Kolesnichenko, Svetlana; Salavelis, Alla; Pavlovsky, Sergey et al.

Article

Development of innovative technology for sauce with lecithin

Reference: Kolesnichenko, Svetlana/Salavelis, Alla et. al. (2021). Development of innovative technology for sauce with lecithin. In: Technology audit and production reserves 4 (3/60), S. 50 - 53.
http://journals.uran.ua/tarp/article/download/238039/237432/547720.
doi:10.15587/2706-5448.2021.238039.

ISSN 2664-9969

UDC 664.647.1
DOI:10.15587/2706-5448.2021.238039
Article type «Reports on Research Projects»

Svetlana Kolesnichenko,
Alla Salavelis,
Sergey Pavlovsky,
Svitlana Poplavska

DEVELOPMENT OF INNOVATIVE TECHNOLOGY FOR SAUCE WITH LECITHIN

Consumers of catering establishments especially value their health and therefore give preference to dishes that correspond to modern concepts of healthy eating. In this regard, the development of such dishes is an important task. Thus, the object of the study was an emulsion sauce made using the spherification technique. Agar-agar was used as a material for encapsulating the sauce. The recipe composition of the sauce contains irreplaceable nutritional components: plant phospholipids (soy lecithin), monounsaturated and polyunsaturated fatty acids of olive oil and camelina oil, natural food fibers of agar-agar. Each recipe component of the developed emulsion sauce contains physiologically active substances with a high efficiency of health-improving effect. Synergy The combination of the positive effects of these prescription components makes it possible to create a therapeutic and prophylactic product. One of the most problematic areas is the formation of a lecithin-oil-water composition with a lamellar structure. Such a structure as a multilayer «container» helps to preserve the biologically active substances that make up the sauce from destruction and to better assimilate them by the human body. Due to the choice of a certain number of recipe components and their sequential combination under certain conditions (temperature 45 °C, mixing), it is possible to obtain a lamellar structure.

In the course of the study, recipe components were selected that correspond to healthy food products, recipes and technologies for the preparation of an emulsion sauce with a lamellar structure were developed. And also provided with the help of spherification an attractive appearance and determined the organoleptic, microbiological indicators and shelf life of the product. To confirm the presence of the lamellar structure of the sauce, carry out optical studies and presented a micrograph in polarizing light.

The research carried out makes it possible to expand the range of sauces with an extended shelf life (three days) for the restaurant industry.

Keywords: *innovative technologies of restaurant industry, emulsion sauce, spherification technique, soy lecithin, oil extracts of spices.*

Received date: 22.03.2021
Accepted date: 30.04.2021
Published date: 31.07.2021

How to cite
Kolesnichenko, S., Salavelis, A., Pavlovsky, S., Poplavska, S. (2021). Development of innovative sauce technology with lecithin. Technology Audit and Production Reserves, 4 (3 (60)), 50–53. doi: http://doi.org/10.15587/2706-5448.2021.238039

1. Introduction

The novelty, innovation and functional orientation of dishes are especially appreciated by guests of restaurant establishments today and significantly affect the competitive ability of enterprises. Visitors to restaurants and cafes care about their health and therefore prefer dishes that correspond to modern concepts of healthy eating.

Particularly popular among a wide variety of sauces, they are prepared and used in restaurant establishments, they have emulsion sauces [1, 2]. Attention is directed to the development of sauces with the inclusion of biologically active ingredients and served in the form of capsules or spheres.

The use of oil extracts of spices as a fat phase makes it possible to expand the range of emulsion sauces and regulate the taste of the product.

As an emulsifier, the use of a multidimensional food additive lecithin is promising. According to GRAS, lecithin (E-322) is the most popular food supplement, a special place of which is due to the combination of technological and physiologically active properties [3, 4]. In the restaurant industry, lecithins are not used widely enough, namely only in the technologies of molecular cuisine in the production of foams and air sauces.

Lecithin, as a source of phospholipids, acts as a kind of factor in the «rejuvenation» of cell membranes, nervous tissue and the whole organism [5, 6]. Despite the fact that the human body has the ability to synthesize phospholipids on its own, its capabilities often do not correspond to current needs, therefore the consumption of lecithin is vital, the daily intake for an adult is 5–7 grams per day.

