IOP Conference Series: Earth and Environmental Science

Development Status and Prospects of Deep Seawater Comprehensive Utilization Industry

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Abstract. The definition, resource characteristics and application of deep seawater were introduced in this paper. Meanwhile, the current status of development and utilization of deep seawater resources at home and abroad was summarized. Finally, the prospects for the development and application of deep seawater are prospected.

Key words: Deep Seawater; Green Resource; Comprehensive Utilization.

1. Introduction

With the continuous reduction of land resources and land-developable space, coastal countries and regions have turned their views of national strategic interests into oceans with vast areas and abundant resources. The deep sea is the largest unknown area on the planet. It contains various strategic resources and energy needed for the future development of human society, and is known as the "new frontier" of the sustainable development of human beings in the 21st century. In addition to the commercial development of deep-sea oil and gas fields and mineral resources, deep seawater is receiving more and more attention and attention as a clean and green new resource.

Deep seawater, also known as deep ocean water, refers to seawater from the continental shelf to the depths of the sea that are not exposed to sunlight. The concept of deep sea has different definitions in different fields, and it is usually defined by the relevant industries in the deep sea according to the characteristics of its own industry. This paper uses the definition of the British Science and Technology Commission to define the area below 200 meters above sea level as the deep sea area [1, 2]. The average depth of the oceans around the world is 3,800 meters. From the broad ocean theory, 95% of the seawater on the earth is deep ocean water [3, 4].

Deep seawater has many unique properties compared to surface seawater [5-7]. First, low temperature stability, the sun is not penetrated in the deep sea area all year round, so the water temperature is much lower than the surface seawater (the sea temperature at 500m is between 8-9 °C), and there is no change all the year round; second, eutrophication, life Marine organisms in deep seawater hardly undergo photosynthetic reactions. Inorganic nutrients such as nitrogen, phosphorus and silicon necessary for plankton growth are accumulated in seawater without consumption. Therefore, deep seawater contains more plant growth and human body. Inorganic salts and trace elements necessary for health; third, cleanliness, deep seawater away from the influence of modern human civilization, not susceptible to pollution by land, atmospheric chemicals, germs, etc., low concentration of particulate suspended matter, and for photosynthesis Bacteria and pathogens whose organic matter is a nutrient source are also difficult to reproduce.

2. Multi-stage application of deep seawater

The unique resource characteristics of deep seawater make it have high extraction, processing and application advantages. Deep seawater can be used as raw material to produce deep seawater products with higher quality than land water and surface seawater products. The deep seawater industry has become the "blue gold" that has attracted the attention of all countries in the world after the natural resources (gold), petroleum (black gold) and environmental protection industry (green gold) in the 21st century.

The development and utilization of deep seawater has mainly gone through three stages, namely direct utilization, primary utilization and deep processing utilization. In the direct utilization stage, people use the low-temperature characteristics of deep seawater to develop applications such as temperature difference power generation and temperature regulation, and use abundance, cleanliness and low temperature characteristics of deep seawater to develop aquaculture. In the primary utilization stage, people separate and concentrate deep seawater to develop drinking water and refined salt. The deep seawater is concentrated and crystallized, which can be used to produce natural salts rich in characteristic trace elements and organic trace components. In the deep processing and utilization stage, people develop deep sea mineralization liquid and deep sea functional concentrate by selective separation means, and use it as an additive to produce high value-added products such as food, beverage, cosmetics and medical care products [8-11]. Deep seawater can be used as a food additive to make a variety of foods and beverages, such as soy sauce, soy products, sauces, pickles, biscuits, bread, rice cakes, instant noodles, sake and so on. The concentrated mineral liquid can be used to replenish mineral loss caused by a large amount of exercise, to resist fatigue and to reduce oxidative damage caused by a large amount of exercise. Major elements such as magnesium and calcium in deep seawater have a significant effect on improving glycolipid metabolism and insulin resistance. The rich and constant trace elements in deep seawater provide a new breakthrough in the treatment of human diseases.

