ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
Vol. 6, Issue 4, April 2019

Catalysts in the Hydrogenation of Oils Technology

Majidova N.Kh., Yu.Kadirov

Ph.D., Department of Food Technology and Industry Ecology, Bukhara Engineering-Technological Institute, Bukhara, Uzbekistan
Assistant Professor, Department of Food Technology, Tashkent Chemical-Technological Institute, Tashkent, Uzbekistan

ABSTRACT: Improvement of quality of fats can be carried out by change of triglyceride structure of oils and fats in the various ways of their modification. The work is directed on improvement of quality and maintenance of food safety of fat-oil, received by hydrogenation of cotton oil, by selection of scientifically valid highly effective technologies and catalyst systems. Object of research were the refined deodorized cotton oil, powdery and stationary floatable catalyst systems on the basis of nickel, copper and various promotored additives, possessing high hydrogenating properties. The stationary floatable catalysts, containing one and two promotored additives are analyzed. Catalyst hydrogenation of cotton oil were carried out in identical technological modes at which the basic properties of stationary floatable catalysts are established. Pressure of hydrogen has the greatest influence of fat-oil qualitative measures in the course of continuous hydrogenation. In these conditions the greatest influence on selectivity of process renders a combination of the raised temperatures to enough high volume velocity on oil. It is established that the optimal catalyst systems for production of firm food fat-oil of high-quality and food safety are powdery and developed stationary floatable catalysts on the basis of nickel, copper and promotor additives. Such catalyst systems have allowed to lower quantity of trance-isomerized fat acids in fat-oil to 5…7 % and to provide maintenance constancy of linoleic acids.

KEY WORDS: cottonseed oil, hydrogenation technology, the conditions of hydrogenation catalysts, stationary and powdered catalyst, hydrogenated fat food, quality indicators, food safety fats, trans fatty acids isomerization.

I.INTRODUCTION

Improvement of quality of fats can be carried out by change of triglyceride structure of oils and fats in the various ways of their modification. Now the basic methods of modification of oils and fats are technology hydrogenation, hydrointeresterification and interesterification [1]. In industrial practice most accepted way of catalyst modifications of vegetable oils and fats is the technology of hydrogenation with use of various types of catalysts [2].

Therefore widely scale researches in the field of development of new technologies and hydrogenation catalysts which main advantage is quality maintenance and food safety catalyst modified fats proceed [3].

II. SIGNIFICANCE OF THE SYSTEM

The work is directed on improvement of quality and maintenance of food safety of fat-oil, received by hydrogenation of cotton oil, by selection of scientifically valid highly effective technologies and catalyst systems. The study of literature survey is presented in section III, Methodology is explained in section IV, section V covers the experimental results of the study, and section VI discusses the future study and Conclusion.

III. LITERATURE SURVEY

Object of research were the refined deodorized cotton oil, powdery and stationary floatable catalyst systems on the basis of nickel, copper and various promotored additives, possessing high hydrogenating properties. For researches basic kinetic laws of process in flowing conditions in the presence of stationary floatable catalysts is used plant of a high pressure with reactors of columned type [4]. For the analysis and an estimation of quality, used modern physical, chemical and physical-chemical methods and mathematical processing of the received experimental data [5, 6].

ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
Vol. 6, Issue 4, April 2019

IV. METHODOLOGY

Hydrogenation was carried out on mixtures of fresh (commercial) and reusable (recycled) catalyst.

Fresh catalyst used in powdered or granular (tablet) form. To increase the working surface of the catalysts and ensure their uniform distribution in the hydrogenated fat, they were crushed, then mixed with dry refined oil.

The feed rate of the catalyst suspension depended on its concentration, the performance of the hydrogenation unit, the quality of the hydrogenated raw materials, the required hydrogenation depth, etc.

Frame filter presses with a cotton or synthetic fabric filtering surface were used to separate the catalyst from the lard.

In the process of repeated use, the catalyst loses its initial activity and is partially replaced with fresh. Thus, the fresh catalyst was spent on compensation of losses and to create the necessary ratio between the fresh and reusable catalyst.

The total nickel concentration in the feedstock was maintained in the range of 0.1-0.3%, depending on the quality of the feedstock, the rate and depth of hydrogenation.

Isomerization ability of catalysts is calculated by the formula:

$$S_i = \frac{\Delta T}{\Delta J_2}$$

The temperature of melting and solidification, as well as the hardness of fats was determined by known methods.

All types of catalytic hydrogenation products were evaluated for their quality. The organoleptic characteristics and physico-chemical characteristics of cottonseed oil, edible fats, high-confectionery fats and margarine products were determined.

V. EXPERIMENTAL RESULTS

In researches on catalyst modifications of cotton oil are used various catalyst systems of new modification. The stationary floatable catalysts, containing one and two promotored additives are analyzed. Componential structure of the analyzed stationary floatable catalysts is resulted in table 1 and 2.