It is known that phospholipids (lecithin) in the presence of non-polar solvents, which include oils, are capable of forming micelles of different orders, related in composition to body tissues and are able to include biologically active components in their structure and store them [7–9]. Therefore, not only the amount of lecithin in the developed food product is of particular importance, but also the structural organization, which contributes to better transportation and preservation of biologically significant substances.

At significant concentrations of lecithins in the presence of oil and water, a predominantly lamellar Lα mesophase is formed; it consists of many parallel lamellae or bimolecular layers. Polar groups of lecithin molecules are located on the bilayer surface, while hydrocarbons «tails» fill the internal volume [9–11]. In a three-component system of lecithin, oil and water, lecithin molecules are located at the oil-water interface.

Lecithins stabilize emulsions, their stabilizing ability is increased by 15–20 % during the previous dispersion of lecithins in the aqueous phase. Sufficiently stable emulsions are formed when the oil-water ratio is equal to 0.4 to 0.6 and the concentration of lecithin exceeds 0.5 wt. % [11, 12]. Numerous studies of scientists have shown that the shell of emulsion droplets in the presence of lecithin consists of a number of molecular bilayers that form multilayer vesicles and liquid crystal lamellar emulsions. That is why such emulsions easily absorb and dissolve in themselves various substances: fat-soluble (in the fat phase) and water-soluble (in the aqueous phase). Therefore, it is advisable to use such lamellar emulsions as a transport container of biologically active substances that make up the sauce. Thus, there are two aspects of the advisability of using lecithin in nutrition:

1) for the design of food systems;

2) to replenish the physiological needs of the body for phospholipids and to correct metabolic disorders.

Understanding the relationship between the features of the structure of food products and the presence of physiological functional prescription components in them, due to the formation of structured emulsions, are better absorbed by the human body, determines the relevance of this work.

Thus, *the object of research* was an emulsion sauce made using the spherification technique. *The aim of research* is to develop a formulation and technology for the preparation of an emulsion sauce of a health-improving orientation based on oil extracts of spices, using lecithin as an emulsifying substance and agar-agar as a substance for encapsulation.

2. Methods of research

The methods of polarization microscopy, system analysis, physicochemical, microbiological and organoleptic research methods are used.

As an extractant for obtaining oil extracts of spices, a mixture of oils was chosen: extra virgin olive oil, camelina oil (TU U 15.4-33721470-001: 2010). The ratio was 1:1.

As a natural surfactant-emulsifier, granulated soy lecithin was used by Protein LLC, St. Petersburg, Russia (raw material Cargil Texturizing Solutions Deutchland GmbH@Co.KG, Germany).

To obtain oil extracts, ground coriander (TU 10.8 01553439-006: 2013), cloves (GOST 29047-91), and ground ginger (GOST 29046-91) were used.

Studies have shown that the spices immediately after opening the package are microbiologically safe: the total number of microorganisms did not exceed $1 \cdot 10^3$ CFU/g.

To obtain extracts, a weighed portion of 5 grams of raw material was poured with 50 grams of a mixture of oils and extracted in a sealed container at room temperature for 12, 24, 48, 72 and 96 hours in a dark place, shaking occasionally. This was done with each spice sample.

3. Research results and discussion

Organoleptic characteristics of spice extracts depending on the extraction time are given in Table 1. To determine them after an appropriate period (12, 24, 48, 72 or 96 hours), the solid fraction was removed by filtration, followed by filtration of the extractant. The filtered oil extracts were defended at 1:00 and analyzed by organoleptic indicators: color, taste, aroma.

Table 1

Organoleptic characteristics of spice extracts

No.	Kind of spice	Processing time	Extract transparency	Color	Aroma	Taste
1	Coriander	12 hours	+	Yellowish green	No	Easy
2	Coriander	24 hours	+	Yellowish green	No	Tangible
3	Coriander	48 hours	+	Yellowish green	Light spicy	Pronounced, pleasant
4	Coriander	72 hours	+	Yellowish green	Spicy	Pronounced, pleasant
5	Coriander	96 hours	+	Yellowish	Spicy	Pronounced
6	Carnation	12 hours	+	Golden	No	Tangible
7	Carnation	24 hours	+	Golden	Easy	Pronounced, pleasant
8	Carnation	48 hours	+	Golden	Expressed	Pronounced, pleasant
9	Carnation	72 hours	+	Golden	Expressed	Pronounced, sharp
10	Carnation	96 hours	+	Golden	Expressed	Pronounced, sharp
11	Ginger	12 hours	+	Yellow	No	Tangible
12	Ginger	24 hours	+	Yellow	Easy	Pronounced, pleasant
13	Ginger	48 hours	+	Yellow	Expressed	Pronounced, pleasant
14	Ginger	72 hours	+	Yellow	Bitter	Pronounced, sharp
15	Ginger	96 hours	+	Yellow	Bitter	Pronounced, sharp

