Original Research Article

Study on the sustainable design method of cruise ship interior installation from the perspective of environmental science

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Abstract: In the context of the rapid development of the cruise industry, its environmental impact has attracted wide attention. Based on the perspective of environmental science, this study deeply analyzes the existing situation of cruise ship loading and its multifaceted impact on the environment. By combining the theory and technology of environmental science, a series of targeted sustainable design methods are innovatively proposed, aiming to significantly reduce the negative effects of the cruise liner on the ecological environment and provide strong theoretical and practical support for the sustainable development of the cruise industry.

Keywords: Environmental science; Cruise liner; Sustainable design; Green materials; Energy efficiency

1. Foreword

1.1. Research background

With the continuous growth of the global economy and the significant improvement of people's living standards, cruise tourism, as a high-end and leisure way of tourism, is being loved by more and more tourists. According to statistics, in recent years, the number of global cruise passengers continues to grow, and the cruise industry shows a vigorous development trend. The interior decoration of cruise ships is a key factor to improve the passenger experience. Its design style, material selection and facility configuration directly affect the comfort and satisfaction of passengers during the journey. However, in the process of pursuing luxury and individuation, the traditional cruise ship interior design has caused an impact on the environment that cannot be ignored.

From the perspective of material use, a large number of non-degradable chemical synthetic materials are widely used, such as all kinds of plastics, artificial leather and so on. These materials not only consume a lot of energy in the production process, but also produce long-term pollution to the environment. According to relevant research, thousands of tons of plastic waste is produced by discarded waste materials every year. It will take hundreds or even thousands of years to enter the ocean, seriously threatening the balance of the Marine ecosystem. At the same time, the excessive exploitation of some natural materials also brings ecological problems. For example, a large number of precious trees were cut down in order to meet the demand for high-grade wood, resulting in a reduction of forest resources and damaged biodiversity.

1.2. Purpose of research

The core goal of this study is to comprehensively and deeply analyze various environmental problems in the interior design of cruise liner from the professional perspective of environmental science. By drawing on the frontier theories and advanced technologies in the field of environmental science, and combining with the actual needs and characteristics of cruise ship interior design, a scientific, systematic and highly operable sustainable

design method system is constructed.

2. The current status of the cruise ship loading and its impact on the environment

2.1. Existing cruise liner interior features

At present, the cruise presents a diversified and personalized design style, integrating cultural elements from around the world, aiming to create a unique and luxurious experience for passengers. In terms of spatial layout, the cruise ship is usually equipped with a rich variety of functional areas, including various theme restaurants, entertainment places, gyms, guest rooms, etc., to meet the needs of different passengers.

The choice of interior materials is very rich, ranging from natural materials to chemical synthetic materials. Wood is one of the commonly used interior materials, used to create a warm, high-grade atmosphere, such as oak, walnut and other commonly used to make furniture, decorative wall. Stone material gives space texture and luxurious sense, marble, granite is widely used in the laying of ground, mesa. Leather because of its soft and comfortable touch, is often used in seats, sofa package. Metal materials such as stainless steel, copper, etc., for decorative lines, lamps, add modern and delicate sense. In addition, a large number of chemical synthetic materials, such as plastic, man-made fiber, because of its low cost, strong plasticity, is also widely used in cruise ships, such as plastic floor, artificial leather decorations.

On adornment technique, cruise ship interior installation pays attention to detail and atmosphere to build. Through exquisite carving, gorgeous fabric decoration, unique lighting design and other means, to create a distinctive space atmosphere. For example, in the theater area of the cruise ship, large crystal chandeliers and sound-absorbing fabric walls are often used to create an elegant and comfortable audio-visual environment; while in the tropical theme restaurant, a large number of green plants, special murals and warm lights are used to create a relaxed and pleasant dining atmosphere.

2.2. Negative impact on the environment

1. Material use: The extensive use of chemical synthetic materials in cruise ships has brought serious environmental problems. In plastics, for example, its production process consumes a lot of fossil resources, such as oil, and emits a lot of greenhouse gases during the production process. According to statistics, the production of 1 ton of plastic requires about 3-6 barrels of crude oil, and 2-3 tons of carbon dioxide. In addition, plastics are difficult to degrade in the natural environment. When discarded plastic interior materials such as plastic tableware and plastic decorations enter the ocean, they will form a “Marine plastic waste belt”, threatening the survival of Marine life.

