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What Does WPNI Tell Me and How Does it Compare with Other Test Methods?

Description

The Whey Protein Nitrogen Index (WPNI) is an analytical method that was originally developed (Harland and Ashworth, 1949) and subsequently modified (Kuramoto et. al., 1959) has been used to provide an indication of the extent of denaturation of whey proteins resulting from heat treatments in the manufacture of milk powders. The method is a relatively simple turbidometric method that estimates the amount of undenatured whey protein nitrogen (milligrams) per gram of milk powder (American Dairy Products Institute, 2016). It has been widely adopted by the dairy industry for the heat classification of milk powders into low (WPNI > 6.0), medium (WPNI between 1.51 – 5.99) and high heat milk powders (WPNI < 1.5).

Limitations

While the method has been useful it is not without its limitations. The WPNI value may be influenced by variations in the concentration of individual whey proteins and non-protein nitrogen content associated with seasonal variations in milk composition and the variation in the absolute protein content of the milk powder (Sikand and Tong, 2008). It has been shown that simply downward standardizing a high protein skim milk powder with milk permeate can alter the classification of a milk powder from low heat to medium heat. Conversely, this suggests that standardized milk powders with low protein content may be difficult to produce with a low heat classification. In addition, the development of turbidity is sometimes unstable and variable with pH. Sanderson (1970) modified the method using amido-black dye that minimized the variation in WPNI contributed by variations in non-protein nitrogen and resulted in better reproducibility provided protocols were carefully followed.

Because of these limitation and advances in analytical techniques, alternatives to the WPNI have been evaluated (Patel, 2007). Fourier Transform Near Infra-Red spectroscopy (FT-IR), one dimensional and two dimensional electrophoretic analyses have been shown to provide useful information on degree of undenatured whey protein content of milk powders with various heat treatments. In particular, the FT-IR provided a rapid method for predicting the WPNI value of milk powders when accurately calibrated.

Conclusions

Despite some valid criticisms of the WPNI method, it remains a key basis for the marketing of milk powders. As a result, other methods that have certain to measure whey protein denaturation must show good correlation to WPNI, be relatively simple and rapid in order to gain consideration for commerce.

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