Thematic Section: Preparative Research. **Full Paper**
Subsection: Chemistry of High-Energy Substances. *Reference Object Identifier* – ROI: jbc-02/17-49-3-101
Publication is available for discussion in the framework of the on-line Internet conference "*Butlerov readings*".
http://butlerov.com/readings/
Submitted on March 03, 2017.

Synthesis of ultrafine CL-20 crystals by means of destruction of co-crystals on its base with some polar solvents

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Keywords: co-crystallization, molecular complex, cyclic nitramine, CL-20, ultrafine crystals

Abstract

The particle size of energy materials is known to have an impact on their physical, chemical and explosive properties and improves significantly efficiency coefficient of fuels. Changing of large-size crystals into ultrafine ones reduces significantly sensitivity to different mechanical loads and increases storing and operation safety of such materials.

The given work is intended to develop a way of synthesizing ultrafine CL-20 crystals by means of destruction of co-crystals on its base with the following polar solvents: *N,N*-dimethylformamide, *N,N*-dimethylacetamide, *N*-methylpyrrolidone and ε-caprolactam. As a result, a possibility to synthesize molecular CL-20 complexes by means of volumetric co-crystallization that had been described before was studied at the first stage of the work. This approach is more convenient and practically feasible in comparison with the technique of cooling saturated solvents.

To obtain superfine CL-20 molecular complexes on its base were subjected to decomposition with water and water-ethanol mixture. The temperature of the decomposing agent was found to have a significant impact on polymorphous composition of the product obtained. As a result of the work both composition of different modifications (α, β, γ, ε) and pure polymorphes as separate substances (α, β, ε) were obtained. Average size of the extracted crystals is 5-10 μm and specific surface of the samples is 4000-7000 cm^2/g.

By the example of co-crystal CL-20/*N,N*-dimethylformamide it was shown that when having been treated with ultrasound the size of crystals reduced up to 3-5 μm and their specific surface increased up to 10000 cm^2/g.

In the course of studies it was determined that when dropping a load of 2 kg explosion frequency of the samples obtained with molecular complex CL-20/*N,N*-dimethylformamide is 12 times lower than with initial crystals CL-20. Thus, increase of specific surface of nitramine causes sharp decrease of its mechanical sensitivity.

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