To prepare the emulsion, a mixture of oil extracts of spices was used: coriander after 72 hours of infusion, cloves and ginger after 48 hours of infusion. The best in terms of organoleptic characteristics was such a mixture of oil extracts: coriander oil extract – 50 %; oil extract of cloves – 30 %; ginger oil extract – 20 %. Thanks to the use of camelina seed oil, the mixture of extracts contains up to 18 % omega-3 essential fatty acids and a significant amount of vitamin E and beta-carotene.

ISSN 2664-9969

For the preparation of the emulsion sauce, Borjomi mineral medicinal table water was chosen as the aqueous phase. The pH of the mineral water was 7.9.

Agar-agar was chosen as the encapsulating agent for the spherification of the sauce. This natural food supplement is capable of:

1) to form elastic spheres of the selected size with layers of warm viscous sauce in cold oil;

2) enrich the product with dietary fiber;

3) design a sauce suitable for vegetarian, kosher, and fasting meals.

The recipe for the emulsion sauce for further spherification is given in Table 2.

Table 2

Emulsion sauce recipe for further spherification

Name	Mass, net, g
Spice oil extract	20
Mineral water	50
Soy lecithin	10
Agar agar	10
Lemon juice	10
Yield:	100

The amount of the selected recipe components and their gradual combination was adjusted by the conditions for the formation of the lamellar structure of the emulsion sauce. This structure contributes to the assimilation of biologically active components of the sauce and their better storage due to closed lamellas (Fig. 1).

spherification (Fig. 3) confirms the presence of an ordered structure of a liquid crystal (lamellar phase), as evidenced by ray structures in a dark field.

The data of the organoleptic analysis of the obtained sauce after encapsulation are given in Table 3.

