

# Research on Recovery and Reuse of Carbon Dioxide in China

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## Abstract

**In nature, carbon dioxide is mainly distributed in trees, oceans, rocks and sediments. Among them, the forest has the highest carbon dioxide content, accounting for more than 60% of the total, while the carbon dioxide concentration on land is higher, but its average concentration is lower than the global average. In the process of industrial production, due to the extensive use of fossil fuels, the air pollution is becoming more and more serious, and the greenhouse effect has become the focus of attention of all countries in the world. Based on the actual situation of our country, this paper analyzes the emission of carbon dioxide and its causes, and puts forward corresponding countermeasures and suggestions.**

## Keywords

**Carbon dioxide; recovery; reuse.**

## 1. Introduction to carbon dioxide

In recent years, a series of problems such as global warming, sea level rise and frequent occurrence of smog have seriously threatened the living environment of human beings. The impact of the greenhouse effect has become increasingly prominent, and the contradiction between energy shortage and ecological environment deterioration has become increasingly acute. Under this situation, governments around the world have issued relevant policies one after another to advocate energy conservation, emission reduction, and green development in order to achieve sustainable economic and social development. In November 2015, the "Opinions of the State Council on Accelerating the Reform of Ecological Civilization System", the "Thirteenth Five-Year Plan" proposed to "establish and improve resource conservation mechanisms, strengthen low-carbon emission management, improve The level of energy consumption reduction, promote the localization of renewable energy technologies and equipment, promote low-carbon industries and clean production, and build a beautiful China." [1]

At present, the main source of carbon dioxide and other gases is fossil fuels, and with the enhancement of people's awareness of environmental protection and the importance of environmental protection, the proportion of carbon dioxide in the atmosphere also increases. According to relevant data, China's CO<sub>2</sub> concentration has reached a peak, while the international average level is 0.02, while the domestic average level is 0.5, and China's annual total CO<sub>2</sub> concentration exceeds 500 million tons. This shows that on a global scale, my country's research on carbon dioxide emission reduction and recycling is still in its infancy, and a complete theoretical system has not yet been formed. Therefore, in practice, how to effectively recover and rationally use carbon dioxide is a There is an urgent problem to be solved. [2]

## 2. The recovery method of carbon dioxide

### 2.1. Low temperature distillation method

The low temperature method refers to heating carbon dioxide at high temperature to convert it into water vapor, and then discharging it from the container. In this process, carbon dioxide will be absorbed and liquefied, so as to achieve the purpose of recovery and reuse of carbon dioxide. At the same time, the cryogenic method can also increase the gas temperature, thereby reducing the concentration of CO<sub>2</sub>. In addition, the low temperature method can effectively control the greenhouse effect. In industrial production, the commonly used low-temperature methods are: ① Pyrolysis and gasification, that is, the carbon dioxide is converted from a gaseous or liquid state to a solid gas and liquid mixture or oil as a raw material, and is evaporated, liquefied, added Press and other processes to obtain the desired crude product. ② Condensation, that is, dissolving carbon dioxide in water, transferring heat to a part of the components by cooling, and converting it into heat energy. ③ Vacuum condensation is a low-level heat medium formed by using the density difference of air. ④ Extraction is a technical means of extracting with the boiling point of the solvent, and this method is used for compounds with high impurities.<sup>[3]</sup>

### 2.2. Membrane separation method and solvent absorption method

Membrane separation method is a method of separating the tested samples by using different concentrations of organic solvents to obtain the content of components in the mixture of the tested substances. The technology uses water as the medium to form a thin film on the surface of the test object, making it close to the solubility of the test object, so as to achieve the purpose of extraction. At the same time, the volatilization of the substance to be tested can be controlled by changing the pH value of the solution, so that it has higher selectivity and higher purity. The principle of the solvent absorption method is to use the soluble solvent to extract the target compound, separate the obtained solvent from the system to be measured, and then go through filtration, washing and other processes to finally remove the desired impurities. The advantages of this process: simple operation, low cost, low energy consumption, and renewable. However, there are also some shortcomings, such as: the investment cost of equipment is large, it requires a lot of human and financial investment, the productivity is not high, and it is easily affected by the environment. Therefore, the application of this method is limited.

