Discussion on the Development of Green Chemistry and Chemical Engineering

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Abstract: Chemical industry plays a vital role in the development process of national economy. However, in view of the special nature of the chemical industry, a large number of poisonous and harmful substances pose a great threat to the ecological environment and human health in the entire process of raw material acquisition, production, transportation, product manufacturing, and the final practical application. Therefore, it is a general trend to promote the development of chemistry and chemical engineering towards a greener environment. This article will focus on some basic problems occurred in the development process of green chemistry and chemical engineering.

1. Connotation of green chemistry and chemical engineering

Simply put, green chemistry is a harmless, clean, and green. The key idea of green chemistry and chemical engineering is to apply chemical principles to the source to minimize the adverse effects of the chemical industry on the environment caused by the chemical industry. And the main development direction of green chemistry and chemical engineering should meet the two requirements of ecological environment protection and human health\(^1\). The chemical technology and related theory knowledge, experimental methods can be applied to various chemicals production, transportation, application and other aspects, so as to reduce or even completely eliminate its adverse effect for the health of people and the environment, avoid the production of all kinds of side effects, and make full use of all kinds of resources, and thus to meet the requirements of sustainable development, and ultimately realize the goal that there is no pollutants in the process of production, so that all pollutants can be eliminated before production\(^2\).

The essence of green chemical industry is to use new ideas of environmental protection from the initial source of new enterprises to carry out new design, so as to achieve the purpose of green and fresh; as for the fact that current enterprises focus on the optimization and integration in the production process, after fully grasp the specific logistics trends, energy gradient and waste recycling technology can be applied to realize the recycling and reuse of waste, which will lead to the effective realization of the concept of sustainable development\(^3\), ensuring that the chemical products in the production and consumption process do not emit any pollutants. And one of the most striking feature of it is the application of modern theories and methods of science and technology to reduce or even completely eliminate the harmful substances in the whole process of chemical products from raw materials to the final application, thus making the research, development, production and application of chemical products be more in line with the requirements of environmental protection, and realizing the harmonious development of human and nature.
2. Development Principles of Green Chemistry and Chemical Engineering

In the development of green chemistry and chemical engineering, in order to realize effective protection of ecological environment and avoid pollution to water quality and soil, the following principles should be observed:

(1) In the chemical industry, we must firmly grasp the concept of green environmental protection when designing the chemical products, so as to significantly improve the utilization rate of chemical products in the process of production, and effectively ensure that chemical products can achieve higher quality level in the green environmental performance.

(2) Because a large number of chemical solvents are carrying a certain toxic and harmful substances, therefore, in the light of some chemical auxiliary products, we should try our best to reduce the amount of solvent, and try our best to apply more green, environmental protection and pollution-free alternative materials.

(3) In the process of chemical production, chemical residue is one of the most serious environmental pollution factors, therefore, in dealing with this problem, it is necessary to continue to actively improve the production process, and the residues in chemical industrial process should be treated in a timely manner so as to convert them into substances that have no toxic side effects, and then discharge treatment can be carried out to avoid serious pollution of water and soil[4].

(4) In the development process of the chemical industry, we must take the green, environmentally friendly, and harmless treatment to production materials and conditions used in the production process, scientifically select materials without any pollution, and scientifically arrange the production process to avoid explosion, leakage of pollutants and other accidents.

3. Basic Problems Faced by Green Chemistry and Chemical Technology

3.1. Green Design

Since the human society has entered the new century, in the face of the worsening ecological environment crisis, people have become more and more conscious of environmental protection, the concept of "green design" has gradually begun to be widely used in various fields of social life. Green design shows people's thinking about the relationship between the development of modern science and technology and the destruction of ecological environment, and it has become a hot topic in the field of industrial technology [5]. In the industrial field, people's awareness of environmental protection is increasing, and the chemical product design has evolved from the traditional pursuit of only the maximization of economic interests to making environmental goals a standard, and comprehensively weighing the economic factors, social development and ecological environment and other aspects of the content to carry out design work. Because the overall framework of chemical product design will directly determine the extent of the impact on ecological environment, therefore, we must take full account of the research and development, production, application, waste recycling and other aspects of chemical products in the design phase rather than thinking about the methods to deal with the final waste when processing the products, or even after the products have been produced and the application has been scrapped. The green design of the chemical industry is shown in Figure 1 below.
In carrying out the design of chemical products, we should consider the appearance, function and cost of the product itself, and firmly grasp the content of resource saving, environmental friendliness, recycling and easy operation. The most obvious features of green design and traditional chemical product design are embodied in: (1) Ecological benefits are good. The design process should not only consider the economic benefits of chemical products, but also pay attention to the environmental and social impacts of chemical products in the whole life cycle. (2) Realize efficient utilization of resources. From the point of view of sustainability, renewable resources should be used as far as possible to maximize the utilization of resources. (3) Keep the technology advanced. In the production process of chemical products, advanced technical means must be adopted to achieve better green effect.

