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Dielectric behavior of adulterated milk with urea and water

Kongshuang Zhao*, Yuan Liu, Qi Zhang

College of Chemistry, Beijing Normal University, Beijing, 100875, China

(Phone: +86-010-58805856 ; Email address: zhaoks@bnu.edu.cn)

Abstract: Milk adulteration, especially by adding urea, is one of the major health concerns. In this work, we report a dielectric methodology to detect the existence of polar adulteration like urea and water in milk. The microwave dielectric spectra of whole milk, skim milk and their mixture with varying contents of water or urea was measured. An obvious dielectric relaxation was observed for these systems. The dielectric relaxations were well represented by the superposition of two relaxation processes which are attributable to free water and water adsorbed on protein, urea-water co-clusters and urea-water co-clusters adsorbed on protein for both milk-water systems, urea aqueous solution and both urea-milk systems respectively. The relaxation of lower frequency was identified as the dipole orientation polarization of water or urea-water co-clusters adsorbed on protein in milk mixtures. Significant differences in dielectric parameters, relaxation time and relaxation strength, between these systems were analyzed by comparing between skim and whole milk with different water contents and among water, skim and whole milk with different urea contents. The results show that microwave dielectric spectroscopy may provide a way or a choice for monitoring of water and urea in adulterated milk.

Keywords: milk; dielectric spectroscopy; urea; quality assessment

Practical Application: This work effort describes the influence of water and urea on dielectric property of milk by dielectric relaxation spectroscopy. It may be helpful to the application of dielectric spectroscopy method to detect milk adulteration.

1. Introduction

Milk is an essential component of a healthy diet for all age groups because it contains fat, protein, and mineral, which are the major elements required for growth.[1] Moreover, dairy products as a major food on dining tables also make from milk. Therefore, the assessment of milk quality is of critical importance. Protein and fat contents in milk are important quality parameters that characterize its nutritional value. To some extent, their content determines the value of the milk for payment. Accordingly, in order to obtain more profit, dishonest seller or/and some farmers would adulterate milk with urea or water to increase its protein content or its volume.[2-5] However, milk adulteration not only reduces its nutritive value but also harms consumers, what is more, it may lead to devastating diseases.[6]

Several conventional chemical methods have been developed for detecting the contents of fat, protein and urea in milk.[7-10] In recent years, some physical means

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