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**TECHNOLOGICAL AND ECONOMIC FEATURES OF ETYL  
TECHNICAL ETHANOL MANUFACTURE  
ТЕХНОЛОГІЧНІ ТА ЕКОНОМІЧНІ ОСОБЛИВОСТІ ВИРОБНИЦТВА СПИРТУ  
ЕТИЛОВОГО ТЕХНІЧНОГО**

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*Abstract. The article deals with the issues of producing technical ethanol from the grain in terms of the combination of technological measures and the determination of the economic feasibility of marketing products in different markets. It is specified that the specifics of such implementation are competition of technical ethanol and products of oil and gas-organic synthesis. A number of measures are considered, which, at insignificant values of their implementation, provide a reduction in the cost of technical processing of grain into technical ethanol.*

*Key words: technical ethanol, methanol, products of technical purpose, yeast, mash, beer.*

**Introduction**

Ethyl alcohol (ethanol) is used in many sectors of the economy and in everyday life. Its largest amount in the world is used as an additive to motor fuels or their main component. In addition, significant volumes of ethyl alcohol are used for technical needs, production of alcoholic beverages, medicine, etc.

In general, there are three main areas of use of ethanol and, accordingly, three of its types as commodity products:

- ethanol rectified; used for the production of alcoholic beverages, vinegar, in some branches of the food industry, in medicine;
- ethanol technical; used in various industries as a solvent, non-freezing component, raw materials for further processing;
- bioethanol (fuel ethanol); used as a component of motor fuels or the main part.

Each of these commodity products has its sales markets, which differ from each other requirements for quality products, value characteristics and the presence of competing products of similar designation, produced by related industries of other countries or other industries, different levels of government regulation. Currently, there is no problem of "product development" (this applies not only to ethyl alcohol), but there is a problem "to sell products with profits." In each item, there are several offers from manufacturers, which allows the buyer to choose the product he needs, taking into account the requirements for the quality of goods and available to the buyer financial resources.

In view of the above, producers of ethanol as commodity products in their technological and technical solutions should take into account not only the production, but also the financial and, consequently, the implementation, the result of their implementation. The overall effect is to ensure the competitiveness of finished products both in local and international markets, thus allowing them to work stably and to consider production issues in both the short and long term.



The article deals with the peculiarities of the production of ethanol technical and technological solutions that are suitable for implementation in view of the specifics of the sale of finished products.

### **1. Specificity of the use of ethanol technical**

Technical ethanol can be used to produce more than 200 types of products of various uses, from synthetic rubber to perfume products. In this case, depending on the directions of use, consumers put forward various requirements for the quality of technical ethanol - from the content of ethanol itself to the amount of impurities that may be present in technical alcohol. These requirements differ significantly from those of alcoholic beverages and other food products manufacturers. Given that the directions of the use of technical alcohol: solvents, non-freezing components, etc. On the market, there are proposals similar products of other industries (primarily petrochemicals); the main role-plays the cost of alcohol and technical products and its use. In most cases, the competitor of technical alcohol is methanol from various sources (mainly from natural gas and waste from the petrochemical industry, but there is also biomethanol). Therefore, technical alcohol must be competitively priced. In many countries, especially the EU, end-users are willing to pay slightly higher costs for non-methanol products (considering the environment), but within reasonable limits.

Thus, when considering the feasibility of introducing technological solutions and their hardware design, it is necessary to take into account their influence on the formation of the cost of production of technical ethanol, that is, on the prospects for its implementation.

### **2. Production of technical ethanol**

The production of ethanol has two main technological stages:

- getting the mature alcohol marc (beer);
- the removal of alcohol from the beer and cleaning it from the admixture with the receipt of the product product of the required quality.

Raw material for the production of technical alcohol may be non-standard grain, molasses and other waste products of food industries.

Ethanol plants of Ukraine are traditionally processed on ethyl alcohol of different types of grain and molasses. Therefore, we do not consider the issue of production of technical alcohol from non-food raw materials, although non-promising raw material for the production of technical alcohol is cellulose-containing raw materials.

The use of new types of raw materials requires significant investment, which is currently unrealistic for the domestic alcohol industry. Therefore, we are considering such technological solutions and equipment that can be really implemented by alcoholic factories of Ukraine at this stage of their production and sales activities.

The main direction of improvement of the technology of obtaining beer is the introduction into production of osmophilia thermotolerant raisins of yeast with the implementation of a complex of technological solutions, which ensures the possibility of fermentation of highly concentrated bases and obtaining beer with high alcohol content, while providing normative indicators of the quality beer and ethanol output.

The first stage of the maturation process is the preparation of mash (milling +



water) and its water-heat treatment. Application in the production of osmophilia raisin yeast provides an opportunity to increase the concentration of dry substances in the mash, and the use of secondary heat sources (reflux water and stillage), along with the dosage of all the required amount of alpha-amylase in the apparatus for making mash, provides an increase in the temperature of the meal and, accordingly, reduces the amount of acute steam needed to increase the mash to the maximum heat treatment temperature. The content of dry matter in the mash (and, accordingly, the content of alcohol in the beer) is limited solely to the ability of yeast to ferment the highly concentrated maturation according to the normative technological parameters of the beer and the yield of alcohol per unit of raw material (if it exists) and must provide the ethanol content in the ripe marsh 14, 0 ... 16.0 vol %, (from the economic point of view - the more, the better).

