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Catalysts in the Hydrogenation of Oils Technology

Majidova Nargiza Kakhramonovna and Kadirov Yuldashkhon Kadirovitch

Bukhara Engineering-Technological Institute, Bukhara City, Republic of Uzbekistan

***Corresponding author:** Majidova Nargiza Kakhramonovna, Bukhara Engineering-Technological Institute, Bukhara City, Uzbekistan. Tel: +998652237884; Fax: +998652236197: Email: kafedra-03@mail.ru

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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 promoted additives, possessing high hydrogenating properties. The stationary floatable catalysts, containing one and two promoted 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.

Keywords: Conditions of Hydrogenation Catalysts; Cottonseed Oil; Food Safety Fats; Hydrogenation Technology; Hydrogenated Fat Food; Quality Indicators; Stationary and Powdered Catalyst; Trans Fatty Acids Isomerization

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, hydro interesterification 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].

Therefor 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].

Purpose of Work: 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.

Research Course: Object of research were the refined deodorized cotton oil, powdery and stationary floatable catalyst systems on the basis of nickel, copper and various promoted 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].

Results and Discussion

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

The catalyst, №	Alloys	Parity of components
Initial		
1	Nickel-copper-aluminium	25:25:50 *
2	Nickel-copper-aluminium	37.5:12.5:50 **
Promrtived		
3 **	Palladium	0.1
4 **	Rhodium	0.5
5 **	Ruthenium	0.15
6*	Rhenium	1.5
7*	Germanium	1.5
8*	Tin	1.5
9*	Vanadium	1.5
Note (*, **): promotor is entered instead of an aluminium part		

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

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

The catalyst, №	The additive	The maintenance, %
10	Palladium	0.5
11	Ruthenium	0.5
12	Rhenium	2
13	Germanium	1.5
14	Tin	1.5
15	Vanadium	2

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

In researches are studied nickel-copper-aluminum (25.0:25.0:46.0... 48.5) alloys with the joint combination of two promoted 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 2000C. 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 (Table 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.

Modification conditions			.n % J_2	The maintenance of trance-acids, %	Acid number mg KOH/g	Temperature of Melting, ⁰C	Hardness g/cm
Temperature, ⁰C	Pressure kPa	Velocity of feed of oil, h-1					
200	300	1.8	74.1	11	0.2	34.5	420
200	300	1.5	72.1	14	0.21	36.1	500
200	100	1	64.2	18	0.27	37.2	540
180	100	1	63.7	19	0.29	37.1	600
180	100	1.2	66.4	21	0.35	38.3	620

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

Conclusion

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 1800C, 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-non-saturated fat acids in food fat-oil.

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