ANALYSIS OF THE PROSPECTS FOR THE DEVELOPMENT OF AUTOMATION OF TECHNOLOGICAL PROCESSES IN THE CHEMICAL INDUSTRY

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ANNOTATION

This article discusses the development of automation of technological processes in the chemical industry and its prospects for the future. The chemical industry is one of the most important industries in the Republic of Uzbekistan. The issue of automation of technological processes is an important and integral part of this industrial branch.

Keywords: automation of technological process, automated control system, chemical industry, automation of hydrogenation process.

INTRODUCTION

The chemical industry is one of the most important industries in the Republic of Uzbekistan. Virtually every item near us is produced thanks to this industry.

A huge influence on the cost of the final product has the efficiency of the process of processing of chemical raw materials. The main products of chemical industry production are such hydrocarbons as ethylene, propylene and their derivatives. The equipment that is produced for chemical production is most often complex. The main equipment are vessels that work under or without pressure. Often these are hermetically sealed hemispherical vessels made of stainless or carbon steel. They are designed to store and transport chemical products, as well as to conduct chemical and thermal processing processes in them [1, p. 63].

Those that work under pressure are classified as hazardous equipment. Therefore, their production and installation is always controlled in order to comply with stringent technological requirements. Non-pressurized vessels include retorts, tanks, flasks, filling tanks and the like [1, p. 74].

To improve the quality of the technological process, and therefore improve the quality of the final product, it is necessary to automate the technological process of ethylene production at all its stages. Thus, automation of technological processes in the chemical industry is very relevant.

Nowadays, thanks to the high level of development of information technology and the capabilities of computing machines, the process of automation can be given special attention by applying modern technological methods for the design, control and evaluation of the effectiveness of the processes being automated.

As a result of production processes in the chemical industry, a wide range of products are obtained by distillation and separation of feedstock. The composition of the products obtained is very complex [2, p. 108].

The majority of technological processes of the chemical industry is aimed at the separation of raw materials. Intermediate products of chemical industry become a raw material for the subsequent distillation and purification. Today, the most common is cracking, as well as a combination of different processing technologies.

The products resulting from oil refining are used as feedstock for the chemical industry.

Specialists use the conventional division of the chemical industry and its raw material base. There are hydrocarbon raw materials, basic products, chemicals and end products.

Most of the raw materials used in the chemical industry are interchangeable. This makes it possible to obtain different products and semi-products.

Interchangeability of names of raw materials and a variety of technological methods for obtaining products and semi-products in the chemical industry give the opportunity to choose the most optimal production process and adjust to market conditions [2, p. 74].

In technologically advanced countries the depth of oil refining reaches 90 %, in Russia it is 70 % [3, p. 120].

Unfortunately, until now the main responsibility for the most complicated production processes in chemistry is borne by man - the operator. To date, not all processing complexes make full use of automated control systems. Introduction of automated process control systems makes it possible to release the operator from performing the functions of monitoring of the technological process.

To get an idea of the functions the operator has to perform, let's consider only a few stages of oil processing and separation.

The ethane-ethylene fraction obtained in the gas separation plant is first subjected to a heating process in a heat exchanger, then already with the hydrogenated ethane-ethylene fraction in the return flow heat exchanger, only after that is mixed with hydrogen-containing gases and fed to isothermal or adiabatic selective hydrogenation reactors.

The hydrogenation reactor consists of several layers, the number of which depends on the volume of acetylene produced during pyrolysis. Before each layer, the temperature of the fraction is controlled in heat exchangers, after which it is mixed with hydrogen and fed back to the reactor layers. Then after the last layer the hydrogenated fraction is cooled in the heat exchanger of return flows, undergoes dehydration process and is fed to the column for "green oil" washing, where it is separated from ethane-ethylene fraction [4, p. 130].

During the hydrogenation process, the operator has to manually change the operating modes of the unit in stages by adjusting the temperature and hydrogen feed level. These operations must be performed in time because the catalyst begins to lose its properties because its surface is covered by coke, thereby reducing its selectivity and activity. There is a very high probability of error if the operator acts incorrectly, which very often leads to reaction failure, loss of productivity and emergencies or plant explosion [3].

Technogenic disasters often occur when chemical reactions on catalyst systems are improperly controlled. During the control process, the operator is not able to fully process the entire flow of information, analyze the indicators of sensors and instruments, which can lead to loss of raw materials and reduce the performance of power plants and increase process costs.

In order to solve all tasks arising in the course of the technological process of production of products, it is necessary to implement a modern APCS.

There are currently 2 types of elementary control systems. The first type of control is load dosed control of the hydrogenation gas. The second type of control is the dosed control of the hydrogenation gas by the concentration of the hydrogenated acetylene molecule at the reactor outlet [4, p. 138].

These control systems use rigid logic without taking into account the concentrations of chemical elements at the reactor inlet. The existing control systems do not have the ability to control the temperature and kinetics of the chemical process, as well as the activation energy of chemical reactions.

A comprehensive solution to such problems requires the implementation of an intelligent automated control system capable of processing and analyzing the flow of information and making full-fledged impacts.

The chemical industry has great potential for development. First of all, this is due to the fact that the total cost of raw materials for the industry is several times lower than in European countries.

The main problem is that the volume of raw material extraction is gradually increasing, while the capacity of its processing has not changed for several decades.

Another significant problem is that only a small part of raw materials is processed locally. As a result, large quantities of raw materials for the chemical industry extracted on the territory of our country are exported [5, p. 148].

The ecology of the industry is of no small importance. Ensuring it allows us to preserve the natural environment for our descendants.

These problems are not insoluble or extremely difficult. It is possible to allocate some possible variants of their decision by development of systems of automation at the enterprises of chemical branch.

For sufficiently simple processes of processing of technological raw materials it is recommended to use a complex system with the possibility of automated control of input and output technical parameters, combined in SCADA system [5, p. 207].

In complex processing processes, it will be very useful to use an additional subsystem of simulation modeling and a subsystem for assessing the degree of cross-level interaction of enterprise information flows.

It is possible to implement a system based on the possibility of predicting the consequences of operator actions. Such automatic control system can be based on both mathematical and experimental dependencies, which describe the dynamics of technological equipment, the relationship between input and output technological parameters, taking into account the time factor and the probability of events. The main advantage of such a control system is the separation of virtual and real time, as a result of which the automated system can "look beyond" the real events and virtually assess the consequences of the operator's actions or the control system itself.

The process control system for the chemical industry allows to stabilize the production process by controlling all equipment parameters. The production information is fully visualized and has an easy-to-learn interface, with which the operator can issue commands to the actuators. The system itself runs automatically.

The main functions of automation in industry include:

1) Control of equipment through software logic;
2) Automatic optimization of the operation mode of refineries and petrochemical plants;
3) Tracking of operating time, raw material and energy consumption;
4) Long-term storage of received information in the database; 5) generation of reports and other documents in the prescribed form; 6) operational equipment diagnostics.

When developing the APCS, specialists provide for the possibility of monitoring and localization of emergencies at the key production units. For this purpose, automatic sensors connected to the equipment are built into the system. The automated control system can change parameter values or switch nodes both independently and by operator's command.

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