

Innovative Research on the Design Concept of Green Furniture Products

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Abstract—Since the beginning of the 21st century, the national environmental protection strategies of various countries have begun to undergo a new turning point. The global green furniture industry restructuring has seen a new green strategic trend, which is to rationalize the utilization of furniture raw materials and reduce the waste furniture. Oriented to the direction of the home environment without pollution or less pollution. Based on the analysis of the design connotation and characteristics of green furniture products and the actual level of current green furniture product design at home and abroad, considering the future development trend, this paper focuses on the research and puts forward that China's green furniture product design should give priority to the development of green material design technology and humanized design technology, design techniques for cleaning paints and compounds, and design techniques for clean environments.

Keywords—Innovative research; Design concept; Green furniture products

I. INTRODUCTION

The rapid deterioration of the global ecological environment is a major crisis facing human survival and development in the 21st century and has become one of the focuses of the international community. As an intermediary to contact production and life, the product has an unshirkable responsibility for the current ecological problems of human beings. For furniture, which is closely related to the environment, design has a greater impact on its performance [1-2]. Comprehensive research on the relationship between environment and resources throughout the product life cycle has important theoretical and practical significance. Through the review of related literatures, this paper gives the concept of green design, shows the current domestic and international status and research results of green design in the development and application of furniture products, and clarifies the direction of future research.

II. THE CONCEPT OF GREEN DESIGN

Green design is a new design concept and method proposed in the early 1990s around the theme of how to conserve resources, use energy efficiently and protect the environment while developing the economy. It is considered to be effective in achieving sustainable development in the manufacturing industry [3-4]. One of the ways has become a research hotspot and main content of modern design technology.

Green design, also known as life cycle design, environmentally oriented design, etc., the concept is to deal with the entire life cycle of the product (from raw material production, product manufacturing process, assembly, packaging, transportation, sales, use to disposal, elimination of products) The sum of the stages involved, focusing on the environmental attributes of the

product (removability, recyclability, maintainability, etc.), and as a design goal, while ensuring the product's due requirements while meeting environmental objectives Function, service life, quality, etc.

Different from traditional design, it involves the whole life cycle of products. It is a process from "cradle to reproduction". Green design fundamentally prevents and reduces pollution, saves resources and energy, and can prevent the environmental and side effects of products and their processes in advance. It has completely changed the process of traditional design from "cradle to grave".

III. RESEARCH STATUS AT HOME AND ABROAD

Green design has become one of the research hotspots of modern design technology. Such as the international CIRP executive member, Leo. of the Technical University of Denmark. Professor Alting is equal to 1993 [5], which emphasizes the ecological analysis of the manufacturing process. In recent years of CIRP annual conferences and some international conferences, more and more research papers related to green design have emerged, and many different viewpoints and methods have emerged. Professor Orting stated in the 1993 CIRP Annual Conference paper "The Foundation of Sustainable Industrial Production: The Life Cycle Concept" that the experience of the "Clean Technology" project completed in the past 10 years of the Danish Industry clearly shows: if the product and its production system Originally designed for environmental characteristics, it will achieve even more significant economic and technical results. To this end, the Danish Polytechnic University has established a Green Product Life Cycle Research Center, which is mainly engaged in three areas of research: life cycle strategy, economics and control (including: total cost assessment of the entire life cycle of the product, control of life cycle requirements and Detection system several information systems, new business concepts and activities related to green products), process and production engineering (mainly: product design rules for environment and resources, these rules should cover the entire life cycle), environment and resource technology. Inoue and Sato, the mechanical engineering laboratories of the Department of International Trade and Industry of the United States, also presented their views on the environmental issues of industrial products, and started the collaborative project of "ecological factory technology" in the laboratory. The main scope includes: product technology, production technology, disassembly technology and recycling technology, and has identified specific research targets for each scope. From the perspective of environment and commerce, Japan has seriously considered the waste of processing and the impact of products on the environment. Since 1992, the Ministry of International

