



Thematic section: Research of Structure Properties.

Subsection: Technology of the Organic Substances.

Full Paper

The Reference Object Identifier – ROI-jbc-B/21-1-2-16

The Digital Object Identifier – DOI: 10.37952/ROI-jbc-B/21-1-2-16

Received 18 August 2021; Accepted 21 August 2021

Properties of cellulose nitrate modified with camphene and carvone

Lyaysan F. Khamzina,^{1*} Lilia E. Nikitina,²
Milyausha R. Garaeva,¹ and Olga T. Shipina¹

¹ *Department of Chemistry and Technology of High Molecular Compound.
Kazan National Research Technological University. Karl Marx St., 68.
Kazan, 420015. Republic of Tatarstan. Russia.*

Phone: +7 999 164 2902. E-mail: laysanhamzina282@gmail.com

² *Department of General and Organic Chemistry. Kazan State Medical University.
Butlerova St., 49. Kazan, 420012. Republic of Tatarstan. Russia.*

E-mail: nikitl@mail.ru

*Supervising author; †Corresponding author

Keywords: cellulose nitrate, camphor, camphene, carvone.

Abstract

This paper presents the results of studies of the properties of cellulose nitrate modified with camphor derivatives. Camphor and its derivatives, camphene and carvone, were used as modifiers. The results of a number of calculation methods for the selection of ratios in the systems "cellulose nitrate: modifier" based on the energy and thermodynamic characteristics using the software packages "HyperChem" and "TERMO" are presented. The thermodynamic limit of compatibility of the products of physicochemical modification of cellulose nitrate has been studied. The fundamental possibility of obtaining modified cellulose nitrate mixtures in the process of mixing cellulose nitrate with camphor, camphene and carvone in a common solvent is shown. Experimental data on the study of the structural and physicochemical characteristics of the studied systems have been obtained and the patterns of changes in the structure and features of the physical transformations of cellulose nitrate have been established. It was revealed that the adsorption of modifiers occurs on the pore surface of film composites. It was found that the addition of camphor, camphene and carvone in an amount of up to 40 % mass. practically does not affect the thermal characteristics of cellulose nitrate, which indicates the stability of the obtained compositions and is an important factor for their further practical use. Microscopic analysis of modified samples of cellulose nitrate films revealed a general tendency of their structural transformations and showed that no changes were observed when heated to 60 °C. Active deformation of films and a change in their structure upon further heating leads to the transition of film materials from a glassy state to a highly elastic state and establishes the presence of a plasticizing effect of camphor derivatives. It is shown that the data of calculations and experimental studies

of the structural and thermochemical characteristics of modified cellulose nitrate are consistent with each other.

For citation: Lyaysan F. Khamzina, Lilia E. Nikitina, Milyausha R. Garaeva, Olga T. Shipina. Properties of cellulose nitrate modified with camphene and carvone. *Butlerov Communications B.* **2021.** Vol.1. No.2. Id.16. DOI: 10.37952/ROI-jbc-B/21-1-2-16

References

- [1] Synthesis and modification of polymers. Under. Ed. K.A. Andrianov. *Moscow: Ed. The Science.* **1976.**120p. (Russian)
- [2] V.I. Sedlis. Cellulose ethers and plastics based on them. *Leningrad: Goskhimizdat.* **1958.** 116p. (Russian)
- [3] E.A. Shokova, J.K. Kim, V.V. Kovalev. Camphor and its derivatives. Extraordinary transformations and biological activity. *Journal of Organic Chemistry. Moscow.* **2016.** Vol.52. No.4. P.471-499. (Russian)
- [4] G.A. Rudakov. Chemistry and technology of camphor. *Moscow: Forest Industry.* **1976.** 208p. (Russian)
- [5] Lyaysan F. Khamzina, Lilia E. Nikitina, Milyausha R. Garaeva, Olga T. Shipina. Properties of cellulose nitrate modified with camphene and carvone. *Butlerov Communications.* **2021.** Vol.68. No.10. P.37-42. DOI: 10.37952/ROI-jbc-01/21-68-10-37 (Russian)