Production of fat-based emulsion powder by prilling process using twin-fluid atomizer for controlled release of iron

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Abstract

Encapsulation of iron is necessary to supply bioavailable iron to large number of population possess iron deficiency. In the present study, we dispersed the iron solution in a fat matrix of palm stearin, and prepared the simple emulsion (water-in-oil) at $60\,^{\circ}\mathrm{C}$, where fat was a continuous phase. Using that emulsion, we produced fat based emulsion particles through prilling (spray + chilling) process using twin fluid atomizers (internal mixing). We characterized the particle in terms of size and size distribution, and investigated the internal structure of the fat-particles by cryogenic scanning electron microscopy (cryo-SEM) for observing the distribution or homogeneity of dispersed phase. Present study includes mainly the iron release kinetics through the fat matrix of the emulsion particle in an in-vitro gastric system ($pH \approx 2.0$) as a function of (a) particle size of prills, (b) thickener concentration (polyethylene glycol, PEG) in dispersed phase, (c) droplet size of dispersed phase, (d) mixing properties (Reynolds number, *Re*), and (e) shelf-life of particles. The release kinetics was explained by the second order kinetics, where we estimated the release kinetic constant, and co-related with the viscosity ratio of dispersed phase to continuous phase, mean particle size of emulsion, and shelf-life of particles. The result showed that the control of the release properties can be obtained by choosing particle size and thickener concentration.

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