Trade and Industry has implemented an annual plan for an "ecological factory" with a budget of 10 to 15 billion yen to conduct research on production system plants and recovery system plants. The production system factory is dedicated to product design and material handling, processing and assembly stages; the recovery system factory is primarily dedicated to material handling and recycling at the end of the product (material use) life cycle. The Ministry of International Trade and Industry also joined forces with Japanese home appliance manufacturers to invest 5 billion yen to research and develop integrated systems for home appliance processing. In 1998, a demonstration small-scale experimental plant was built. In October 1995, Toyota announced a car demolition recycling process and elaborated on the car disassembly procedure. The Hong Kong Productivity Council has slogan "Green Productivity" and is actively implementing the ISO14000 International Environmental Management Certification System, the Green Product Labeling and Green Award Scheme, and the training of cleaner production talents. In addition, Germany, Canada, the United Kingdom, etc. have carried out a lot of research on disassembly techniques and methods, and recovery of work methods.

International economic experts believe that the current ratio of "green products" is about 5% to 10%. In another 10 years, all products will enter the green design family: recyclable, easy to disassemble, parts or machines can be refurbished and recycled. That is to say, in the next 10 years, green products may become the leading products in the world's major commodity markets, and the design and selection of green products will become the norm of industrial production behavior. It can be predicted that in the future, green design will not be implemented and the qualification of products entering the international market will be cancelled. Since the production of green products is best suited to the current popular manufacturing strategy: resource globalization, parallel design, total quality management, etc., green products can be manufactured and sold more efficiently than ordinary products. From the current sales situation in the market, green products are easier to sell than ordinary products. According to statistics, in 1988, the trade volume of green products in North America reached US\$106 billion; in Western Europe, it was about US\$100 billion; in the Asia-Pacific region, US\$50 billion.

In order to adapt to the development of "green consumption wave", a new concept of environmental awareness design and manufacturing ECD&M (Environmentally Conscious Design & Manufacture) was proposed abroad, and a lot of research work was carried out around this theme, and some research results were obtained. At the same time, in line with the propaganda of this technology, in 1990 the United States founded the "International Environmental Awareness Design and Manufacturing Magazine."

China's resources are not rich, but the problem of environmental pollution has become very prominent. The manufacturing industry must not only solve the problem of pollution and resource waste in the production process, but more importantly, provide the society with various products that have no pollution and save resources during the whole life cycle. China's industrial development still uses the high-energy, high-input extensive industrial development model, which wastes resources and energy, and accelerates the depletion of natural resources. In

recent years, China has also carried out research and application of green design. For some products and industries, such as automobiles and refrigerators, we have achieved phased research on the theory and methods of detachability, recyclability and green product evaluation. Research results. The concept of green design of furniture products was put forward in China soon. At present, it is still in the stage of attention to the environmental protection performance of materials and manufacturing processes (such as cleaner production). There is still a lack of systematic understanding of the true green design, and the design of green design in furniture. The study of specific application methods is still in the exploration stage. Therefore, it is necessary to learn from the successful experience of other industries such as the machinery industry, combined with the characteristics of furniture products to carry out research on furniture ecological design.

IV. RESEARCH ON DESIGN CONCEPT OF GREEN MATERIAL DESIGN AND HUMANIZED DESIGN

The green material design technology is designed with the technical performance, economic performance and environmental performance of the product. The material selection of the green furniture product design should be based on the green material, and the environment of each part of the whole design process should be carried out in the environment of concurrent engineering. The evaluation of green factors is to minimize the pollution of the product to the home environment, so that it can obtain materials suitable for the design of green furniture products. The choice of green materials with excellent overall performance should consider the impact of the use of green materials on the market benefits of product design, process and manufacturing. The choice of materials for green furniture products is to emphasize the protection of the home environment, to prevent pollution of living spaces, to avoid the abuse of materials, paints and rubber materials that endanger people's health, and to make environmental protection factors and engineering properties of materials together as the target of material selection, so that the products have both Excellent booking function helps protect the home environment and ecological environment. It is necessary to establish a green material evaluation technology system, develop new material practical design technology, combine new material development and development technology and existing material environmental performance improvement technology, and recycle, process and reuse materials and green furniture. Product life cycle design combines to meet specific environmental protection requirements during the entire life cycle and products that are harmless or less harmful to the ecological environment, have the highest resource utilization, and have the lowest consumption of coatings and rubber. Green furniture product design requires designers to reduce paint and size, ease of disassembly, recyclable and environmental protection, and ensure functional, performance, quality, longevity and cost requirements of the product at the design stage. Design goals and ensure smooth operation in the production process.

