RESEARCH ARTICLE

On Chemical Production Technology in Chemical Engineering

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Abstract: Chemical industry plays an important role in China's national economic system. The development of chemical industry is of great significance to China's economic and social development and modernization. However, due to the various types of work and products in the chemical industry, the production process is more complex. And a large number of toxic substances are often discharged in the production process. Waste gas, waste residue and waste water will lead to environmental pollution. It is a "big polluter" in many industries. Considering the important position of chemical industry in social and economic structure and the characteristics of chemical engineering, it is bound to put forward higher requirements for chemical engineering and chemical production process. This article will briefly introduce the chemical production process in the key period of China's industrial structure transformation, analyze the problems existing in China's current chemical production, and put forward corresponding countermeasures in order to improve the development capacity of China's chemical engineering and promote the healthy and sustainable development of the industry.

Keywords: Chemical engineering; production process; pollution problem

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1. Introduction

With the further deepening of social division of labor, the chemical industry has gradually penetrated into all links of social construction and development, and its products are all over all aspects of people's daily work and life. However, for a long time, the chemical industry, including oil refining and metallurgy, has not only promoted social and economic growth, but also brought some problems of pollution and waste of resources. Based on the continuous deepening and implementation of the concept of sustainable development in the industry and society, optimizing chemical production process, scientifically processing chemical raw materials and doing a good job in the collection and classification of chemical products are of great practical significance to promote the development of the whole industry. At the same time, the industry should also pay attention to the research, introduction and application of green chemical production processes. In recent years, the research on chemical production process in China's chemical industry has been deepening, and certain achievements have been made after long-term development and practice. However, the problems that have plagued the development of the whole industry for a long time can not be solved overnight. Only by continuous attention and increasing research can we better promote the improvement of chemical production process level.

2. Principles of Chemical Process Flow

According to the development of China's chemical industry, it is divided into three categories: petrochemical, basic chemical and chemical fiber. Although there are differences in production and marketing modes in different fields, there are some commonalities in some production processes, which is bound to follow the principle of chemical process production process. As a key link in chemical engineering, the quality of chemical process will directly determine whether the project can be carried out smoothly. In order to operate each unit more conveniently, the whole process will generally be shown in the form of drawings. In the process of chemical production, in addition to meeting the quality and model of raw materials, the production process and production mode adopted by the enterprise must follow the modern mode. The whole

process needs to strictly follow the production principles of high yield, low consumption and low cost. In the process of production, the conversion rate of chemical reaction should be considered first, so as to reduce the waste of resources caused by low conversion efficiency and improve the technical level of production process. At the same time, chemical enterprises should also pay attention to the secondary utilization of resources, set recovery and separation procedures in the production process, and fully recycle the by-products and other chemical products produced in the production process [1]. Secondly, the cold and hot reaction in chemical production requires chemical enterprises to have a basic understanding of their field and common chemical reactions, and make full use of the heat generated inside the process, so as to purposefully reduce the external heating and cooling consumption and achieve the purpose of solving the cost. In addition, in the process of chemical production, the flexibility of the chemical process itself should be ensured, so that the enterprise can adjust the process itself in time.

3. Analysis of Chemical Production Process

3.1 Scientific Treatment of Raw Materials

The treatment of raw materials is not only the premise of chemical production, but also an important content of chemical process. Different kinds of raw material treatment procedures will have a certain impact on the quality of chemical production. In the preparation and treatment of gas raw materials, chemical enterprises need to take the production effect as the basis, strengthen the operation guarantee before production, do a good job in the storage of gas materials, and avoid deterioration of materials at the same time. In the treatment of fixed materials, the dissolution and fusion methods are correctly adopted to ensure the feasibility of subsequent processes and the rigor of production. In the treatment of liquid materials, filtration and evaporation are generally used. In the process of chemical reaction, the waste of raw materials should be effectively controlled, pretreatment should be carried out in advance, and scientific treatment of different types of raw materials should be done well.