Table 1. Componential structure of new types of nickel-copper-aluminum floatable stationary catalysts

The catalyst, №	Alloys	Parity of components
	Initial	
1	Nickel-copper-aluminum	25:25:50 *
2	Nickel-copper-aluminum	37.5:12.5:50 **
	Promotived	
3 **	Palladium	0.10
4 **	Rhodium	0.50
5 **	Ruthenium	0.15
6*	Rhenium	1.50
7*	Germanium	1.50
8*	Tin	1.50
9*	Vanadium	1.50

Note (*, **): promotor is entered instead of an aluminum part

As the most effective powdery catalyst it is used catalyst "Nysosel-800" made by firm Engelhard in Holland [7].

ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
Vol. 6, Issue 4, April 2019

Table 2. Componential structure of new types of nickel-copper-rhodium (0.5 %) - aluminum alloys, promotored additives

The catalyst, №	The additive	The maintenance, %
10	Palladium	0.50
11	Ruthenium	0.50
12	Rhenium	2.00
13	Germanium	1.50
14	Tin	1.50
15	Vanadium	2.00

In researches are studied nickel-copper-aluminum (25.0:25.0:46.0... 48.5) alloys with the joint combination of two promotored additives.

Catalyst hydrogenation of cotton oil were carried out in identical technological modes at which the basic properties of stationary floatable catalysts are established.

Research of influence of temperature for velocity of saturation of cotton oil at presence of non-promotor and promotor nickel-copper-aluminum catalysts carried out at following conditions: pressure 300 kPa, velocity of feed of hydrogen of 60 ml h^{-1}, volume velocity of feed of oil 1.2 h^{-1}.

With rise in temperature velocity of saturation increases, thus intensive growth of velocity is observed at 200°C. At this size decrease sharply that specifies in limitation of process by hydrogen diffusion [8].

Pressure of hydrogen has the greatest influence of fat-oil qualitative measures (tab.3) in the course of continuous hydrogenation. In these conditions the greatest influence on selectivity of process renders a combination of the raised temperatures to enough high volume velocity on oil.

Table 3. The characteristic of fat-oil, received by continuous catalyst modification of cotton oil

Modification conditions			I.n % J_2	The maintenance of trance-acids, %	Acid number, mg KOH/g	Temperature of melting, °C	Hardness, g/cm
Temperature, °C	Pressure, kPa	Velocity of feed of oil, h^{-1}					
200	300	1.8	74.1	11	0.20	34.5	420
200	300	1.5	72.1	14	0.21	36.1	500
200	100	1.0	64.2	18	0.27	37.2	540
180	100	1.0	63.7	19	0.29	37.1	600
180	100	1.2	66.4	21	0.35	38.3	620

VI. CONCLUSION AND FUTURE WORK

It is established that the optimal catalyst systems for production of firm food fat-oil of high-quality and food safety are powdery and developed stationary floatable catalysts on the basis of nickel, copper and promotor additives. Such catalyst systems have allowed to lower quantity of trance-isomerized fat acids in fat-oil to 5…7 % and to provide maintenance constancy of linoleic acids.

The most comprehensible technological modes of manufacture of the high-quality hydrogenated fats were temperature 180°C, pressure 100 kPa and volume velocity of feed of oil 1.2-1.5 h^{-1}. Such conditions have allowed lowering the quantitative maintenance of trance-isomerized mono-nonsaturated fat acids in food fat-oil.

ISSN: 2350-0328
International Journal of AdvancedResearch in Science, Engineering and Technology
Vol. 6, Issue 4, April 2019

REFERENCES

[1] Arutyunyan , N.S. 1999. Fat processing technology. M .: Pishepromizdat. P. 452. [In Russian]
[2] Tovbin, I.M., Melamud, N.L., Sergeev, A.G. 1981. Hydrogenation of fats. M.: Light and food industry, P.246. [In Russian]
[3] Akramov, O.A. 2008. Modification of cotton oil on effective catalysts. Tashkent. Tashkent Technical Institute of Technology, P.26. [In Russian]
[4] Majidova, N.K. 2010. Improving the quality and ensuring the food safety of salomas obtained by hydrogenating cottonseed oil. Tashkent: TashCTI. P.26. [In Russian]
[5] A guide to research methods, techno-chemical control and accounting for the production of fat-and-oil industry. 1967-1989. L.: V. I-VI, B.1-2. [In Russian]
[6] Adler, Yu.P., Markova, E.V., Granovsky, Yu.V. Planning an experiment when searching for optimal conditions. M.: Science [In Russian]
[7] Majidova, N.K., Akramov, OA, Khujanov, I.Kh., Majidov, K.Kh. 2007. Improving the technology of catalytic modification of cotton oil. Collection of works of the Republican Scientific and Technical Conference. Tashkent. P.279-281. [In Russian]
[8] Majidov, K.Kh. 1987. Research and Improvement of Cotton Oil Hydrogenation Technology on Modified Alloy Stationary Catalysts. L.: P.48. [In Russian]