The design of green furniture products covers all stages of the production, use and disposal of furniture products from the concept of production, use and even after disposal, that is, the entire life cycle of the product, from the conception, the reproduction of the work to the end of the product. Green furniture

product design is based on the protection of environmental resources as the core of the product design process. In the whole life cycle of green furniture products, the product home environment attributes are prioritized and used as the main goal of the design. While meeting the requirements of the green furniture environmental requirements, the basic functions, service life and quality of the products should be guaranteed. Ideas about green furniture product design and green home environmental friendliness include: &'(")\$ standard, product for meeting the increasing consumer demand for "green" products, managing the life cycle of furniture products Recycling and green design in waste disposal and destruction. The design principle is closed-loop parallel design, considering not only the entire life cycle of the product, but also how to handle and reuse the product after it is discarded.

At present, the international community can make the maximum use of resources, coatings and rubber materials, and reduce or eliminate the environmental pollution caused by waste products, as a concrete manifestation of sustainable development. Giving priority to product environmental attributes, focusing on research and prioritizing the development of key technologies for green furniture product design, has great strategic and practical significance for the sustainable development of China's furniture industry enterprises. In addition, consumers are increasingly recognizing the purchases they have made. The impact of the product on the environment. All of these force us to seriously solve the key technologies of the green home environment and the rational and rational use of coatings and materials in the design of green furniture products. To fundamentally prevent pollution and save resources, coatings and rubber compounds, the key lies in the design and manufacture of green furniture products. It is impossible to wait for furniture products to produce adverse environmental consequences and then take precautionary measures. It is necessary to try to prevent the negative impact of products and manufacturing processes on the environment and then manufacture them. This is the basic idea of green furniture product design.

Humanized design technology is a human-oriented product design technology based on human chemistry theory. The goal of humanized design is to improve the effectiveness of occupants' work under the constraints of environmental systems, reduce the irritability and unnecessary mistakes that occupants may have, reduce the physical exertion of occupants, and adapt them to different levels of occupants as much as possible. Simplify the user's operation as much as possible to reduce the occupant's domestic work intensity, improve the living conditions of the occupants, try to fit the occupants' psychological and physiological characteristics to relax, and enable the operator to easily complete life, work and study. And entertainment to achieve the best efficiency and effectiveness of people's mind and body system, improve people's work efficiency and quality of life.

Humanized technology is closely related to the study of human chemistry theory. Any new theory about human psychological processes will cause technological changes. Different from the disciplines of other researchers, the study of humanized design technology is not a single person, nor a system alone. It is a concept of the intrinsic connection between the

two. Therefore, human chemistry is not a researcher in isolation. It also studies other components of the system to establish a theory and method for solving the contradiction between the human environment and the green design of the home, in order to design according to people's acceptability and environmental characteristics. And transforming the home system, this is the basic connotation of humanized design technology. In exchange for the greatest spiritual achievement with minimal design cost. When designing a green furniture technology system, care should be taken to properly distribute the work between the home user and the design technology system. When coordinating people and the environment, it is necessary to relax the technical requirements for home users and operators as much as possible in green furniture. There are behavioral science cognition and analysis techniques in the product design category. Users use psychological prediction technology, involving human settlement environment design technology, humanized measurement new technology, user type analysis technology, and humanized creative design in product design.

