

Innovative Projects for the Processing of Industrial Waste

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Abstract: The study deals with innovative projects for the processing of industrial waste. Industrial waste has become a pressing issue for the big cities and their disposal is an important task of the government. At the same time, stocks of raw materials are reducing and the cost of their production and transportation is increasing. That is why, the task is assigned to establish a sustainable environmental waste management system in Russia. Environmentalists need new and innovative equipment for the collection, transportation and reduction of industrial waste as well as innovative technologies for its processing. Innovative projects analyzed in the study solve the problem of industrial waste disposal which has economic and social benefits.

Key words: Industrial waste, innovation, innovative project, processing, evaluation of industrial waste hazard class, waste disposal, environmental services, recycling tax, regional schemes for waste management

INTRODUCTION

Industrial waste includes solid, liquid and gaseous waste products resulting from mechanical, chemical, thermal or other material changes. The problem of waste management is one of the major problems of any industrial production process. The larger is the production, the more difficult is it to solve this problem. A wide range of industrial waste complicates the issue of its recycling. Recycling is a technological operation or a set of technological operations which results in the manufacturing of one or more types of marketable output from the waste. Waste disposal has become an important public issue. A number of federal laws and regulations of the Government related to the collection and recycling of industrial waste (Anonymous, 1992, 1994, 1998) as well as industry regulations and recommendations (Anonymous, 2000, 2014) have been adopted.

Russian President Vladimir Putin has signed the amendments to the Law "On Production and Consumption Waste" which among other things introduces a recycling tax which is viewed as a new tool to promote waste recycling. The law involves the transition to a program method of implementing the organization functions of waste collection, sorting, recycling and disposal. It outlines requirements to the development of regional schemes for waste management (Anonymous, 2014). The company "Ekouniversal" is a leader in environmental services involved in the collection and disposal of >1,000 types of industrial waste. Over 500 large enterprises are served by "Ekouniversal." The

company collects >200,000 tons of solid waste annually. Medical, chemical and industrial waste is junked at the plant in Yaroslavl.

MATERIALS AND METHODS

Industrial waste disposal should begin with an assessment of its hazard class. In accordance with GOST 12.1.007-76 all industrial waste is divided into four toxicity class (Anonymous, 1999); the 1st class waste includes extremely hazardous substances. These are wastes containing mercury, chromate, cyanide, potassium, antimony trichloride, benzopyrene, arsenic oxide and other toxic substances. The 2nd class waste consists of highly hazardous wastes. They contain copper chloride, nickel chloride, nitric acid, lead and other less toxic substances.

The 3rd class waste is moderately hazardous. These are wastes containing sulfuric acid, copper, oxalic acid, copper, nickel chloride, lead oxide, carbon tetrachloride and other substances. The 4th class includes low hazardous waste. It contains manganese sulfate, phosphate, zinc sulfate, zinc chloride.

Solid Domestic Waste (SDW) landfills accept the toxic waste of 3rd and 4th hazard classes only. In this regard, the development of limited liability company "Kazan University Ecology" is of great interest. The essence of the project "Test system for rapid assessment of the hazard class of industrial waste, substances and materials" is the testing of the developed microbial contact method based on an evaluation of the inhibition

of dehydrogenase activity of *Bacillus pumilus* KM21 in the presence of a test sample as well as the supplementing of the method with other test functions, in particular, with enzymes that catalyze nitrogen metabolism. The result of the project is a method for assessing toxicity, registered in the State Committee for the Russian Federation for Standardization and Metrology (Gosstandart) as well as the culture of microorganisms in the lyophilized state. Every year the population and industrial enterprises sent millions of tons of waste to SDW landfills. Some wastes require neutralization before placement on the landfills. Waste neutralization is a technological operation or a set of operations which results in a transformation of a primary toxic substance into a neutral and a non-toxic one. Modern scientific research allows to neutralize a significant portion of industrial waste and ensure safety. In our opinion, the project "Technology of energy processing of Solid Domestic Waste (SDW) in the high-temperature mode with a complex system of waste preparation and flue gas cleaning, developed by Ltd. "CIT" is timely and relevant. The project focuses on disposal of SDW with simultaneous production of heat. The use of high-temperature conditions will significantly increase the efficiency of the combustion process and minimize the content of organic toxic compounds in the flue gases.

RESULTS AND DISCUSSION

Chemical industry accounts for the large share in the Tatarstan economy. The project "Development of technology for finely-dispersed bitumen emulsions based on anionic emulsifiers derived from organic chemistry industrial waste" of LLC "CIT-1" is focused on the use of organic chemistry waste. The project envisages the creation of new finely-dispersed bituminous emulsions, where detergent industry technological waste from Kazan enterprises is used as emulsifiers, namely, cottonseed oil and flux processing waste. Based on the composition and molecular structure of these products they can be regarded as raw materials for producing potentially useful anionic emulsifiers. At the same time the problem of industrial waste disposal is also solved which has economic and environmental benefits.

Construction sector of Tatarstan is rapidly developing in the 21st century. This was facilitated by the well-known projects: "The program of liquidation of slum dwelling", "1000th anniversary of Kazan", "Universiade 2013", "World Swimming Championship 2015", "FIFA World Cup 2018". Accordingly, the demand for building

materials is increasing. Thus, in the Industrial complex of Tatarstan which included >400 enterprises, sales of building materials accounted for approximately 26 billion rubles in 2013. During the VI Russian Investment and Construction Forum the Minister of Construction and Housing Mikhail Men noted that 81 million m² of housing were built in Russia in 2014. One can observe an increase of almost 15% compared to 2013. In this regard, industrial wastes can be used in the manufacturing of construction materials which would reduce their production cost.

Two projects, involving the use of industrial waste in the production of building materials and organization of construction works deserve our attention. The first project "Modified Gypsum dry mix based on local mineral resources of the Republic of Tatarstan and industrial waste", developed by LLC "CeSi". Production of gypsum plaster and putty dry building mixes which by their physical and technical properties correspond to the characteristics of similar modern domestic and foreign products are competitive in terms of price, due to the use of local mineral raw materials and industrial waste.

The second project is the "Production of complex antifreeze additive for concrete based on aluminate component", developed by LLC "CeSi". The project foresees the production of complex antifreeze additive based on industrial waste. Taking into account the composition of the aluminate waste, they can be regarded as effective antifreeze additive components for monolithic construction. At the same time, the problem of industrial waste disposal is being solved which has economic and environmental benefits.

CONCLUSION

Active use of innovations in solving environmental issues allows organizations to reduce production costs, create new jobs, enhance the production efficiency. Collection and processing of industrial wastes becomes a very profitable business. Thus, it is possible to obtain plastic pellets costing 80-140 rub. kg⁻¹ from plastic production waste of a similar weight costing 15 rub. kg⁻¹. The growing role of innovation raises new demands to the question of choosing the most effective methods of industrial waste recycling. The company's commitment to innovation is characterized by an innovative climate that predetermines the success of the innovative projects.

At the moment, the Russian economy sees a disproportion between the presence of innovative opportunities for processing industrial waste and their real implementation, due to the current financial crisis.

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