With the deepening of research on physical, chemical and biological aspects of deep seawater, with the continuous updating of development technology, its use value has been recognized by more and more people. Under the shortage of resources and people's respect for healthy natural food, The development and utilization of deep seawater has increasingly highlighted the attractive market prospects.

3. Development and utilization at home and abroad

Up to now, the United States, Japan, South Korea and other developed countries as well as Taiwan in China have achieved remarkable scientific research results in the development and utilization of deep-sea water resources. They have developed and established consumer products and industrial chain structures related to deep seawater. It has been applied in many industries such as life sciences, medicine, fine chemicals, beauty, food, aquaculture, agriculture, power generation, etc., and has achieved substantial economic benefits [12-20].

The world's first deep seawater research facility was built in 1974 in Hawaii, USA. Hawaii is in the middle of the deep water cycle in the Pacific Ocean, where deep water flows to the seamounts (the Hawaiian Islands). In 2004, US federal agencies once again invested in improving deep seawater mining technology, extracting polar ice source water from below 4,000 meters in the natural 915-meter surge below the sea surface, and applying it to biopharmaceuticals and health care. In terms of deep seawater application, the United States has a geographical advantage, and has mature mining technology, scientific research system, standard production specifications and perfect market operation, and has an excellent international status in the health industry.

Since 1976, Japan has carried out scientific pre-study of deep seawater. The main research content is to grasp the concept of deep seawater, understand its water quality characteristics and develop water abstraction technology. In 1989, the Marine Science and Technology Center established the Deep Water

Research Institute in Kochi Prefecture and built Japan's first deep seawater abstraction and testing facility with a daily water intake of 920 tons. In 1999, related research and development products, such as beverage water, lotion and deep sea algae, were introduced. As of May 2009, Japan has built 16 deep seawater water storage facilities, mainly in Kochi, Toyama and Okinawa counties. Japan has achieved a series of achievements in marine aquaculture, microalgae cultivation, beauty, beverages and food.

South Korea's deep ocean water is concentrated in the East China Sea (Japan Sea), and its resources are very rich, estimated at 3.79 trillion tons. Under the active promotion of the government, in 2008, a total of nine sea areas were approved for water withdrawal, and water supply permits were issued to eight enterprises. Related products include alcohol, cosmetics, beverages, food and other commodities.

Taiwan Province of China was mainly devoted to the study of ocean temperature difference power generation from 1989 to 1998. In 2000, the Fisheries Research Institute of the Agricultural Committee began planning to use the characteristics of low-temperature, clean, nutrient-rich and trace elements in deep seawater to carry out research on important aquatic product breeding, and promote the development of aquaculture and marine biotechnology industries with high technology. Water intake areas have been set up in Yilan, Taitung and Hualien, and related development industrial parks have been established. In 2005, Taiwan announced the “Deep Sea Water Resources Utilization and Industrial Development Policy Program” to study the application of deep seawater to low-temperature vegetables and flower breeding.

The Tianjin Institute of Seawater Desalination and Comprehensive Utilization of the Ministry of Natural Resources, based on the research results obtained in the use of seawater, has undertaken national research projects, carried out deep seawater surveys, water quality resource characteristics assessment and development of typical application technologies, and built deep sea water resources. The development and utilization of the experimental platform has formed a complete set of technologies for the comprehensive utilization of deep seawater, filling the gap in the research of deep seawater systems in China, and providing technical support for the large-scale utilization of deep seawater.

4. Conclusion

Deep seawater is an inexhaustible and inexhaustible renewable resource. Deep sea water related products have the characteristics of high added value and outstanding economic benefits. With the deepening of research on physical, chemical and biological aspects of deep seawater, its application range will become wider and wider, and its utilization value will also attract worldwide attention. As people's awareness of food safety and health care continues to improve, in the future where natural and non-polluting substances are receiving more and more attention, products related to deep seawater will be more popular, and the market potential is huge and the prospects are extremely broad.

Acknowledgments

This work was financially supported by Global Change and Air-sea Interaction Special Project (GASI-03-02-02-05) and Haikou City's "Thirteenth Five-Year" Marine Economic Innovation and Development Demonstration City Project (HHCL201810).

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