3.2. Green Production
The whole process of chemical production, that is, the conversion of raw materials into products, is the whole stage from the ideological level to the physical and technical means. The initial form of the product is established by design, however, no matter how excellent the design, it must also be carried out through actual production links before it can eventually acquire products of practical value, and the production process is also a phase that must be experienced in the phase of green development of chemical technology. In this stage, the most important thing is to ensure that the raw materials used are harmless, concretely speaking, it can be realized in the following aspects: (1) Ensure the cleanliness of raw materials. Raw materials should be fully applied, because in some areas of technology, raw materials themselves have higher requirements for purity, conversion rate, etc., therefore, if the application is not enough, it will cause unnecessary waste of resources. (2) Use renewable raw materials whenever possible. The material mainly consists of paper, steel and other raw materials. (3) Use alternative raw materials whenever possible. Some chemical production process may cause pollution, and release toxic material. Therefore, some non polluting alternative raw materials should be chosen. (4) Use materials with low energy consumption as raw material as much as possible. Generally, the more complex the product processing technology is, the greater the energy consumption will be, therefore, under the same treatment requirement, we should choose the simple process technology as much as possible.

After the screening of the raw materials, we can be enter into the production process, which is an important basis for enterprises to carry out various work, and is the stage that has the most frequent interaction with the ecological environment. The impact of the production process on the environment is shown in Figure 2.
3.3 Green Packaging and Marketing

The marketing of chemical products mainly includes packaging, transportation, warehousing, sale and so on. It is the most important function of packing to ensure the good quality and appearance of products, so that it is more convenient to transport and store. And it is very important to take proper packing. However, the chemical products sold on the market are generally over packed, and the packages can be seriously polluted after being discarded. In the green chemical industry, green packaging is also one of the most important aspects, and it is the most important content to promote the sales of chemical products to be green, and the packaging of chemical products must be carried out in accordance with the "3R1D" principle, that is to reduce the loss of packaging materials, packaging containers reuse, packaging materials recycling, and the effective degradation of packaging materials.

The marketing of the products is right after the green packaging. The traditional enterprise marketing process often takes into account the short-term economic benefits, but ignores the long-term interests of social development. And with the worsening of the current resources, environment and other issues, green marketing concept has come into being. Compared with the traditional marketing, the green marketing concept pays more attention to the overall efficiency level of society, and pays more attention to the social responsibility that enterprises should undertake. Chemical enterprises adopt green marketing strategy, which is mainly embodied in: (1) Speed up the innovation of chemical enterprises in production technology, marketing thinking and sales strategy; (2) Promote the overall promotion of resource utilization, so that the production costs of enterprises can be greatly reduced; (3) Realize the diversification of chemical products and improve the social image of enterprises; (4) Broaden financing channels. At present, the state has given great support to green development, and green marketing will help enterprises to get more financial support.

3.4 Green Consumption

Consumption plays a crucial role in human economic life, and it is directly related to all aspects of social life, and also has a great impact on the ecological environment. The impact of consumption on the environment is shown in Figure 3.
From the perspective of chemical products, the connotation of green consumption can be summarized as the following: (1) the consumption process can effectively reduce the loss of resources; (2) the products consumed are green, chemical and chemical products; (3) the consequences of consumption are not harmful to themselves and the environment, and are characterized by sustainability. The factors that influence the consumption of chemical products comes from every aspect, first, people must have the idea of green consumption; the second aspect is about differences in income levels. Only when people's income level has reached a certain level can they begin to consider green consumption. After all, people's income level is sensitive to price differences, and economic base determines the superstructure. The green consumption of chemical products is the result of the joint efforts of many aspects of society. And the government should play an active role in guiding and publicizing.

3.5 Waste Treatment and Reuse
The raw material acquisition, production and final application of chemical products can cause certain environmental pollution, and eventually waste water, waste residue and other wastes will be discharged. The recycling of these waste materials is the last step of chemical product life cycle, and once this link is missing, the wastes directly discharged into the natural environment can not only cause environmental pollution, but also will cause the waste of resources. Many wastes are not in themselves good for nothing, they can even be said to be just “misplaced resources”. With appropriate recycling and reuse technologies, components that can be reused can be obtained, and this is also an important part of green chemistry and chemical engineering.

4. Conclusions
Since the human society has entered the new century, the trend of economic globalization has become increasingly serious, and the environmental problems faced by all countries in the world have become increasingly prominent. In order to fully protect the ecological environment, and promote the green, environmental protection and sustainability of social and economic development, all countries in the world are vigorously carrying out research work on new energy sources. In the era of increasing chemical pollution, green chemistry and chemical industry came into being, and in the development of chemistry and chemical engineering, using the idea of "green", adopt green manufacturing methods, and paying attention to the training of talents in the field of expertise will be the main direction and goal of our country's future efforts in the field of chemistry and chemical engineering.

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