2. Energy consumption: The lighting system installed in the cruise ship is an important part of energy consumption. Traditional incandescent bulbs and fluorescent lamps emit less efficiently, and a lot of electricity is converted into heat and wasted. A large cruise ship may be equipped with thousands of lamps, if all traditional lamps, the daily power consumption is huge.

3. Waste treatment: there are a wide variety of waste generated in the operation process of cruise ships, including construction waste generated by the replacement of internal materials, such as abandoned wood, stone, metal, etc., as well as household waste generated by passengers, such as food packaging, disposable goods, etc. Due to the limited offshore space, the waste treatment facilities are relatively simple, and some waste is difficult to be properly disposed of. Some non-degradable garbage, such as plastic bottles and plastic bags, may be directly discharged into the ocean, causing long-term pollution to the Marine ecological environment. In addition, sewage

treatment on cruise ships also faces challenges. The discharge of untreated sewage will lead to eutrophication of Marine water bodies, cause ecological disasters such as red tides, and affect the survival of Marine life and the sustainable utilization of fishery resources.

3. Application of environmental science theory and technology in the design of cruise ship

3.1. Ecosystem balance theory

The theory of ecosystem balance emphasizes the interdependence and mutual restriction among the components of the ecosystem. The destruction of any link may lead to a chain reaction and affect the stability of the whole ecosystem. The application of this theory in the interior design of cruise ships means that the impact on the ecosystem should be fully considered in material selection, energy utilization and waste disposal to ensure that the interior design will not cause irreversible damage to the ecological balance.

In terms of energy use, following the ecosystem balance theory means reducing the dependence on non-renewable energy sources and increasing the use of renewable energy sources. For example, solar panels are installed on cruise ships to use clean solar energy to power part of the equipment and reduce the consumption of traditional fossil energy. The use of solar energy can not only reduce carbon emissions, but also reduce the damage to the ecosystem caused by energy exploitation and use。

3.2. Resource recycling technology

Resource recycling technology is one of the important means to achieve sustainable development. It reduces the waste of resources and reduces the pressure on the environment through the recycling, reprocessing and reuse of waste. In the design of cruise ship, resource recycling technology has a wide application prospect.

On the one hand, the waste internal materials, such as metal, glass, plastic, etc., can be classified and recycled and reprocessed. For example, discarded metal parts can be melted to make new metal products for cruise ship interior decoration or equipment manufacturing. Glass products can be recycled and reprocessed into fiberglass or new glassware. For plastic waste, physical or chemical methods can be recycled, used for the production of plastic floors, plastic decorations, etc.

3.3. Energy-efficiency improvement technologies

1. Lighting system optimization: the use of energy-saving lighting equipment is the key to improve the energy efficiency of the installed lighting system of cruise ships. As a new lighting technology, LED lamp has the advantages of high luminous efficiency, low energy consumption and long life. Compared with the traditional incandescent bulbs, LED lamp energy consumption can be reduced by 80% -90%, and the life can be extended by 10-20 times. In the cruise ship, replacing traditional lamps with LED lights can significantly reduce the energy consumption of the lighting system. For example, installing LED light belts and LED light bulbs in the corridors and guest rooms of the cruise ship can not only provide sufficient lighting, but also reduce energy consumption.

2. Air conditioning and ventilation system improvement: the installation of efficient air conditioning and ventilation equipment is an important measure to improve energy efficiency. Variable refrigerant flow (VRF) air conditioning system is an advanced air conditioning technology, which can accurately adjust the cold heat according to the actual demand of different regions, and avoid the energy waste of the traditional air conditioning system. For example, in different functional areas of cruise ships, such as restaurants, guest rooms, entertainment

places, with different personnel density and heat load, VRF air conditioning system can automatically adjust the flow and temperature of refrigerant according to these differences, achieve accurate cooling or heating, and improve energy efficiency.

4. Sustainable design method for cruise liner installation

4.1. Green material selection and application

1. Use of renewable materials: Renewable materials refer to the materials that can be recycled or recycled in nature in a relatively short period of time. In cruise ships, the extensive use of renewable materials can effectively reduce the dependence on non-renewable resources and reduce the impact on the environment. Bamboo is an ideal renewable material, its growth rate is very fast, generally 3-5 years can be formed. Bamboo has the characteristics of high strength, tough texture and beautiful texture, which can be used to make furniture, decorative panels, floors, etc. For example, in the public area of the cruise ship, the bamboo floor can be used, which not only has good anti-skid performance, but also creates a natural, comfortable atmosphere.

