THERMAL PROPERTIES OF SOME FATS USED IN FOOD PRODUCTS

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We studied: coconut oil, spermacetite, palmitic oil, stearin, cocoa oil by thermal analysis method. As a result of tests conducted on a derivatograph and a calorimeter, their melting temperatures and specific heat of melting were determined.

Food products of vegetable and animal origin, which contain important and necessary substances, usually undergo special preparation before consumption. Thermal analysis allows us to study the physical and chemical effects that occur during the normal food processing cycle and are associated with temperature changes such as boiling, freezing and drying. A deep understanding of these processes is of great importance for the food industry.

Initially, thermal analysis was used as a standard method to study polymers. However, practice has shown that it is excellent for testing food products and their ingredients. In recent years, effective methods and technologies have been developed to test food products, including proteins, carbohydrates, fats, oils and packaging materials.

Fats, along with proteins and carbohydrates, are one of the main components of food, due to their nutritional value and the role they play in the body's physiological processes. Fats are the main energy fuel of our body. When "burning" 1 kg of fat, the body produces about 38 kJ of heat, and when burning 1 kg of carbohydrate or protein, about 17 kJ of heat. Fats of vegetable and animal origin are used with certain regularity in the production of this or that food product. In order to determine the quality of these products and to identify fats, thermal analysis is used. Their content is an important parameter in food processing and finished product evaluation.

Changes in properties that can be used to determine the natural composition of the fat phase of butter. In order to increase the biological value of butter food, fats of vegetable origin are used, in which solid fats such as coconut, palmitine and others can be used for replacement.

We studied: coconut oil, palmitoleic oil, stearin, cocoa butter, because they are often used as a cheap component in combined fats and butters.

Fig. 1 Palm oil.

Recently, palm oil is especially used in edible fats (Fig. 1). It contains both saturated fatty acids (primarily palmitic acid) and unsaturated fatty acids. The ratio of unsaturated and saturated fats is twice as high compared to butter. Its composition of unsaturated fats is very similar to olive oil and, therefore, it has similar positive effects on the human body. Bioavailability is high. Cholesterol content is minimal. Like other vegetable oils, palm oil does not contain trans fats (a type of unsaturated fat that is in the so-called trans configuration). It is known that naturally trans fats are formed as a result of the action of bacteria in the stomach of mammals, they are found in the amount of 5-8% in meat and dairy products. A large amount of trans fats increases the risk of cardiovascular and oncological diseases.

It is possible to get trans fats in vegetable products only when the liquid fat (oil) is hydrogenated, i.e. converted into a solid state (which is often necessary in the food industry). Palm oil has a high melting point and has a semi-solid consistency from the beginning. This is due to the content of palmitic acid in it, the presence of which is typical for the composition of animal fats. It is this fatty acid that is the "culprit" in the fact that the fat does not flow. Due to this property, palm oil does not need artificial hardening, as, for example, sunflower oil, therefore, it does not contain trans fats. What is of great importance in food technology. If ordinary oil is used to create ready-made food, it is hydrogenated, thereby hardening it, but in this process the trans fats mentioned above are created, which is very undesirable. It is also worth noting that the shelf life of confectionery products increases when using palm oil. Coconut fat is obtained from freshly prepared dill, it has a pleasant taste, it turns white after refining and is used as food, making margarine or confectionery fat. Certain vegetable fats also contain alkaloids, essential oils, and others, which account for their toxic or medicinal properties.

The melting process of vegetable fats takes place in a wide temperature range (35-38□C). First, the relatively easy-to-melt components of the solid phase melt. Then, the melting process at a higher temperature consists in the successive opening of the crystals, which have a higher melting temperature, mixed with the already melted fatty phase.

The melting character of the fat phase, which is separated from combined fats, is very different from both natural fats and fats of vegetable origin, which allows us to characterize the milk fat thermogram as an individual characteristic, using which we can make conclusions about the naturalness of the fat. fig. [1,3] shows the DTA curves of some vegetable fats. Thermal effects of milk fat and palm fat fall out of the identification zone when the mass fraction of the latter is more than 10%, i.e. At such a concentration, it is possible to detect an addition of palm oil to any other milk fat. The DTA method is useful for quality control of combined fats. Changes in properties that can be used to determine the natural composition of the fat phase of butter. In order to increase the biological value of butter food, fats of vegetable origin are used, in which solid fats such as coconut, palmitine and others can be used for replacement.

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The melting process of coconut, spermaceti, stearin, cocoa and palm fat has been studied by thermal and calorimetric studies. Coconut fat is obtained by refining, after which it is white in color and becomes transparent when heated to 400C. Its main fatty acids are palmitic, stearin, olein. Cocoa fat differs in its consistency from all other fats, it is yellow in color when freshly obtained, it has the smell and taste of cocoa. It is polymorphic under different conditions. Fig. [1,3] shows DTA curves of melting of coconut and spermatozoa, and fig. [2,4] shows coconut. DSC curves of spermaceti.

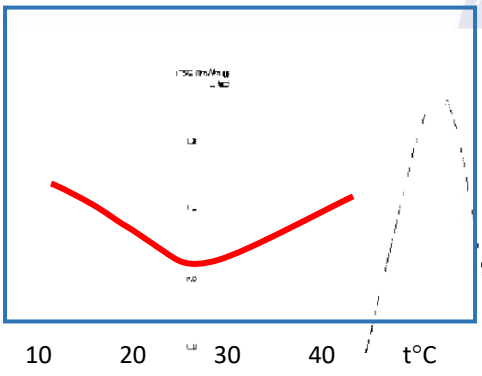

Fig. 1. Melting DTA curve of coconut fat

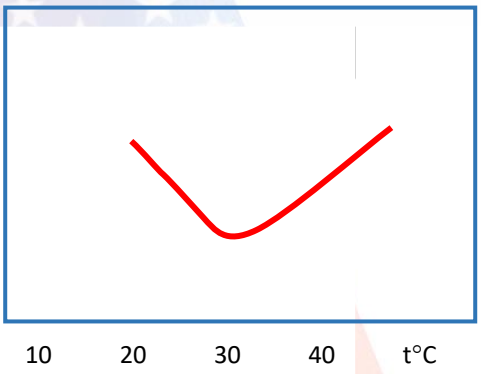

Fig. 3. DTA curve of spermaceti melting

Thus, as a result of tests carried out on a derivatograph and a calorimeter, it was determined that stearin melts at 60C, the specific heat of melting is equal to 194.4 J/g. Spermacet – 30 □C, specific heat of melting equal to 28.67 J/g, cocoa fat – 70 □C, specific heat of melting equal to 193.4 J/g. Coconut oil at 25 □C, specific heat of fusion is equal to 107.9 J/g, palm fat at 37 □C, specific heat of fusion is equal to 140.5 J/g.

References

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2. Thermal Analysis, Compendium of Terminology, RSC Books, Jan 27, 2023. Royal Society of Chemistry.