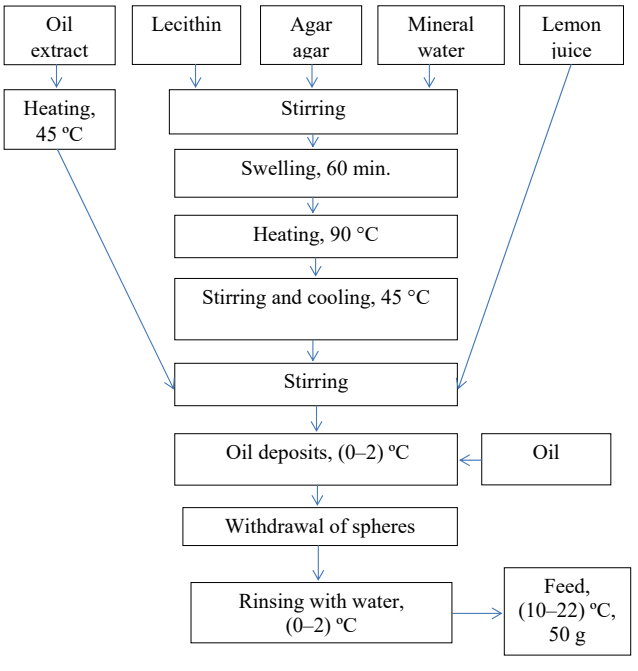

Fig. 2. Technological scheme for the preparation of spherical emulsion sauce

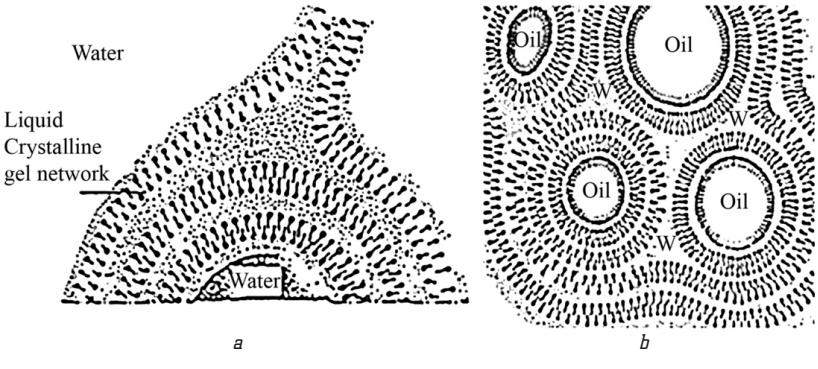

Fig. 1. Schematic representation of a lamellar liquid crystal emulsion [8]: *a* – with the encapsulation of the liquid phase (water); *b* – with the encapsulation of the fat phase (oil)

Fig. 3. Photo of a sample of emulsion sauce after spherification in polarizing light (x100)

Cooking technology. Pour soy lecithin and agar-agar with mineral water, stir and leave to swell for 1 hours, then heat to 90 °C with constant stirring. Then let's cool to 45 °C, add oil extracts of spices and lemon juice warmed up to 45 °C. Stir until a homogeneous viscous emulsion is formed. Transfer the resulting emulsion into a pastry bag with a nozzle and deposit it in oil (0–2 °C). Filter the resulting capsules and rinse with cold water.

Let's recommend serving emulsion sauce in the form of spheres with cold meat, fish dishes and as a recipe component of vegetable salads.

The technological scheme for preparing a spherical emulsion sauce is shown in Fig. 2.

To confirm the presence of the lamellar structure of the sauce, optical studies were carried out in polarized light. A micrograph of a sample of emulsion sauce after

Table 3

Organoleptic characteristics of spherical sauce

Indicator name	Product description
Appearance	Spheres with a diameter of 7–8 mm
Taste	Taste is rich, pleasant, salty-spicy, with a hint of appropriate spices and lemon juice
Smell	Light spicy
Color	Beige

Microbiological studies have shown that after 72 hours of storage in a refrigerator, the number of mesophilic aerobic and facultative anaerobic microorganisms (MAFanM) was within the normal range of $1.7 \cdot 10^2$ CFU/g. manufacturing, that is, the selected cooking technology allows to increase the shelf life in the refrigerator of the developed spherical sauce up to three days.

The implementation of the technology has certain limitations:

– it is necessary to use dry powder or granular lecithin;

– compliance with the temperature regime is mandatory: 90 °C to achieve microbiological safety in the preparation of the lecithin-agar-agar-water composition and 45 °C when this composition is combined with a mixture of oils to prevent the destruction of omega-3 fatty acids;

– mixing of the components must be carried out at the minimum mixing speed in order to obtain the lamellar structure of the sauce;

– storage of spherical sauce should be carried out at a temperature of (4–8) °C.

Spherical emulsion sauce is served exclusively with cold meat and fish dishes or as a recipe component in vegetable salads.

Further research on this topic can be devoted to the use of natural food colors in the form of aqueous extracts to obtain multi-colored spherical sauces to further expand the range.

4. Conclusions

As a result of the research, formulations and technologies for the preparation of a spherical emulsion sauce with oil extracts of spices have been developed. To obtain oil extracts, spices were selected (ground coriander, cloves, ground ginger), the spices were extracted with a mixture of olive and camelina oils, the best samples of extracts were selected according to organoleptic indicators and their optimal combination was determined, namely: coriander oil extract – 50 %; oil extract of cloves – 30 %; ginger oil extract – 20 %. The sauce preparation technology determines the formation of a lecithin-oil-water composition with a lamellar structure. Such a structure as a multilayer «container» helps to preserve the biologically active substances that make up the sauce from destruction and to better assimilate them by the human body. Each recipe component of the developed emulsion sauce is selected so that it contains physiologically active substances with a high efficiency of health-improving effect. The synergism of the combination of the positive effects of these prescription components has made it possible to create a therapeutic and prophylactic product. Organoleptic analysis of the spherical emulsion sauce showed high taste characteristics. The microbiological safety of the spherical emulsion sauce has been proven. The specified shelf life is three days. Consumption of one portion of the developed spherical sauce by 50 % will satisfy the body's daily need for omega-3 polyunsaturated fatty acids and lecithin.

