A Spectrophotometric Method for the Detection of Cheese Whey in Milk

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A spectrophotometric method for the detection of cheese whey in milk is described. The method is based on the colour reaction of sialic acid bound to the glycomacropeptide (GMP) - a marker peptide of cheese whey. In this method, GMP present in adulterated milk is first selectively precipitated by employing double precipitation method, wherein, trichloroacetic acid (TCA) concentration in milk is first raised to 8% to precipitate all the major proteins from milk followed by raising the TCA concentration to 14% to precipitate out GMP. The sialic acid in washed GMP precipitates was reacted with acidic ninhydrin reagent which gave yellowish-brown colour (maxima 470 nm), the intensity of which increases with the increase in the level of cheese whey in milk. The reagent blank as well as control milk sample (unadulterated milk) also gave faint yellow colour with OD values of 0.004±0.002 and 0.032±0.01, respectively. The method can detect presence of 10% cheese whey in milk where OD value increased to 0.1±0.01. The method was validated in milk samples added with different levels of cheese whey.

Keywords: Glycomacropeptide; GMP; sialic acid; cheese whey; milk adulteration, ninhydrin

INTRODUCTION

Milk is one of the products which can be adulterated in many ways affecting the quality of further dairy products. Addition of rennet whey from cheese production is one of the many frauds in liquid milk and milk products such as dried milk (Chavez et al., 2008; Martin-Hernandez et al., 2009). Adulteration of liquid or dehydrated milk by adding cheese whey is economically attractive because the cheese whey cost is four to five times lower than milk and does not adversely affect the sensory perception of the product by consumers. Due to its lower cost and assumed comparable functional and nutritional properties and freedom from objectionable flavour, cheese whey is an appealing alternative ingredient for adulteration of milk. However, this adulteration may give rise to important quality problems in finished products and incurs financial losses (Martin-Hernandez et al., 2009) and has nutritional & legal implications (Alcazar et al., 2000). The another reason for the adulteration of milk and milk products with cheese whey could be to its high BOD load and thus posing problems in its disposal. Milk processor industries and distributors of many countries have reported the problem of milk adulteration with cheese whey.

Different methods were developed to detect fraudulent addition of rennet whey to milk and milk products and Table 1 lists the detection methods available. The developed methods can be broadly categorized into two different groups. One group consists of the methods based on the compositional difference between rennet whey and milk (non-GMP based methods). The other group of methods which are mainly based on the presence of glycomacropeptide (GMP) in the suspected samples are GMP-based methods. Ninhydrin assays are extensively used in studies on the formation, isolation, and characterization of so-called free ninhydrin-positive compounds from plant, bacteria, animal, and human sources (Friedman, 2004). One of the compound which gives colour reaction with ninhydrin under acidic conditions is sialic acid (Yao et al., 1992; Friedman, 2004). Fukuda et al. (2004) adapted a technique described earlier by Yao et al. (1989) wherein acidic ninhydrin was used as a chromophor for the determination of the concentration of sialic acid in sialoglycoprotein and proposed a spectrophotometric method for quantitative determination of sialic acid; free, or linked to the glycoprotein in fluid milk and

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