3.2 Multiple Chemical Reactions

Chemical reactions in chemical production are mainly heat release and heat absorption. When producing different chemical products, chemical enterprises need to fully consider the differences of chemical reactions of different chemical products, formulate paper instructions for different processes and determine the corresponding treatment methods.

3.3 Product Treatment

The purity of the product obtained from the chemical reaction of raw materials is generally not high, which contains a variety of impurities and cannot be used as the final reaction product. For the products obtained by chemical reaction, technicians need further treatment, and enterprises need to judge their application value according to the types of impurities and collect impurities by classification. In the process of product refining, technicians need to collect valuable products for reuse and optimize the waste treatment process and scheme [2].

4. Problems in Chemical Production in Chemical Engineering

4.1 The Overall Chemical Production Efficiency is Low

As an important driving force of China's social and economic development, chemical industry plays an important role in the transformation of China's social and economic system. However, due to the impact of the shock of the international chemical market on China's chemical industry in recent years, coupled with the national adjustment of the traditional industrial structure, the development of China's chemical industry is facing challenges. Throughout the development of China's three major industries, the development of chemical industry is not optimistic. The main reason is that China is still in the primary stage in the research of chemical process. The problems such as low production efficiency and environmental pollution caused by the backward technical level will become the main obstacle to the development of chemical engineering in China in the future. For example, the production of chemical fertilizer requires chemical enterprises to control the temperature and humidity in the production process. However, due to the poor quality of reaction vessels or improper process management of some enterprises, the low quality level of chemical fertilizer and the generation of a large amount of waste can not meet the demand for high-quality chemical fertilizer in agricultural production, but also cause environmental pollution.

4.2 Low Environmental Protection Capacity of Chemical Production

The chemical industry has always been a key industry in pollution prevention and control. China's environmental pollution problems are largely caused by chemical production, especially the pollution mainly caused by heavy metals and chemical wastes. For a long time, in order to reduce costs, some chemical enterprises discharged

untreated sewage and waste gas, which not only damaged the surrounding environment, but also posed a threat to the health of surrounding residents [3]. In recent years, aiming at the pollution problem of the chemical industry, the environmental protection department has successively issued a series of regulations and policies to guide chemical enterprises to change their thinking of chemical production, optimize the production capacity structure, and shut down a large number of non-conforming chemical enterprises.

4.3 Lack of Coherence in Chemical Production Process

According to the current development situation of China's chemical industry, it can be found that the high production cost and low production efficiency are still the problems that can not be effectively solved in the development of China's chemical engineering. The reason is that many chemical enterprises in China have a low level of chemical process, can not ensure the continuity of production work in the production process, can not be effectively connected between different production links, and the reaction process also lags behind. As a result, a large number of chemical resources are wasted, which virtually increases the production cost of enterprises.

5. The Application Strategy of Chemical Production Process in Chemical Engineering is Discussed

5.1 Optimization of Reaction Unit

As one of the industries prone to pollution, it is necessary to balance economic and ecological benefits in the process of development. In the process of production, chemical enterprises should first start from the perspective of ecological and environmental protection, reduce the damage to the surrounding ecological environment and improve the utilization efficiency of resources. In addition, there are many factors affecting the smooth progress of chemical engineering, some of which are highly unstable, which is difficult for chemical enterprises to control and easy to have a negative impact on industrial production. In this regard, chemical enterprises should scientifically analyze various conditions of chemical reaction in the process of production, so as to improve production quality and efficiency. On the one hand, chemical enterprises can introduce waste purification devices to strengthen the treatment capacity of waste and reduce waste discharge. On the other hand, chemical enterprises need to make full use of their own chemical advantages to improve the advanced nature of [4]. For example, ethylene is widely used in chemical production. Considering that there are many ways to obtain ethylene, chemical enterprises can produce ethylene according to their needs, optimize the production process and improve the production efficiency. Ethylene can be obtained by the opposite reaction of water and ethanol. In the process of synthesis, chemical enterprises need to constantly improve the chemical reaction processes and improve the synthesis efficiency. In August 2015, the "200000 t / a complete technical process package for cyclohexanone preparation by esterification and hydrogenation of cyclohexene" jointly developed by the Academy of Sciences and Baling Petrochemical Company proposed a new technical route for cyclohexanone preparation based on optimized production process, which can effectively reduce hydrogen consumption and improve atomic economy and process economy. The reaction equation of the new process for preparing cyclohexanone is shown in Figure 1.