Today in ethanol production from corn the use of antiseptics is gaining greater popularity to inhibit the contaminating microflora development and decrease its activity. However, despite the spectrum of antiseptics being used in alcohol production technology is wide enough nowadays, information about technological and economic efficiency of their use, influence on the final product quality is absent. In this case, there is a necessity to conduct researches towards that goal and to elaborate the recommendations for the use of antiseptics in ethanol industry.

To prevent the activation of life of a foreign microflora can, except for the effect of high temperatures (75 ... 95<sup>0</sup>C), the use of antiseptics in the stage of preparation of mash. The maximum permissible dose of antiseptic is calculated solely by its influence on the fermentation activity of yeast (without taking into account the influence on the quality of technical ethanol) and, as a rule, it allows to reduce the maximum temperature of water-heat treatment, which also reduces the cost of technical ethanol. Nevertheless, the question of the use of antiseptics should be considered and the economy. For example, the maximum allowable dose of antiseptic is determined by its effect on yeast. Ethanol is produced using dry yeast, which should be periodically renewed. Therefore, it is necessary to make a joint technological and economic analysis that is more appropriate: to apply an increased dose of antiseptic and more often to update the yeast, but to reduce the temperature of thawing, or to work with the maximum possible term of the work of yeast and the corresponding doses of antiseptics and the temperature of thawing. Here, along with technology, the process economy is also important.

The amount of stillage, which can be used in the stage of cooking, as well as the multiplicity of use is limited to the production parameters of yeast. Again, it is necessary to make a comprehensive calculation again: increasing the amount of stillage and its multiplicity of use can lead to more frequent updating of yeast, but reduces the use of the will of the drinking quality and the sharp pair. In addition, here the economy should sum up - which is more profitable in monetary terms.

In the production of the technical ethanol, it is expedient to introduce continuous fermentation with biomass recycling. This increases the productivity of the fermentation department and, accordingly, reduces the cost of technical ethanol. In this case, the technological scheme should provide for the process of solubilizing the rarefied mass in a separate apparatus.



The specifics of the production of technical ethanol from grain also include the following.

The maximum possible morphological characteristics of yeast ethanol content in the ripe mash significantly reduces the cost of steam for its distillation.

Even if the buyer submits certain requirements for the presence of impurities in the technical ethanol (for example, manufacturers of non-freezing washing liquids for cars limit the content of aldehydes, esters and fusel oil), the ethers column works without hydrolysis. For the production of a number of grades of technical ethanol (for which there are no restrictions on the content of the main and final impurities), the ethers column is not used at all. In this case, the cost of technical ethanol (taking into account the distillation of the bar with high alcohol content) is minimal. In addition, the experience of cooperation with European consumers shows that even in one country there may be different requirements for the content of ethanol in finished products. Thus, the formulations of production of non-freezing washing liquids for cars of the two Austrian manufacturers are calculated on the content of ethanol in technical alcohol at the level of 94%. and 95% vol. Reducing the content of ethanol in technical alcohol (if possible) is a way to reduce its cost.

The current domestic normative documentation also provides for the production of absolute (dehydrated) technical ethanol with a concentration of ethanol from 99.0% vol. up to 99.99% vol.

### **Conclusion**

The raw material base of Ukraine, the availability of skilled personnel and their training system (universities, institute of postgraduate education) provide the opportunity to develop the production of technical ethanol for both domestic market and export needs.

World ethanol markets have a certain level of prices for various types of ethanol as commodity products, and the production of ethanol within these prices creates opportunities for its export.

Thus, the production of technical ethanol, unlike alcohol for food purposes, aims to meet the needs of many industries to produce a wide range of products for various purposes and does not directly depend on the population. Therefore, producers can count on the long-term stable operation of their enterprises, provided that the competitiveness of both technical ethanol and products with its use is ensured. When considering the feasibility of introducing new technological and technical solutions, the determining factor is their influence on the cost of technical ethanol.

Technology and the economy must be inseparable, and then the success in the production and realization of technical ethanol will be ensured.

*Анотація. В роботі розглянуті питання виробництва спирту етилового технічного з зерна з точки зору поєднання технологічних заходів та визначення економічної можливості реалізації товарної продукції на різних ринках. Вказано, що специфікою такої реалізації є конкуренція технічного спирту та продуктів нафто- та газоорганічного синтезу. Розглянуто ряд заходів, які при незначних вартостях їх впровадження забезпечують зменшення вартості технічної переробки зерна у технічний спирт.*

*Ключові слова: спирт етиловий технічний, метанол, продукція технічного призначення, дріжджі, заміс, бражка.*

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