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Application of optical and positron spectroscopy to structure transformation study in milk fat and its simple purified fractions

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Structure transformations from amorphous to crystalline state in milk fat as well as its simple purified fractions have been studied using optical and positron spectroscopy. The crystallization of amorphous fat results in appearance of a high-intensity peak in its luminescence spectrum. Transmission and luminescence excitation spectra have been also studied at different temperatures.

Методами оптической и позитронной спектроскопии исследованы структурные переходы молочного жира и его простых фракций из аморфного в кристаллическое состояние. Кристаллизация аморфного жира приводит к появлению интенсивного пика в спектре его люминесценции. Исследованы спектры пропускания и возбуждения люминесценции жира и его фракций при различных температурах.

Long chain compounds, such as milk fat (MF), contain various fractions, which can occurred in different crystal forms, a phenomenon is known as polymorphism. The polymorphic forms of these fractions differ in a number of properties, including melting points and stability. The crystal size and shape in a fat is related to its polymorphic state [1].

The triglyceride MF molecule is formed by three molecules of different fat acids connected to glycerol one and looks like a tuning fork manifesting an anisotropy in physical properties. These molecules have methyl groups at the ends of fat acid chains and exhibit strong interatomic bonds inside the molecules and relatively weak Van der Waals type bonds between them. Between the nearest terminating CH_3 groups, the crystalline structure defects, i. e. pores, can exist in MF due to different lengths of the acid chains. Most data on the polymorphism of long chain compounds has been obtained by studying simple purified substances. The natural fat often contains a wide variety of glycerides differing in chain length and unsaturation degrees of their fatty acid components. The polymorphic behaviour of such complex mixtures is often not easy explained in terms of one or more of their major components.

The method used most widely to study lipid polymorphism is X-ray diffraction. There are other well-known methods, such as low-temperature infrared spectroscopy, differential scanning calorimetry, microscopy, and thermal analysis, are also employed. Photoluminescence spectroscopy is a rather sensitive tool for studying the optical properties of solids which depend on