Whipped creams

Whipped creams are widely used for cooking in households and in the catering sector, especially for desserts and cake decorations. The whipped creams may be in the form of dairy whipping cream or imitation whipping cream. Dairy whipping cream with above 35% fat is the original product; however, nowadays creams based on vegetable fat are commonly seen. These vegetable fat based products are called e.g. imitation creams, non dairy creams, topping creams or confectionery creams.

The whippability of dairy whipping cream depends on the fat content as well as on the fat globule structure. The fat content should be above 35%, as dairy creams with lower fat contents do not whip into a stable foam. Further, the original fat globule structure should be maintained, meaning that the cream, in contradiction to most other dairy products, are not homogenized. If high shear is applied during processing the whippability is diminished, which can, however, be re-established by application of emulsifiers.

There are several advantages of using imitation whipping cream compared to dairy whipping cream.

- Products with a fat content down to 20% can be whipped into a firm foam meaning that healthier products may be developed.
- Imitation whipping creams are less sensible to overwhipping and consequently more flexible in use.
- Higher overrun can be obtained with imitation whipping cream compared to dairy whipping cream resulting in improved cost in use calculation.
- Vegetable fat is lower priced than butterfat also resulting in better cost in use calculation.
- Even though dairy proteins are commonly used in production of imitation whipping cream it is possible to produce 100% vegetable products avoiding allergens and supporting veganism.

Production of imitation whipping cream

Imitation whipping cream is a liquid oil in water emulsion, which is whipped into a stable foam. The foam is air bubbles dispersed in the serum phase stabilized by destabilized fat.

Imitation whipping cream normally contains vegetable fat, milk proteins, sweeteners, water and emulsifiers and stabilizers. The milk protein is often sodium caseinate as whey proteins tend to induce agglomeration in the liquid cream during storage. As the fatty acid composition of the vegetable fat tend to influence the viscosity of the liquid cream as well as the foam structure, firmness end eating properties, the manufacturer must ensure that the fat chosen is suitable for the application.

Likewise the choice of emulsifier and stabilizer has great importance for the quality of the cream. Emulsifiers and stabilizers are important in the formation of a stable liquid emulsion and in the whipping process for formation of a stable foam with a high overrun. This will be described in more details below.

Photos/Diagrams: Palsgaard

Manufacturing Delicious Imitation Whipping Creams

Over the past years imitation whipping creams have become increasingly popular due to a number of benefits, such as reduced fat content, better cost-in-use calculations and better foam stability which makes them easy to use and hence attractive bakers and caterers. However, producing successful imitation whipping creams requires not only the right fats but the right combination of emulsifiers and stabilizers. This article explains the science behind imitation whipped creams and the effect of the emulsifiers and stabilizers.

by Hanne K. Ludvigsen
Imitation whipping cream is commonly produced by means of the UHT-process as this ensures a long shelf life of the product. With the right choice of emulsifiers and stabilizers the cream may be stored at room temperature. The design of the UHT-plant should be downstream with 2 stage homogenization ensuring the formation of a stable emulsion.

**The effect of emulsifiers on imitation whipping cream**

Emulsifiers are surface active ingredients due to their hydrophilic-lipophilic properties. In competition with the proteins it locates in the interface between the oil droplets and the serum phase, or in the case of foam, in the air serum interface. Hereby it lowers the interfacial tension between two phases. Proteins and emulsifiers also interact altering the fat globule membrane and its emulsion stability and resistance towards mechanical interactions. The effect depends on the hydrophilic and lipophilic groups as well as the ionic properties.

The main functionality of emulsifiers in imitation cream is to destabilize the fat globule membrane covering the fat globules formed during homogenization of the cream. During storage of the liquid cream the proteins covering the fat globule are displaced by emulsifiers. Hereby agglomeration and partially coalescence of the fat globules is facilitated. This is important for the structure formation and air cell distribution formed during whipping. Further emulsifiers are important for the stability of the formed air cells i.e. the strength of the air cell walls.

For imitation whipping cream there is a conflict between formation of a stable liquid emulsion with good storage stability and an easy whippable emulsion with good foam stability. During whipping the fat globules need to be broken and release fat which then agglomerates and coats the air cells and thereby builds a stable foam skeleton.

