. Ltd., Okazaki, Japan

Objective: Two-step heating (75 and 95 °C) of raw soymilk has been reported to increase the viscosity of heated soymilk and produce harder tofu. We would estimate effect of heating rate, solids content on the viscosity increase. Furthermore, the role of two main globulins, namely, 7S (beta-conglycinin) and 11S (glycinin) in two-step heating would be compared by using 7S rich and 11S rich soybeans.
Methods: Three varieties of soybeans were used in the preparation of raw soy milk: a variety containing both 7S and 11S globulins (Fukuyutaka), another one containing mainly 7S (7S rich), and the other containing mainly 11S (11S rich). The raw soymilk was heated to 80 °C as the first step and 95 °C as the second step by Ohmic heating. Viscosity of soymilk was measured with a tuning fork vibro viscometer. Surface hydrophobicity was measured by fluorescence of ANS. Protein particle content was estimated by measuring the protein concentration in the supernatant after ultracentrifugation (160,000×g, 30 min).
Results: In the case of Fukuyutaka soymilk, thicker soymilk and slower heating rate were effective in increasing the viscosity of the soymilk by two-step heating. The higher protein concentration and slower heating were considered to be associated with the greater interaction among proteins and/or oil bodies. Two-step heating enhanced the formation of protein particles, however, there was little change in surface hydrophobicity, which indicates degree of denaturation. The increase in viscosity of 7S rich soymilk was smaller than that of Fukuyutaka soymilk. Protein particles did not increase in the soymilk samples derived from 7S rich and 11S rich varieties by two-step heating, unlike Fukuyutaka soymilk.
Conclusion: The increase in viscosity of soymilk prepared by two-step heating may be related to the formation of protein particles. In addition, both 7S and 11S globulins appeared to be required for the effect of two-step heating of soymilk.