

Assessment of radio frequency heating on composition, microstructure, flowability and rehydration characteristics of milk powder

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Short title: Radio frequency heating affected properties of milk powder

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Abstract: Radio frequency heating (**RFH**) provides higher efficiency and more uniform heating zone compared with conventional method, and is potentially used in post-process lethality for milk

powder. The aim of present work was to evaluate the effect of RFH (at 90°C for 5 or 10min) on changes of compositions (protein oxidation and fat distribution), microstructures, flow characteristics and rehydration properties (contact angle, conductivity, moisture sorption isotherms and solubility) of infant milk powder. The results indicated that the concentration of protein dityrosine was enhanced, more free fat appeared on powder surfaces, and porosity in powder matrix was increased after RFH treatment. Raw milk powder had low cohesiveness (specific energy=4.39 mJ/g), and RFH provided better flowability reflected by higher values of flow function; while the compressibility of milk powder decreased. Moreover, RFH had negative impact on contact angle, slow-dissolving rate, and solubility of powder particles, indicating slightly worse rehydration abilities. Moreover, Guggenheim-Anderson-de Boer (**GAB**) model was applied to fit moisture vapor sorption isotherms, and only the c constant showed obviously differences with longer RFH duration leading to higher c values (about 63% increase at 10 min). In addition, the RFH initiated browning reaction considering CIE $L^* a^* b^*$ values. Briefly, it was critical to evaluate the influence of RFH treatment temperature and duration on bulk characteristics of milk powder when applied in post sterilization in dairy industry.

Keywords: radio frequency heating, infant milk powder, microstructure, powder flowability, powder rehydration