V. INNOVATION IN THE OVERALL DESIGN CONCEPT OF GREEN FURNITURE PRODUCTS

Green furniture products clean green environment design is a new product design concept. The design guideline is designed to meet the clean green environment design as long as the product is easy to manufacture and has the required functions and performance. Under the premise of considering or taking into account the environmental attributes, the company is required to select clean green raw materials and processes in the production process to produce clean and green products, so that users do not produce environmental pollution or only minor pollution when using the products. There is very little waste generated in the recycling process for scrapped products. Make the most of all material resources, let green furniture products minimize the amount of materials used, and reduce the types of materials used, especially rare and expensive materials and toxic and hazardous materials. This requires that when designing the product, the product structure should be simplified as much as possible to meet the basic functions of the product, the materials should be used reasonably, and the parts and materials in the product can be reused to the maximum extent. The clean green overall design of green furniture products should maximize the saving of paints and rubber compounds. Green furniture products should consume the least amount of paints and rubber compounds in all stages of their life cycle, so that clean green paints and rubber compounds can be effectively utilized. . Under this premise, it is the basic concept of sustainable green furniture product design. Products manufactured according to traditional designs become a pile of waste after the end of their useful life. The establishment of environmental indicators for green furniture product design and its regularization and quantification solve these problems. The evaluation system and sales method of green furniture products can ensure that its market is expanding. The research on the theory and method of integrated design of furniture products is also suitable for green furniture products. The detachable design of materials for green furniture products is also part of its modern design concept. The modularity and interface design of the detachable structure is the key to achieving this concept. The green evaluation method and

evaluation index system of green furniture products will promote the popularization of clean green design innovation concepts.

Clean environment design provides the necessary constraints for product design. Traditional design usually only considers the basic attributes of the product 'function, quality, longevity, cost (does not consider the polluted environment, does not consider the quality of life of human beings, does not consider the sustainability of production development. The product design of green furniture products clean green environment includes There are many disciplines and a wide range of topics. At present, many aspects are still in the process of development and perfection. Unlike the traditional design, the green design concept of clean green furniture products involves the entire life cycle of the product, which is the whole process from cradle to reproduction. The design concept is to fundamentally prevent pollution, save resources and use non-toxic paints and rubber compounds. The key to achieving this is design and manufacturing. It is impossible to take preventive measures after products have produced adverse environmental consequences. The negative impact of the process on the environment, and then remanufacturing. In summary, the design of a clean home environment and green furniture products is a systematic design method and concept, that is, from the perspective of system integration throughout the product life cycle. Product environmental attributes 'removability, recyclability, available Maintainability, reusability and personal health and safety (and basic attributes and as a design goal, to ensure that the product meets the environmental objectives while ensuring the basic performance, service life and quality, etc.. Green materials The design technology is based on materials, and is designed, manufactured, used, and discarded throughout the life cycle of the product (at each stage of the product, with the environmental impact and effective use of the material as the control target, while achieving the functional requirements of the product. Green design technology that minimizes environmental pollution and minimizes resource consumption.

The technical, economic and environmental indicators of the product are considered in the product planning stage. It is a reform of the method concept of green furniture product design, the feasibility analysis of new product design, and the selection of green materials with small environmental pollution. Effectively use to identify various feasible and environmentally compatible design options. At the same time as the functional and economic analysis of various feasible solutions, environmental assessment of various materials that can meet the functional requirements is also carried out at the design stage of the project, and the design with the best overall performance is selected. In the structural design stage, it is necessary to optimize the screening of new materials so that the designed structure should have the functions and good processability and at the same time be easy to disassemble and recycle. In the detailed design stage, the material used in the product should be statistically built according to its disassembly performance, recycling performance and recycling performance, so as to facilitate the recovery and treatment of the material after the product is discarded. The core of green material design technology is to select green materials for product design, fundamentally reduce environmental pollu-

tion and reduce the consumption of resources, coatings and rubber. Green materials refer to materials with lower environmental load values, higher recyclability and good performance in the whole life cycle of raw material acquisition, production, processing, use, regeneration and disposal. The environmental load value mainly includes resources. Factors such as intake, paint and rubber consumption, pollution emissions and their hazards, waste discharge and ease of recovery and disposal.

VI. CONCLUSION

Compared with traditional product design ideas, the green design of green furniture products is a new product design concept. Unlike traditional design, modern design involves market analysis, product design, process design, manufacturing and sales of product life cycle. And after-sales service and other stages, and the design is based on the company's own development and economic interests, but also consider how to meet user requirements and meet the basic attributes of the product, such as basic functions, quality, longevity, cost, etc. Considering the environmental attributes, based on the psychological and physiological characteristics of people, using the latest achievements and data of science and technology to design green furniture and home systems, in line with human requirements, improve the environment, and optimize the human settlement system to achieve the best fit To ensure the health of people.

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