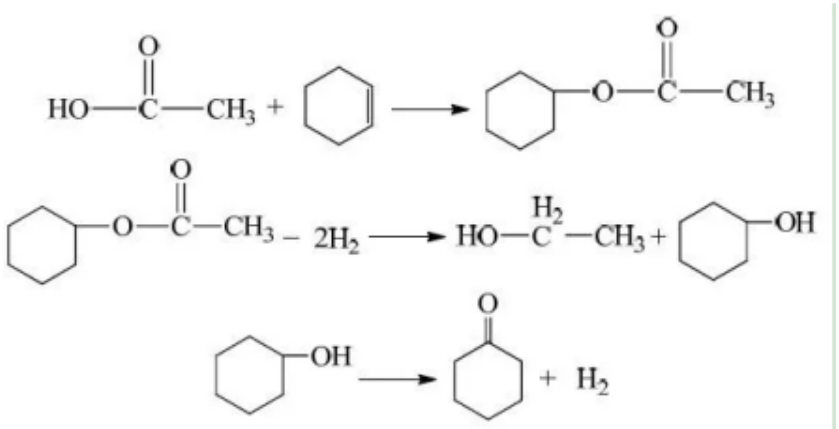

Figure 1. New preparation process of cyclohexanone

5.2 Adjusting Reaction Conditions

Chemical production has high rigorous requirements, and various subjective and objective conditions in chemical reaction may become factors affecting production quality. With the development of society, the demand for chemical products is increasing, and the scale of chemical engineering in chemical enterprises is also expanding. Not only the management difficulty is improved, but also the requirements for chemical production process are improved. In this regard, it is necessary for chemical enterprises to optimize chemical reaction conditions, take production efficiency as the core and build a high-quality production system for the purpose of reducing the impact of unstable factors on chemical production. As an important element in chemical reaction in chemical production, the use of catalyst directly affects the quality of chemical production. There are many types of catalysts and their catalytic effects in different chemical reactions are also different. Therefore, chemical enterprises can take the use of catalysts as the starting point to master the properties of different catalysts. In chemical engineering, it is necessary to clarify the use specifications of catalysts in chemical production and master the use methods of heterogeneous and homogeneous catalysts, Minimize the generation of waste and improve the quality of production. In addition, in some cases in the chemical industry, metals such as platinum and palladium will be used as catalysts, in which platinum can also realize the conversion of substances such as nitric oxide [5]. It can be seen that catalyst has high application value in chemical process. Its rational utilization can significantly improve production efficiency and reduce waste emission.

5.3 Waste Reduction

In chemical production, due to the pollution of raw materials and other factors, waste is often generated after chemical reaction. The generation and treatment of waste in the reactor mainly include the following six ways: first, due to various reasons, some raw materials fail to fully react in the reactor and are difficult to recycle again, For the treatment of this kind of waste, enterprises are required to adopt the method of improving the conversion rate of single irreversible reaction. Second, chemical enterprises need to reduce waste from the main reaction of producing waste by-products. Technicians need to adopt a variety of reaction paths to reduce waste according to the types of raw materials and the specific types of chemical reaction. Third, the compound reaction is carried out again in various by-products of waste generated by the reaction to achieve the purpose of waste treatment. In addition to the main reaction, the chemical side reactions in the process of chemical production may also lead to the generation of a large amount of waste. In this regard, technicians need to treat and reduce waste or treat waste in terms of reactor type, reactant concentration, reaction temperature and pressure regulation. Fourth, minimize the generation of waste. If there are large impurities in the feeding process, the chemical reaction may turn raw materials or products into waste, resulting in waste. In this regard, chemical enterprises need to weigh the cost of feed purification and waste treatment. Fifth, improve the value of waste by-products. Technicians can react them again in another different reaction system according to the by-products obtained in chemical production, so as to improve their value and reduce the generation of unusable waste. Sixth, minimize catalyst waste, and use heterogeneous catalyst in the production process as much as possible, so as to reduce the generation of waste on the one hand, and reduce the difficulty of product separation and feed recycling on the other hand. For chemical enterprises, a large amount of waste generated in the process of chemical production will not only cause waste of resources, but also increase their treatment cost. Therefore, it is necessary to improve the production process from the perspective of reducing waste generation, optimize the chemical reaction conditions to the greatest extent, improve the purity of reaction products and reduce waste generation.

