



INFLUENCE RATIO OF WATER AND OIL PHASE OF EMULSIONS ON VISCOSITY, PARTICLE SIZE AND TURBIDITY OF PRODUCTS

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Abstract: *The paper systematically describes the basic theoretical information about the improvements in the production of emulsions. We consider the theory of a stable emulsion system, namely the particular use of raw materials and their properties analyzed the conditions necessary for the process of homogenization. And based on this, a large number of existing theories determined the most effective, which is used for the production of emulsions. Much attention is paid to the use of different stabilizers receipt of test data required for the calculation formulas finished products, and technological design process of emulsions. To assign these methods using two stabilizers: resin acacia and modified starch, which when used for stability during storage of emulsions yield different results. Of great importance for the stability of these products is the size of the particles. The diameter of the emulsion depends on a process of manufacturing technology. More detail the process of homogenization of emulsions. For the features of this process are a few examples that will visually see the results emulsion stability during storage. Based on the processed foreign sources give modern technology and types of equipment for the homogenization process, with reference to the drawings, which will assimilate the information produced. We consider the design features of these devices, their advantages and disadvantages.*

Keywords: *emulsion, particle size, phase, stability, stabilizer*

1. Introduction

Some food, that are made using emulsions containing 1–1000 nm particle size and treated as objects of classical colloid chemistry.

Of great importance for the stability of these products is the size of the particles. In the case you known information about the particle size emulsion, you can control their stability and quality. It is known that the diameter of the emulsion depends on a process of manufacturing technology, the recipe emulsion. To prepare emulsions, is dispersion of one liquid in another, in practice, using mechanical means, which allow disperse phase.

There is a theory about the mechanism of emulsification [1]. The first stage of this process lies in the tension drops of liquid

dispersion in a field environment. Pulling drops in thread accompanied by an increase of the surface and flow of work to overcome the molecular forces of surface tension. This extended liquid drop becomes so unstable that spontaneously breaks into small spherical droplets. This is the second stage of the formation of emulsions, which is accompanied by a decrease in surface and spontaneous process. Then comes the next, third stage, when formed droplets on the one hand, coagulated in collisions, and the other - again stretching into smaller parts to equilibrium. The basis of increasing dispersion emulsion is spontaneous decay drops learned to unstable size [2–4].

Found that a stable, emulsions are closely associated with the mechanism of dispersion and depends on many factors,

such as oil content, type and concentration of emulsifier, the route of administration phases, time and intensity and degree of dispersion and temperature. Study of factors that ensure stability of emulsion, led to the conclusion that the critical degree of dispersion [5–9].

Experiments found that for each type of emulsifier has its own optimum concentration that provides the highest resistance obtained emulsions [7]. For an introduction to emulsify oils (for each concentration of emulsifier) is also optimum in which the most stable emulsion is obtained, that are determining the optimal ratio between the aqueous and oil phases. Excess oil in the emulsion is separation. Thus for each emulsifier is its optimum concentration, the corresponding amount of oil in the emulsion [8].

The optimum concentrations of emulsifiers for certain ratios of the phases in obtaining stable emulsions are not fixed and depend on the degree of dispersion. Using of high-

speed mixing, and especially increasing pressure homogenizer leads to increased dispersion, viscosity and the formation of more stable emulsions [9].

2. Materials and methods

The aim of the study particle size effects on the stability of emulsions during storage and use in the manufacture of beverages and their stability during 180 days. As materials for research prepared samples of emulsions with various stabilizers (gum arabic, modified starch). Stability of emulsions depends of viscosity, particle size, muddy turbidity depends on the ratio of water and oil phases.

For studies prepared 5 sample emulsions of varying oil phase and a constant number of Gum arabic (Table 1) and 5 samples emulsions of varying oil phase and constant number of starch as stabilizer (Table 2).

Table 1

Formulations of emulsion of varying oil phase and a constant number of gum arabic

The ingredients of the emulsion	Content ingredient, g/kg				
	Number of emulsion				
	1	2	3	4	5
Citrus oil	60	60	60	60	70
Rezynogum (E 445)	20	40	50	60	70
Gum arabic (E 414)	50	50	50	50	50
Citric acid (E 330)	5	5	5	5	5
Sodium benzoate (E211)	2.5	2.5	2.5	2.5	2.5
Water	862.5	842.5	832.5	822.5	802.5
Total	1000	1000	1000	1000	1000

Table 2

Formulations of emulsion of varying oil phase and constant number of starch

The ingredients of the emulsion	Content ingredient, g/kg				
	Number of emulsion				
	6	7	8	9	10
Citrus oil	40	50	55	60	70
Rezynogum (E 445)	40	50	55	60	70
Starch (E 1450)	120	120	120	120	120
Citric acid (E 330)	5	5	5	5	5
Sodium benzoate (E 211)	2.5	2.5	2.5	2.5	2.5
Water	792.5	772.5	762.5	752.5	732.5
Total	1000	1000	1000	1000	1000

Preparation of emulsions

1. Preparation of oil phase.

Weigh the required amount of flavor; add Esther scales in stirrer at room temperature until Esther scales completely dissolved.

