

Use of the principles of Green Chemistry in development and implementation of advanced technologies of mineral fertilizers and inorganic acids



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Abstract

The oldest in Russia (established in September 1919) industry-oriented institute JSC "The Research Institute for Fertilizers and Insecto-Fungicides Named after Professor Y. Samoilov" (JSC "NIUIF"), specializing in extraction and beneficiation of raw materials, production of inorganic acids, fertilizers and technical salts, always follows all the twelve principles of Green Chemistry while developing and implementing the technologies. For example, when developing the environmentally friendly, energy- and resource-saving technology of sulfuric acid from sulfur according to DC-DA scheme (double conversion - double absorption), the optimal design of the converter was proposed, the load of catalyst from leading manufacturers was determined and calculated so that to ensure maximum oxidation of SO₂ into SO₃ and conversion of almost all sulfur into the final product (sulfuric acid). This technology eliminates formation of effluents

and solid wastes, the heat from sulfur combustion is converted into 40 bar steam used for power generation, as well as for other process needs (i.e., for concentration of wet phosphoric acid (WPA), etc.).

There was also developed a zero-waste two-stage dihydrate-hemihydrate (DH-HH) process for WPA production from various types of phosphate rock. To prevent waste formation, the single-stage schemes for WPA production were supplemented with the technology of ammonium sulfate production from phosphogypsum and fluorosilicic acid (FSA), as well as the technology of aluminum fluoride production from FSA.

The Institute has also developed:

- a flexible, efficient, zero-waste, universal technology of NP / NPS / NPK / NPKS fertilizers with maximum utilization of heat from chemical processes;
- an innovative, zero-waste, no-analogue technology of granular PK / PKS / NPKS-

fertilizers with controlled dissolution rate and nutrient supply into the soil solution, which allows to process a number of wastes and by-products.

JSC “NIUIF” is also engaged in development and improvement of analytical methods for determination of various substances, as well as harmful substances for environmental control. In 2019 the institute elaborated two national standards of the Russian Federation “Agricultural products, raw materials and feed with improved environmental characteristics”. Institute specialists are part of IFA working groups dealing with improvement of methods for control and utilization of phosphogypsum.

Biography

Andrey Norov was born on 26 April 1957 in Russia (USSR). Upon graduating from Mendeleev’s University of Chemical Technology in Russia, for over 25 years Mr.Norov had been working at Mineral Fertilizers Plants. Since April 2007 he has been working for JSC “NIUIF”, at the present moment his job title is Industrial Technology Director. Mr Norov has got Ph.D. in Engineering Science. He is an Honorable Chemist of the Russian Federation, he also has got governmental and industry-related awards. Mr.Norov is an author of over 100 research articles and publications and 27 patents in the field of phosphorus-containing fertilizers technology. Mr.Norov took part as a speaker in 35 international conferences and symposiums.