LOW-ERUCIC RAPESEED OIL AS A RAW MATERIAL FOR VARNISHES

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The capacity of low-erucic rapeseed oil production in moderate-climate countries often exceeds the demand for this raw material for alimentary purposes. This is the reason of research on the possibilities of its economic utilization in other fields.

Low-erucic rapeseed oil has a little higher content of multi-unsaturated acids than high-erucic one and therefore it can be an interesting material for the paints and varnish industry. As illustrated in Table 1, the content of polyenes in domestic low-erucic rapeseed oils is in the range of 31 - 42 %.

Table 1

Fatty acids composition in domestic low-erucic rapeseed oils

Designation of acids	Content, in % by mass
C 16:0	3.6 - 5.9
C 18:0	0.8 - 1.9
C 16:1	0.5 - 0.7
C 18:1	39.3 - 54.3
C 20:1	4.1 - 5.8
C 22:1	1.6 - 6.6
C 18:2	22.3 - 30.6
C 18:3	8.9 - 11.8

On the average the polyenes content attains a value of about 32 %, what is not sufficient for the application of rapeseed oil as a valuable component of varnishes used as a replacement of the known drying oils and semidrying oils, such as linseed and soybean oil.

This amount of polyenes in rapeseed oil makes it possible to enhance the so-called drying characteristics of this raw material by bond conjugation of its polyenes. The conjugated unsaturated bonds are characterized by a much higher chemical reactivity.

The conjugation of unsaturated bonds is a particular case of positional isomerization. This process can be carried out with only inconsiderable yield under conditions of high temperature. High temperature process promotes conjugation of unsaturated bonds in polyenes, but it also accelerates other accompanying reactions, this side reaction being undesirable in applications for varnish products.

The main problem in the elaboration of the conditions of the positional isomerization process is thus the choice of an appropriate catalyst of the reaction.

The following are the main features required from an ideal catalyst for this process:

- high degree of conversion at possibly lowest temperature and within short time, thus limiting any undesirable thermal side-reaction,
- high selectivity in the reaction of positional isomerization without successive and parallel reactions such as cis-trans isomerization, geometrical isomerization and polymerization,
- ease of catalyst separation from the reaction product
- meeting the economical requirements of the process.

The research carried out initially at the Industrial Chemistry Research Institute only, and then in cooperation with the Research Centre of Rubber and Vinyl Materials in Oświęcim and with the Polifarb Works of Paints and Varnishes in Cieszyn was concerned with a series of catalytic systems, both homogeneous and heterogeneous.

Among the known homogeneous catalysts there are known sodium and kalium alcoholates, iodine derivatives and antraquinone. As a heterogeneous catalysts, metals or their salts on various type carriers are used.

In Table 2 there are given the results of our studies in several of the above mentioned catylysts from the point of view of their meeting the above mentioned requirements.

It can be concluded that no system has been found fulfilling all the requirements simultaneously. It was the reason of a decision to make additional experiments and to elaborate a special catalyst for this process.

Table 2

Results of studies in various catalysts for the process of positional isomerization

Type of catalyst / Trade name	Degree of conversion of dienes and trienes	Temp., °C and time, h	Selectivity and viscosity at 20°C, mPas	Separation from the reaction	Remarks
homogeneous antraquinone	26	260, 6	poor, 189	filtration	
homogeneous magnesium iodide	34	200, 0,5	high 115	washing off	oil becomes dark, iodineadds to unsaturated bonds
heterogeneous 45 % Ni on a carrier	24	265, 2,5	medium 189	filtration	
heterogeneous Cu 203 T copper-chromium heterogeneous G - 22 -nickel	17	200, 1-3	due to low degree of conversion not estimated	stationary	

As a result of our studies, we have elaborated a heterogeneous x-Cu catalyst on aluminium oxide and active carbon as a carrier.

The rapeseed-oil isomerization process is carried out with 2-% of this catalyst at a temperature of 240°C with a 40 - 50 % degree of conversion of dienes present in rapeseed oil.

After the isomerization step, catalyst is removed by filtering it off and returned to the next operation. The properties of isomerized low-erucic rapeseed oil are summarized in Table 3.

Table 3

Properties of isomerized low-erucic rapeseed oil

Property	Value
Content of conjugated systems, % by mass	15
Content of polymers, % by mass	5 - 10
Content of isolated trans isomers, % by mass	5 - 10
Iodine number after Woburn	105 - 120
Viscosity at 20°C, mPas	90 - 110
Refractive index n_D^{20}	1.4730 - 1.4780