References

1. Gureev, S. A., Mingazova, E. N. (2020). To the question of the international experience of vitaminization food and food as population health technologies. *Problems of Social Hygiene Public Health and History of Medicine, 28,* 723–728. doi: https://doi.org/10.32687/0869-866x-2020-28-s1-723-728
2. Starovoytova, K., Tereshchuk, L. (2019). Development of mayonnaise recipes considering the main trends in product range improvement. *Food Processing: Techniques and Technology, 48 (1),* 91–98. doi: https://doi.org/10.21603/2074-9414-2018-1-91-98
3. Dzyak, G. V., Drozdov, A. L., Shulha, S. M., Hlukh, A. I., Hlukh, I. S. (2010). Modern notions about biologic properties of lecitin (lecture for physicians). *Medical perspectives, XV (2),* 123.
4. Shchipunov, Y. A., Shumilina, E. V. (1997). Molecular model for the lecithin self-organization into polymer-like micelles. *Progress in Colloid & Polymer Science, 106 (1),* 228–231. doi: https://doi.org/10.1007/bf01189526
5. Olsson, V., Håkansson, A., Purhagen, J., Wendin, K. (2018). The Effect of Emulsion Intensity on Selected Sensory and Instrumental Texture Properties of Full-Fat Mayonnaise. *Foods, 7 (1),* 9. doi: https://doi.org/10.3390/foods7010009
6. Tran, T., Green, N. L., Rousseau, D. (2015). Spheroidal Fat Crystals: Structure Modification via Use of Emulsifiers. *Crystal Growth & Design, 15 (11),* 5406–5415. doi: https://doi.org/10.1021/acs.cgd.5b01033
7. Wynne, K. (2017). The Mayonnaise Effect. *The Journal of Physical Chemistry Letters, 8 (24),* 6189–6192. doi: https://doi.org/10.1021/acs.jpclett.7b03207
8. *Krem dlya vosstanovleniya kozhi na lamellyarnoy emul'sii.* Available at: http://sm-point.ru/krem-dlya-vosstanovleniya-kozhina-lamellyarnoj-emulsii.html
9. Usol'tseva, N. V. (2011). *Zhidkie kristally: liotropnyy mezomorfizm.* Ivanovo: Ivan. gos. un-t., 316.
10. Mulet, X., Boyd, B. J., Drummond, C. J. (2013). Advances in drug delivery and medical imaging using colloidal lyotropic liquid crystalline dispersions. *Journal of Colloid and Interface Science, 393,* 1–20. doi: https://doi.org/10.1016/j.jcis.2012.10.014
11. Kolesnichenko, S. L. (2016). Ispol'zovanie letsitina v lechebno-profilakticheskom pitanii. *Archivarius, 6 (10),* 5–8.
12. Victorova, E. P., Lisovaya, E. V., Agafonov, O. S., Martovshchuk, V. I. (2019). Comparative evaluation of the micelle formation process of phospolipids of rapeseed and sunflower lecithines in nonpolar solvents. *Novye tehnologii, 1 (47),* 19–28. doi: https://doi.org/10.24411/2072-0920-2019-10102

✉***Svetlana Kolesnichenko,*** *PhD, Associate Professor, Department of Restaurant and Health Food Technology, Odessa National Academy of Food Technologies, Odessa, Ukraine, e-mail: svetlanalk@ukr.net, ORCID: https://orcid.org/0000-0002-8752-053X*

Alla Salavelis, *PhD, Associate Professor, Department of Restaurant and Health Food Technology, Odessa National Academy of Food Technologies, Odessa, Ukraine, ORCID: https://orcid.org/0000-0001-9432-4951*

Sergey Pavlovsky, *PhD, Associate Professor, Department of Technology of Bakery, Confectionery, Macaroni Production and Food Concentrates, Odessa National Academy of Food Technologies, Odessa, Ukraine, ORCID: https://orcid.org/0000-0001-5701-8031*

Svitlana Poplavska, *Assistant, Department of Restaurant and Health Food Technology, Odessa National Academy of Food Technologies, Odessa, Ukraine, ORCID: https://orcid.org/0000-0002-4981-7834*

✉*Corresponding author*