5.4 Improve the Comprehensive Utilization Rate of "Three Wastes"

In the process of chemical production, due to the influence of various factors, the generation of waste is often inevitable. In addition to reducing the generation of waste as much as possible, we should also improve the comprehensive utilization rate of waste to the greatest extent. Industrial enterprises need to adopt appropriate methods to recycle and utilize chemical reaction by-products according to their specific types and properties, which can not only control the "three wastes" pollution, but also create additional value. In the treatment of waste gas, chemical enterprises usually use condensation method and catalytic combustion method. Chemical enterprises need to comprehensively weigh the cost and adopt the corresponding treatment scheme according to the specific situation of waste gas. The treatment of typical chemical waste gas mainly focuses on flue gas desulfurization and flue gas denitration. Various toxic and harmful gases produced in the process of chemical production can be properly treated. Chemical and biological methods can be used for wastewater treatment. The biological wastewater treatment process is characterized by the membrane

adopted by the New Membrane Biosensor [6]. Generally speaking, it can treat sewage that is difficult to be treated by chemical means such as mineral oil. Chemical means mainly include SBR process, a / O process, etc. (the SBR wastewater treatment process flow chart is shown in Figure 2). Compared with the above two wastes, the remaining waste residue after chemical reaction can continue to be recycled for other purposes. The unrecoverable part is usually stacked for treatment, and harmless treatment is carried out by means of oxidation and hydrolysis.

5.5 Reduce Kinetic Energy Consumption

Firstly, chemical enterprises can actively introduce frequency conversion control procedures in chemical production. At present, many enterprises have applied motor drive system in chemical production, which helps to liberate manpower and improve production efficiency. However, a large number of practices show that the motor drive system will produce a lot of energy consumption in the operation process, resulting in a lot of resource waste in the production process. In this regard, chemical enterprises can install frequency conversion control program in the system, which can ensure production efficiency and reduce the impact of energy consumption [7]. Secondly, chemical enterprises need to optimize the heating system. In the process of chemical production, they need to provide continuous and stable thermal energy resources for the occurrence of chemical reactions. From the perspective of cost saving, chemical enterprises need to optimize the existing heating system, improve the utilization rate of thermal energy resources and reduce the waste of excess thermal energy. In addition, the chemical industry needs to actively develop new chemical energy and reduce its dependence on traditional energy. At present, the processes used in China's new energy development mainly include nanotechnology and electrochemistry. Therefore, chemical enterprises should increase the research on the chemical process of energy development and improve the health of chemical production process.

5.6 Increase the Introduction and Application of Green Chemical Production Process

Through the analysis of the current situation of green chemical production process, it can be found that green chemical industry will become the main direction of the development of China's chemical industry in the future. The characteristics of green chemical production process are mainly reflected in bioengineering science, cleaner production process and the sustainable utilization of environmental protection products. At present, the disciplines represented by biochemistry and bionics have made great efforts in the field of chemical industry. Based on the application of bioengineering, the investment in the process of chemical production is relatively small, and there are few pollutants. Its main feature is that raw materials are usually non-toxic and harmless. For example,

