STUDY ON THE USE OF THICKENERS FOR OBTAINING LOW FAT MAYONNAISES

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Abstract
The paper presents the production process and technique of using a stabilizer used in the preparation of mayonnaises. In addition to the qualitative effect, respectively the improvement of the texture, this stabilizer also helps to reduce the fat content of the prepared mayonnaise. It also gives mayonnaise an increase in volume.A requirement difficult to fulfil faced by manufacturers of mayonnaise, is the need to imitate all the properties of products with normal fat content, in versions with low fat.The problem proposed to be solved in this paper is to get the stabilizer and achieve a recipe for mayonnaise with low fat content. There were obtained three stabilizers (S1, S2, S3) using hydrocolloids as xanthan gum, CMC and cellulose gum, samples from the firm Hercules; these stabilizers have provided behavioural traits and similar texture to the lipid components from the composition of the mayonnaise. With these stabilizers were obtained three samples of mayonnaise M1, M2, M3, which were compared with the control sample in terms of emulsifying capacity,of the fat content and of the volume.It was chosen the optimal mayonnaise (M2) using CMC as a stabilizer, which presented an aspect of ointment, creamy, shiny, homogeneously textured, elastic without tendencies of oil separation in time.

Key words: xanthan gum, carboxymethyl cellulose (CMC), cellulose gum

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1. INTRODUCTION

Hydrocolloids used in food industry that are also known as gums, are high molecular weight polymers, which have the properties of thickening, stabilization, forming of films and retaining water, and the gelling (Rasenescu, 1988; Garsia-Alonso, A., et al.1999).

Hydrocolloids presents three key roles:

- A structural role of water binding
- Serve the functions of the food, controlling and influencing the form, the texture, the water-binding capacity and all other sensory properties of foods;
- Have dietary functions, being sources of nutrients and dietary fiber;

We know two basic criteria in the classification of hydrocolloids: the chemical structure criteria and the origin of hydrocolloid criteria. (Rasenescu, 1988)

After the chemical structure criteria :

- ➢ polysaccharides (starch, cellulose, dextran, arabic acid and salts, pectic acid, pectin, galactose, alginic acid, alginates);
- ➢ polypeptides: proteins (gelatin, globin, casein, albumi);

After the origin criteria :

- ✓ natural hydrocolloids:
  - of vegetable origin (starch, xanthan, dextran, plant extracts, algae extracts)
  - of animal origin (gelatin, casein, albumin, etc);
- ✓ natural hydroacids modified: cellulose derivatives, starch derivatives, pectins;
- ✓ synthetic hydrocolloids: polymers of ethylene oxide (Parvu D., 1991; Dickinson E., 2009);

An important function of hydrocolloids represents their emulsifying capacity (Ionescu A., 1999).

Emulsifiers are used to form the emulsions. Mechanical dispersion of oil in water in the form of small spheres for the preparation of an emulsion requires an energy expenditure to defeat the forces of cohesion between molecules oil. The more the energy will be greater the dispersal will be more advanced. If an emulsifier is added, the emulsification is carried out more easily and separation occurs more slowly. This is explained by the fact that the two immiscible liquids have different superficial tensions. The emulsifier serves to reduce the superficial tension of the two liquid phases, thus facilitating the dispersion. Focusing on the interphase, the emulsifier forms a monomolecular layer around the dispersed particles protecting them from merging. Emulsifiers stabilize these emulsions and distribute the fat finely throughout the product. In the low-fat products, food additives are responsible for their pleasant quality similar to products with high fat content (Turabi E., et al., 2008). The emulsifiers function is therefore to facilitate dispersion of the internal phase in the external one and stabilize the emulsion. Emulsifiers action is achieved by: reducing interfacial tension (it facilitates dispersion); forming a layer around the particles (inhibits small particles that tend to merge); conferring an electric charge to the particles dispersed; increasing viscosity environment (Banu, 1999).

Emulsifiers that are frequently used in the food industry are purified natural products or synthetic chemicals with structures similar to those natural.

Emulsifiers used to getting mayonese: cellulose, carboxymethyl cellulose and methylcellulose.