### 2.3. Catalytic combustion method

Catalytic combustion refers to the method of converting carbon dioxide into chemical energy and then converting it into other forms of energy through chemical reactions to produce raw materials and fuels for life. Its main principle is to use the catalytic action of the catalyst to separate the formation of carbon dioxide from the reaction in the synthesis process, thereby obtaining CO<sub>2</sub>, H<sub>2</sub> and other gases. The characteristics of this process are as follows: ① In this process, due to the presence of carbon dioxide, it will decompose and generate a large amount of hot exhaust gas, so a lot of nitrogen oxides will be emitted in the whole process, and the content of these nitrogen oxides will vary with temperature. Therefore, this technique can be used to analyze the composition and properties of hydrocarbons to determine the type, concentration and distribution of hydrocarbons. ② The design of the device needs to take into account the factors affecting the environment, for example, to ensure the cleanliness of the air, avoid excessive dust pollution, and pay attention to ventilation to reduce the discharge of harmful gases. ③ The equipment used must have certain corrosion resistance to prevent damage and accidents caused by prolonged exposure. At the same time, it should also have good sealing performance for the safety of operators. In addition, it should also have anti-corrosion functions.

### 3. The use of carbon dioxide

#### 3.1. Synthesis of lipids with carbon dioxide as raw material

Ester raw material is an important chemical raw material. It is mainly composed of carbon, nitrogen, phosphorus and other compounds. It has high thermal stability and stable chemical properties. It can be used as organic synthesis intermediates and catalysts. It is widely used in industrial production. use. But its disadvantages are: the catalyst is difficult to regenerate, the reaction time is long, and there is a certain pollution to the environment. In addition, the activity of the catalyst and the selectivity of the catalysis are small, and it is easy to cause secondary damage. There are two main methods for synthesizing esters from carbon dioxide: one is to directly use biomass for chemical reaction, and the other is to use organic solvents such as methanol and ethanol to convert biomass into esters. Among them, the most commonly used method is the alcohol generation method, which has the characteristics of simple operation, stable process, low equipment investment and low energy consumption. Using ethanol as raw material, methanol as carbon source, and phenol as secondary hydroxyl group, react with aniline to generate cyclohexane, which is then dehydrated to obtain cyclohexanone, and then cyclohexanone is recovered by ammonia water method, and then it is made into ester. [4]

#### 3.2. Synthesis of polymers using CO<sub>2</sub> as raw material

Using CO<sub>2</sub> as a raw material, it is converted into polymers, which are then recycled. At present, the technical level of our country is not mature. Therefore, in the recovery and utilization of CO<sub>2</sub>, carbon dioxide can be used as the main raw material, and other organic solvents and water can be used as the medium to make it into a polymer through reprocessing. This method is an efficient recycling method, but it also has certain limitations due to its high cost. Relevant technicians should consider how to increase the absorption rate of CO<sub>2</sub>, rather than blindly pursuing economic interests, which requires reducing the energy consumption of production as much as possible under the premise of ensuring safety, thereby reducing carbon dioxide emissions. [5]

#### 3.3. Carbon dioxide can be catalytically hydrogenated

Since the catalyst will convert CO<sub>2</sub> to H<sub>2</sub>O in the catalytic process, high temperature treatment is also required during hydrogenation to reduce its impact and pollution on the environment. At present, the domestic technology mainly adopts the pyrolysis method, but the disadvantage of this method is that the cost is high, and it is easy to cause the instability of the secondary reaction, so few enterprises choose to use it. The advantage of pyrolysis is that it can effectively mix low-carbon organic compounds with high-carbon inorganics directly, making it a new type of green energy. The characteristics of this method are renewability, recyclability, environmental protection, degradability and so on. The advantages of the pyrolysis method are reflected in its simple operation, low equipment investment, low energy consumption, and the method has a wide range of applications, such as: petroleum, chemical, pharmaceutical and so on.

### 4. Conclusion

By analyzing the status quo of carbon dioxide in China, we can find that the current level of economic development in China cannot meet the needs of the world; the consumption structure of energy is unreasonable, and the phenomenon of waste of resources is serious; The deterioration of the social and ecological environment has become one of the focuses of people's attention. In order to resolve these contradictions, corresponding measures must be taken to improve the current situation and deal with the challenges and risks it brings. [6]

## References

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