2. Preparation of the aqueous phase.

a. Weigh the required amount of water into a glass and heated to 20-50 ° C.

b. Attach the required amount of sodium benzoate and completely dissolve. Add citric acid and dissolve completely.

c. Attach the required amount of stabilizer and dye solution in warm water (20-50°C).

d. *Stabilizer* mix and dissolve at a moderate speed mixer until it is completely dissolved. Subject the immediate hydration; leave for a few minutes for aeration.

3. Preparation of the pre- emulsion

For the *preparation of the pre-emulsion* use a high-speed mixer. Slowly adding the oil phase to the aqueous phase, and then stirred at maximum speed.

4. Preparation of the emulsion by homogenization.

Homogenization undergoing the parameters

a. Pressure is the first step / second step 200 /50 bar, two numbers of moves for emulsion with starch.

b. Pressure is the first step / second step 280 /40 bar, two numbers of moves for emulsion with gum arabic.

5. Measure turbidity, viscosity and average particle size of the emulsion.

Investigation of the stability of emulsions was carried out by determining the size of the diameter of the particles by laser granulometry and placement on the stability of soft drink, which was used emulsion for 180 days.

In the production of emulsions initially prepared aqueous and lipid phases, mixed them turbomixer and received pre-emulsion with particle size of about 3.0 microns.

In the next step, by homogenizing the emulsion obtained with particle size from 0.1 to 1.0 microns. During the preparation of the aqueous phase in water soluble all items that are part of this phase: stabilizers (gum arabic, modified starch), acid dyes, water soluble, preservatives, antioxidants (ascorbic acid). In practice, the most important stabilizer in the manufacture of emulsions for soft drinks are: gum arabic and modified starch. To protect the product from microbial spoilage used preservative sodium benzoate. Acidification lemon emulsion or malic acid to pH 4.0 bolsters preservative as well as a positive effect on the effective viscosity of the emulsion.

An important factor in the production of emulsions is a significant difference in density between oil and water. Essential oils have an average density of about 0.845 g/l, while the density of water is 1.0 g/l. It is therefore necessary to align low-density essential oil by adding substances that increase density. Substances that increase density are rezynogum.

3. Results and discussion

The results of measurement of each emulsion: Brookfield viscometer - viscosity microscope EASTCOLIGHT 92012-ES (100x, 250x, 550x, 750h) – particle size , muddy turbidity meter 2100P, lab aerometer - density, lab pH-meter – pH displayed in Table 3..

Analyzing the figures emulsions with different stabilizers characterized by an increase in the number of oil as a part of the product shows that increasing viscosity, density, particle size of emulsion and turbidity. By continuing other components of the emulsion, the smaller the particle size, the lower the turbidity of the emulsion (but higher storage stability).

Table 3

The results of measurement of the finished product

Number of emulsion	Viscosity Brookfield, cP	Turbidity dilution 0.025 %, NTU	The average diameter of the particles of oil D, μm	Density, g/cm^3	pH
1	14	168	0.505	1.03	2.7
2	15	180	0.659	1.06	3.2
3	16	192	0.705	1.07	3.3
4	17	216	0.903	1.09	3.7
5	18	240	1.101	1.1	3.9
6	20	143	0.67	1.03	2.6
7	22	156	0.73	1.05	3
8	23	170	0.75	1.07	3.3
9	24	182	0.84	1.09	3.65
10	26	196	0.97	1.1	4

If the particle size less than 1 micron, the emulsion is highly robust stability and gives some turbidity but less than 1 micron particle size, the less turbidity, if the particle size is not greater than 0.3 micron, the turbidity almost any clear solution.

The principle of leverage ratio of water and oil phase of emulsions with different stabilizers same. In the obtained parameters also affects the nature of emulsions stabilizer.

4. Conclusion

The best result of research in emulsions – is to obtain the maximum number of particles of about 1 micron.

Technology of preparation of emulsions with gum arabic is different from the technology of emulsifying starch.

Dissolve gum arabic is faster and easier than with the dissolution of starch as emulsion obtained using gum arabic, stable in quality and more expensive in value compared with emulsions prepared by using starch.

Different pressures for homogenization of emulsions with gum arabic and starch as the process of emulsification affects the nature of stabilizing.

The results of measurement of each emulsion: viscosity, particle size, muddy turbidity depends on the ratio of water and oil phases.

5. References

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