Cellulose is a natural polyglucide, macromolecular consisting of rests of β-D-glucopiranose connected by links β-1,4 glycoside with molecular formula $(C_6H_{10}O_5)_n$ and degree of polymerisation n = 100 – 3000.

The layout of glycoside cycles in the macromolecule cellulose permits the formation of multiple hydrogen bonds between its macromolecules and water, gently hydrating and forming stable emulsions (Ashwini, et al., 2009).

Each glucose residue of the cellulose macromolecule has three free hydroxyl groups capable of being chemically transformed. The cellulose derivatives are obtained by esterification and eterification, some of which are soluble in water and therefore they can potentially be used as hydrocolloids.

The most important of these derivatives, present interest as hydrocolloids: sodium carboxymethylcellulose (Na-CMC), methylcellulose (MC), hydroxypropyl cellullose (HPC).

Sodium carboxymethylcellulose shows the ability to bind water, is hygroscopic, thereby enhancing the viscosity and stability of mayoneses, preventing their syneresis. Na-CMC is hydrolyzed by the microbial flora in contrast to cellulose which is metabolised; This makes the toxicity of the product to be reduced (Morris E.R., 1993)

The xanthan

Xanthan is a polysaccharide produced by anaerobic fermentation at pH=6-7,5 and at t=28-31^{0}C of glucose by the bacteria *Xantomonas campestris*, the culture medium containing a nitrogen source, K_2HPO_4 and other nutrients (Katzbauer B, 1998).

Xanthan shows similar basic structure to cellulose, to each second rest of glucose being attached two short chains that make xanthan be soluble in water (Sworn, 2009).

It is composed of: D-glucose (40%); D-manose (32%); glucuronic acid (22%) and pyruvic acid (41%), and the acetyl group is 2%. About 8% of the hydroxyl groups are acetylated form.

It forms viscous solutions even at low concentrations by solubilizing its rapid hot and cold water. The high viscosity of xanthan solutions, mixing at low speed, affords suspensions, emulsions and stable foams.

Xanthan presents synergistic effect in the presence of other agents of thickening. Thermoreversible gels are obtained in the presence of guar gum and locust gum. It can form flexible films, with greater cohesion, which is very important in obtaining emulsions and in stabilizing foams, and in the formation of protective films or encapsulation.

Xanthan is hydrolyzed in the gastrointestinal tract at a rate of 15%, being absorbed and metabolized to CO_2 without any accumulation in the tissues. The remaining xanthan is excreted in the faeces (Parvu D., 1991).

2. MATERIALS AND METHODS

To obtain mayonnaise were used as hydrocolloids: xanthan gum, CMC and cellulose gum (samples from the company Hercules), sunflower oil and chicken egg yolk.

To determine the ability of emulsifying was used the method to determine the ability of emulsifying the oil to the breaking of the emulsion and for determining the fat content the Soxhlet method was used.

The various stages of mayonnaise with low fat content:

Stage 1 : obtaining the stabilizer which should provide behavioral and texture characteristics that mimic those of the lipid composition of mayonnaise.

Procedure for making the stabilizer: 5 grams of xanthan and 2 grams of NaCl are disolved in 10 ml of cold water. The solution is heated to 60 ºC with continuous stirring until the solubilization. The solution was cooled to 40 ºC for gelling time that is added in the drop 23 ml sunflower oil (preheated at 80ºC), containing emulsification. It was obtained S_1.

Using the same procedure stabilizers S_2 and S_3 are made, using instead of xanthan CMC (carboxymethylcellulose) for S_2 and cellulose gum to S_3.

Stage 2: Obtaining mayoneses using stabilizers S_1, S_2, S_3.

With these stabilizers were prepared 3 mayonnaise (M_1,M_2,M_3) which were compared with the witness phase, according to the recipes in the tables 1-4.

Obtaining mayonese M_1

-it is dissolved in 10 g water : 23 g S_1 and 0,4 g NaCl while stirring and heating until 95º C.