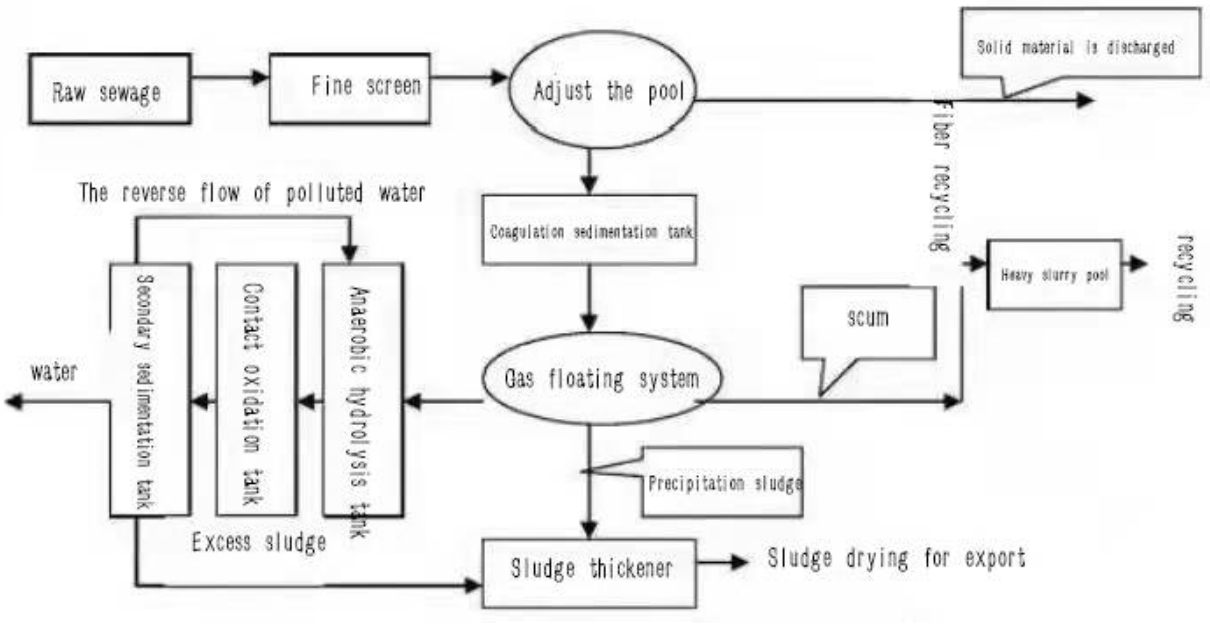

Figure 2. SBR wastewater treatment process flow chart

microorganisms are used as raw materials to realize the transformation of renewable resources. Moreover, the chemical reaction can also be carried out without toxicity and harmlessness. The chemical reaction has high selectivity, produces relatively few wastes and impurities, and the products after the reaction are also friendly to the natural environment. Various enzymes are commonly used in chemical environment, and the reaction conditions and products are mild to human and nature, At present, it is applied in the production of many chemical products (the solid-state fermentation production process of bio organic fertilizer is shown in Figure 3). At present, the cleaner production process is mainly based on the research on waste pollution. In the current research and practice, it emphasizes the harmless treatment of chemical production pollutants and the treatment of pollution problems [8]. The goal of cleaner production process is to realize the comprehensive utilization of various resources in the process of chemical production. In addition to the maximum utilization of raw materials, it also includes the secondary utilization of various by-products, which helps to improve the utilization efficiency of resources and reduce the impact of production activities of industrial enterprises on the surrounding environment. In addition, the current chemical industry advocates the use of environmental protection products, such as green alcohol and a series of environmental protection products, which can replace traditional chemical products. The raw material of green alcohol production is natural sugarcane. The production process is environmentally friendly and has been widely recognized in chemical engineering.