2. Application of degradable materials: degradable materials refer to the materials that can be decomposed into harmless substances within a certain period of time in the natural environment. Promoting the use of biodegradable materials can reduce waste pollution to the Marine environment. Polylactic acid (PLA) is a common degradable material, it uses corn, cassava and other renewable resources as raw materials, after fermentation and polymerization reaction. PLA has good biocompatibility and processability, and can be used to make disposable tableware, packaging materials, and decorations, etc. For example, the disposable tableware on the cruise ship can be made of PLA material, which can be gradually decomposed in the natural environment after use, and will not cause long-term environmental pollution like the traditional plastic tableware.

3. Selection of environmental protection certification materials: the selection of materials through the international authoritative environmental protection certification is an important means to ensure the environmental protection of the cruise ship. FSC certification is an international certification for forest management and wood processing, and FSC certification means that its source is legal, sustainable, and the cutting and processing processes meet environmental standards. Choosing FSC certified wood in the cruise liner interior loading can ensure the quality and environmental protection of the wood, while supporting sustainable forest management.

4.2. Energy-efficient use design

1. Solar energy utilization: As a clean and renewable energy, solar energy has great potential in the design of cruise ships. Solar panels installed at the top of the ship or in other suitable locations can collect solar energy and convert it into electricity for some lighting, equipment charging, etc. The installation of solar panels can not only reduce cruise ships' dependence on traditional energy sources, but also reduce carbon emissions, which is of great significance to environmental protection.

5. Case analysis

5.1. Case introduction of sustainable design cruise ship

In terms of material selection, the Oasis of the Sea actively uses renewable and biodegradable materials. Some of the furniture in its rooms is FSC certified recycled wood, which not only ensures the sustainability of the wood source, but also follows the environmental standards in the processing process, reducing the use of

chemical agents and reducing the risk of indoor pollution. In public areas, such as corridors, halls, etc., a large number of use of bamboo decorative panels. Bamboo grows rapidly and is a typical renewable material. Bamboo panels not only create a natural and warm atmosphere for the cruise ship, but also show a unique aesthetic value. In addition, the disposable items on the cruise ship, such as tableware, toiletries packaging, mostly use polylactic acid (PLA) and other degradable materials. After use, if these materials enter into the natural environment, they can be decomposed into harmless substances within a certain period of time, greatly reducing the long-term pollution of waste to the Marine environment.

In terms of energy use, the Oasis of the Seas has installed large areas of highly efficient solar panels on the roof. These solar panels can fully collect solar energy during the voyage and convert it into electricity, providing electricity to support some of the lighting systems and small electrical equipment on the cruise ship. According to statistics, in the case of sufficient sunshine, the electricity generated by solar panels can meet about 10% -15% of the daily electricity demand of cruise ships, effectively reducing the dependence on traditional fossil energy. At the same time, the cruise ship is equipped with an intelligent energy management system, which monitors energy consumption in real time through sensors distributed in various areas. For example, when an area is inactive, the system will automatically close the non-essential lighting equipment and some electrical appliances in the area; in different seasons and periods, intelligently adjust the operating power and temperature setting of the air conditioning system according to indoor and outdoor temperature and personnel distribution, to avoid energy waste.

5.2. Evaluation of the sustainable design effect

After the implementation of the sustainable design of the Oasis of the Seas, it has achieved remarkable results in many aspects. In terms of environmental benefits, its energy consumption is reduced by about 20 percent compared with a similar type of traditional cruise ships. This is mainly due to the application of solar panels and the optimization of intelligent energy management system, which reduces the dependence on traditional fossil energy, and correspondingly reduces the emissions of greenhouse gases such as carbon dioxide, and plays a positive role in alleviating global climate change. In terms of waste disposal, through the effective operation of waste classification and recycling system; to sum up, the “Oasis of the Ocean” has achieved remarkable achievements in energy utilization and waste disposal through sustainable design, which not only shows the great potential of green development of the cruise industry, but also provides a valuable reference example for the sustainable transformation of the global shipping industry, which is expected to promote the whole industry towards a more environmentally friendly and efficient direction.

Project Title

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Source of the Project

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