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ECONOMIC EVALUATION OF TECHNOLOGICAL MODES AND PARAMETERS OF STAGED HYDROGENATION OF COTTON OIL

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Abstract
An economic evaluation of technological methods for the hydrogenation of cottonseed oil on powdered and stationary catalysts has been carried out. The economic acceptability of the stage-by-stage hydrogenation technology on stationary and disperse catalysts has been established.

Keywords: hydrogenation, technological parameters, material and technical costs, production cost, profit from production.

Introduction

Industrial hydrogenation of cottonseed oil is carried out using powdered and stationary catalysts [1, 2]. The use of powdered catalysts ensures the production of edible hydrogenated fats in relatively strict technological regimes [3]. This technology is associated with an additional technological stage of the separation of catalyst metals from the hydrogenation product by filtration [4]. This technological process requires the use of a filter cloth, which is economically unacceptable.

Hydrogenation of cottonseed oil on a stationary catalyst does not provide edible hydrogenated fats. The use of such catalysts is most acceptable in the technology of obtaining tallow for technical purposes. Recently, methods have been proposed for obtaining food tallow on stationary catalysts by training and regenerating them in a continuous technology for the hydrogenation of cottonseed oil. [5, 6].

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In connection with the foregoing, methods for the step-by-step hydrogenation of cottonseed oil with the sequential use of stationary ones are proposed. and powdered catalysts in the technology of continuous hydrogenation of cottonseed oil [7, 8].

In this regard, the economic evaluation of technological regimes and parameters of various methods of hydrogenation of cottonseed oil is of great interest.

In this work, an economic evaluation of technological methods for the hydrogenation of cottonseed oil on powdered and stationary catalysts was carried out.

Technical and economic indicators obtained in laboratory experiments and the results of pilot tests were selected for analysis and evaluation [9,10].

Tables 1 and 2 show the results of a comparative assessment of technological regimes and material and technological costs for the production of edible hydrogenated fats with various methods of continuous hydrogenation of cottonseed oil.

Table 1 Technological regimes and parameters of methods for catalytic hydrogenation of vegetable oils.

Hydrogenation methods	Technical parameters and values of modes			
	Temperature °C	Pressure kPa (unit of pressure)	Oil supply, m³/hour	Hydrogen supply m³/h
On a dispersed catalyst	200-220	3-5	60-62	60-65
On a stationary catalytic converter	180-200	3-7	58-60	60-65
On stationary and disperse catalyst	160-180	1-3	64-66	58-60

Table 2 Material and technological costs for the production of target lard in the process of hydrogenation.

Material and technological expenses	Hydrogenation technology		
	On a dispersed catalyst	On a stationary catalytic converter	On stationary and disperse catalyst
Raw vegetable oil, tons	1002,4	1001,6	1000,3
Catalyst, kg/ton	0,27	0,24	0,21
Hydrogen, m³/ton	60	60	58
Waste and losses, kg/ton	0,04	0,03	0,01
Filter fabric, mg/ton	1,2	-	0,04
Steam, kg/ton	47,3	44,7	42,6
Electricity, kW / ton	128,1	120,4	118,3
Water, kg/ton	39,5	36,4	34,7
Cost of production, mln. soum/ton	8,089	8,041	7,981

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The analysis and evaluation of the conducted data indicate that the use of the technology of staged hydrogenation of cottonseed oil on stationary and powdered catalysts ensures the production of target edible fats with acceptable technological regimes and technical and economic indicators.

The economic efficiency of the technology of staged hydrogenation of cottonseed oil was carried out by the following calculations.

The economic efficiency of scientific and technological developments was determined by the formula:

$$Э=(C_c-C_H)\cdot E\cdot K_H\cdot A_H$$

where: C_c – the cost of production before the development of new technology

C_H – the cost of technology after new technology

E – normative coefficient of efficiency of capital investments: E=0,15

A_H – the volume of production

H_H – specific capital costs per unit of production

The profit from the production of products with various technologies for the hydrogenation of vegetable oils was established by the following formulas:

$$П_д= (C_o - C_д)\cdot V = (1000-808,97)\cdot 160=30\ 564,8 \text{ tons soum}$$

$$П_{ст}= (C_o – C_{ст})\cdot V = (1000-804,14)\cdot 160=31\ 337,6 \text{ tons soum}$$

$$П_{дс}= (C_o - C_{дс})\cdot V = (1000-798,16)\cdot 160=32\ 294,4 \text{ tons soum}$$

$П_д$ – profit on dispersed catalyst, tons soum

$П_{ст}$ – profit on stationary catalyst, tons soum

$П_{дс}$ – profit on a stationary and dispersed catalyst, tons soum

C_o – wholesale price of lard, tons soum

$C_д$ – prime cost of lard on a dispersed catalyst, tons soum

$C_{ст}$ – prime cost of lard on a stationary catalyst, tons soum

$C_{дс}$ – the volume of production, tons soum

V – the volume of production, tons.

Thus, the evaluation and analysis of technical and economic indicators of methods for the hydrogenation of cottonseed oil made it possible to establish the acceptability of the use of staged hydrogenation of raw materials in production conditions.

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