In production of imitation whipping cream several types of emulsifiers are used in combination: Lactic acid esters of mono- and diglycerides (Lactem) improves the whippability and overrun of the product due to its α-tending properties. α-tending emulsifiers strengthen the foam skeleton due to increased fat agglomeration. Lactem is often used in combination with mono- and diglycerides. Mono- and diglycerides are added for their destabilizing effect on the emulsion improving the foam stiffness and stability, an effect increasing with increased iodine value of the emulsifier. The combination of the high fat content in the cream and the fat destabilizing effect of the added mono- and diglycerides, leads to increased viscosity in the cream, sometimes to an extent so that the liquid cream is becoming a paste which isn’t attractive for the consumer.

This viscosity increase may be inhibited by adding the more polar emulsifier lecithin, or an anionic emulsifier like diacetyl tartaric acid esters of mono- and diglycerides (Datem) or sodium stearoyl lactylate (SSL) acting as strong oil in water emulsifiers. They interact with proteins in the interphase by hydrophobic and electrostatic interactions forming an emulsifier/protein film. Hereby the negative net charge of the fat globules is increased and the emulsion stability increased. The increased emulsion stability counteracts the whipping properties, which is why a balance in the use of different emulsifiers is important.

**The effect of stabilizers on imitation whipping cream**

Emulsifiers are used in combination with stabilizers. Stabilizers are hydrocolloids which bind and immobilize water. In imitation cream stabilizers are working in water phase improving the emulsion stability in the liquid cream, improving the foam stiffness and preventing drainage in the whipped cream. By combining the emulsifiers and stabilizers in different levels imitation whipping creams with good piping definition but different body and mouth feel but can be produced.

At our application lab in Denmark creams were produced according to the following composition:

- 25% vegetable fat
- 0.8% sodium caseinate
- 10% sugar,
- 1% sorbitol
- 0.6% stabilizer – Palsgaard® Cream-Whip 415
- 1% emulsifier – respectively Palsgaard® CreamWhip 451 and Palsgaard® CreamWhip 440.

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CreamWhip 440 or Palsgaard® CreamWhip 451.

Both of the mentioned emulsifier blends include Lactem as the whipping agent. The cream was produced by means of UHT. After whipping in a Hobart whisper the hardness was analyzed in a TaXT2 texture analyzer.

From Figure 1 it can be seen that simply by changing the composition of emulsifier it is possible to influence the hardness of the foam giving the hardness/softness needed by the application or desired by the customers. This even at the same overrun in the cream as demonstrated in Figure 2.

From Figure 2 it is also evident that imitation creams with Palsgaard® CreamWhip 440 and Palsgaard® CreamWhip 451 have a good stability against overwhipping. After the maximum overrun is reached continuous whipping for 30 to 60 seconds won’t influence the overrun. This is an important parameter for employees in catering and bakeries as they are handling more tasks at the same time. Here flexibility is a must. It’s important also to notice that by changing the emulsifier composition e.g. by addition of polysorbate (PS) or mono- and diglycerides (MDG) it is possible to obtain the higher overrun and still have a good foam structure and stability – see Figures 3 and 4.

In Figure 4 results of the hardness analyzed by means of the TaXT2 texture analyzer are shown and it is evident that the measured hardness is at the same level for the standard and high overrun solution. This opens an opportunity for cost saving in e.g. bakeries.

**Protein free UHT imitation whipping creams**

Palsgaard® CreamWhip 440 and Palsgaard® CreamWhip 451 are applicable in imitation creams with protein in the water phase. However, sometimes a protein free product is requested either for nutritional or for technological reasons.

As the protein, when available, is an important functional ingredient in the emulsion formation and structure building, the types of emulsifiers and stabilizers have to be modified and other ingredients added in production of protein-free alternatives to obtain the same overrun and stability in the liquid cream as well as in the whipped product.

Palsgaard is now offering a solution for protein free whipping cream called Palsgaard® CreamWhip 453. This combined emulsifier and stabilizer solution makes it easy for the manufacturer to produce a high quality protein free UHT imitation whipping cream. The emulsifier uses polyglycerol esters of fatty acid (PGE) as the main emulsifier. PGE is a hydrophilic emulsifier improving whippability and foam stability of emulsions.

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