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Redness generation via Maillard reactions of whey protein isolate (WPI) and ascorbic acid (vitamin C) in spray-dried powders

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Abstract: Obvious redness generation has been observed in storage and processing for spray-dried WPI-ascorbic acid powders. The lower limit of detection by human observation is 0.001 g/mL for the concentration of ascorbic acid (AA:WPI ratio of 1:100). The redness is related to the adsorption of violet light (380 nm) and blue/green light (500 nm). Fluorescence analysis suggests the formation of formyl threosyl pyrroles and crosslinked poly(amino acids). DSC analysis shows that ascorbic acid peaks disappear as the Maillard reaction progress. The storage temperature has been found to significantly affect the Maillard reactions between WPI and ascorbic acid. Results show that the Maillard reaction rates between WPI and ascorbic acid are fast in spray-dried powders even at 20 ^{o}C. The formulated infant/baby milk powders on the market are suggested to require low temperatures (4 ^{o}C) or low oxygen (N_2 atmosphere) storage to reduce the extents of Maillard reactions (redness generation).

Keywords: Maillard reaction; redness generation; whey protein isolate; ascorbic acid; spray drying