6. Conclusions

To sum up, the development of the chemical industry has also promoted China's social and economic development to a certain extent and made an important contribution to China's modernization. However, for a long time, the development of chemical engineering and chemical production has caused some damage to the ecological environment and led to a waste of resources. In order to promote the healthy development of the industry, chemical enterprises need to improve the production process through a variety of methods. This paper analyzes the three main problems existing in chemical production in China's current chemical engineering, and puts forward solutions from the level of chemical production technology, in order to bring some guidance to the development of chemical engineering and improve the flexibility of chemical production technology in China.

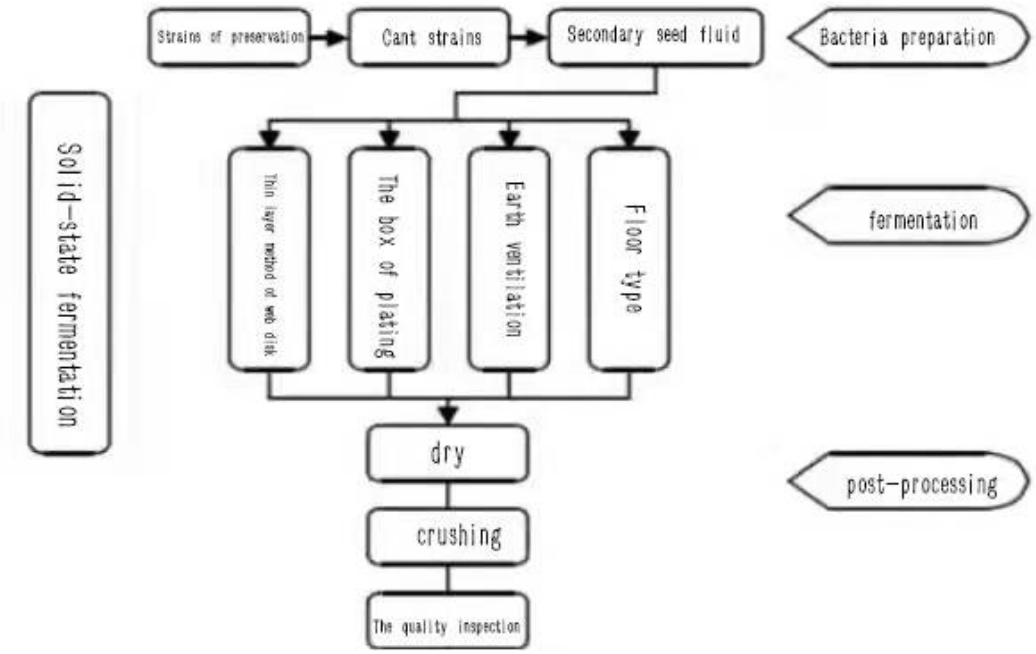

Figure 3. Solid state fermentation process of bio organic fertilizer

References

[1] Zhang, Y., Zhuge, Sh.Y., 2021. Chemical Industry Management. (31), 46-47.

[2] Jia, X.F., Yang, Zh., Han, Ch., 2021. Chemical Industry Management. (31), 150-151. (in Chinese)

[3] Mi, C.H., 2021. Discussion on process design of energy saving and consumption reduction in chemical process. Chemical Industry Management. (30), 46-47. (in Chinese)

[4] Tian, B., 2021. New technology of energy saving and consumption reduction in chemical process and its application. China Petroleum & Chemical Standard & Quality. 41(18), 175-176. (in Chinese)

[5] Tian, B., 2021. Current situation and existing problems of chemical process design. Chemical Design Communication. 47(09), 62-63. (in Chinese)

[6] Wu, R.X., Zheng, Z.L., Wang, Ch.L., et al., 2021. Shandong Chemical Industry. 50(18), 209-210+214. (in Chinese)

[7] Guo, H.F. Analysis of energy saving and consumption reduction strategy in petrochemical production [J]. Public Standardization,2021(18):258-260. (in Chinese)

[8] Huan Xiaochun, Zhang Zhenliang, Wang Enxiang, GAO Qiang.Chemical Engineering and Equipment,2021(09):241-242. (in Chinese)