-the mixture is cooled to a temperature of 40ºC

-is added in the drop 60 ml sunflower oil heated at 80 ° C.

-the mixture is emulsified to obtain a fine and stable emulsion.

-emulsion can be treated with vinegar from white wine, flavored wine, specific spices for mayonnaise, sugar, lemon salt, etc.

Mayoneses M_2 and M_3 are prepared after the same formula, using different amounts of oil according to the adapted recipes.

Table 1. Mayonnaise recipe witness

Name of materials	U.M	Quantity
Yolk	g	10,34
Mustard	g	10
Oil	ml	60

% fat = 94,70 % ; C.E. (PM) = 12,04; C.E.- emulsifying capacity

Table 2. Mayonnaise recipe M_1

Name of materials	U.M.	Quantity
Yolk	g	10,34
Mustard	g	10
Oil	ml	60
S_1	g	23

% fat= 91,02%; C.E. (M_1) = 14,70

Table 3. Mayonnaise recipe M_2

Name of materials	U.M.	Quantity
Yolk	G	10,34
Mustard	G	10
Oil	Ml	90
S_2	G	23

% fat = 90,7%; C.E. (M_2)= 103/ 4,98 = 20,68

Table 4. Mayonnaise recipe M_3

Name of materials	U.M.	Quantity
Yolk	G	10,34
Mustard	G	10
Oil	Ml	28
S_3	G	23

% fat= 80,3%; C.E. (M_3)= 7,22

3. RESULTS AND DISCUSSIONS

They compared the three samples of mayonnaise M_1, M_2, M_3 with the witness phase and the results were scored in the following table:

Table 5.Characteristics of mayonese M_1, M_2, M_3

Name	Cap. emuls.	% gr.	Vmayonese (ml)
Witness phase	12,04	94,70	54
M_1(xanthan)	14,70	91,02	95
M_2 (CMC)	20,68	90,7	130
M_3 (celulose gum)	7,22	80,3	67

Mayonese (M_1) prepared with S_1 shows an increase in the emulsifying capacity of 22.10%

as compared to the witness phase, a lower fat content with 3,88% as compared to the witness phase. It shows a reduced viscosity, while we noticed the appearance of a quantity of oil to the surface of the product.

Mayonese (M_2) prepared with S_2 shows an increase in the emulsifying capacity of 71,76% as compared to the witness phase, a lower fat content with 4,22% as compared to the witness phase and with 0,35% lower than M_1. It presents an aspect of ointment, creamy, shiny with a smooth texture, elastic, with no clear separation of oil over time.

Mayonese (M_3) prepared with S_3 shows a decrease in the emulsifying capacity of 43,02% as compared to the witness phase and a lower fat content with 24,07%. It presents a dense, viscous, sticky, unsuitable form, with oil separation tendencies.

In terms of volume of the 3 samples we found that M_2 shows an increase in volume of 140% as compared to the witness phase, with 36,84% compared to M_1 and with 94,02% compared to M_3.

Comparing the values obtained, the mayonnaise prepared with S_2 (using CMC) obtained the best values on emulsifying capacity, fat content and volume.

4. CONCLUSIONS

The thickeners used in the preparation of the 3 stabilizers (S_1, S_2, S_3) were emulsified yielding the corresponding 3 mayonnaise samples.

In addition to the qualitative effect, respectivly improving texture, these stabilizers helps to reduce the fat content of mayonnaise. as compared to the witness phase, these stabilizers also give mayonnaise an increase in volume.

A requirement difficult to fulfill that manufacturers of mayonnaise face is the need to imitate all the properties of products containing normal fat versions with low fat.

The products obtained must have the textural characteristics similar to those containing fat unreduced (Morris E.R., 1993).

Mayonnaise type products, with low fat, can be manufactured by means of stabilizing additives, necessary to reduce the fat content. These stabilizers are used to replace at least a part of the fonctions normally fulfilled by fat. They must give the desired performance characteristics, ie that mimics the functionality of the fat component of traditional mayonnaise; moreover they have to give mayonese an increase in volume and a corresponding fineness (Ionescu, 1999).

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