

Retraction

Retracted: Application of Green Ecological Design in Food Packaging Design

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

- [1] Z. Yuan, "Application of Green Ecological Design in Food Packaging Design," *Journal of Food Quality*, vol. 2022, Article ID 8491934, 7 pages, 2022.

Research Article

Application of Green Ecological Design in Food Packaging Design

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In order to put an end to the widespread existence of excessive packaging and to reduce the packaging cost beyond the value of the product itself, it has caused harm to the environment and serious waste of resources. In this paper, a food packaging design based on green ecological design is proposed. Through the discussion of the theoretical framework of ecological design and the study of ecological materials for food packaging, the ecological design principles of green ecological food packaging are summarized to better guide the packaging design. The experiment shows that, through the 7-month experimental comparison and tracking of a biscuit food, although the sales volume of the product has not increased significantly, or even may decline, the cost of the product has been reduced by 20~30%, thus increasing the profit of the product by 30~40%. *Conclusion.* The experiment shows that food packaging design based on green ecology can effectively promote the sales and turnover of products, is friendly to the environment, and can also bring profits to enterprises.

1. Introduction

With the development of the times, in order to survive and develop, human beings transform nature through labor practice. In this process, they also improve their understanding of nature, resulting in a complex and contradictory relationship between man and nature [1]. After entering the industrial civilization, human beings have reached an unprecedented level in their ability to transform and conquer nature with the help of scientific and technological productivity. While enjoying the rich material civilization, they also regard nature as an inexhaustible resource warehouse and garbage can with unlimited capacity, resulting in the deterioration of the ecological environment and frequent social-ecological crises. Ecological crisis is directly caused by human practice, but in the final analysis, it is caused by human's lack of understanding of nature and themselves [2]. Under the guidance of more or less problematic ideas and concepts, such as the omnipotence of science and technology and the infinite development of human society, they try to satisfy the endless desire for consumption by conquering nature. Like dominoes, they directly or indirectly transmit the power to destroy the ecosystem and finally cause the global ecological crisis, energy crisis, and economic crisis

through human practical activities. The design was originally intended to solve the problems people are facing now or in the future, but under the guidance of flawed ideas, it has become a practical activity to create problems for the ecosystem. Just as Engels' theory of "first-line victory and second-line failure" said, when we indulge in our achievements, we have planted the seeds of a greater crisis. The crisis is obvious, but mankind has not yet found a real solution to the crisis, and it is difficult to reach a consensus at the Doha climate change conference, which has gathered the most intelligent minds of mankind. Relevant experts pointed out that, in history, human beings fought against crises in different ways. One is to expand abroad to obtain greater development space; the other is to seek a solution to change one's lifestyle [3, 4]. At present, mankind has not been able to expand beyond the Earth, nor has it built a Noah's ark that can save itself when a crisis comes. Therefore, to avoid the crisis, mankind must change its own way of life. Food packaging design is one of the most important subjects, which is of great significance to the green ecological research of packaging design [5].

Therefore, this paper puts forward a kind of food packaging design based on green ecology. Through the discussion of the theoretical framework of ecological design

and the research on ecological materials for food packaging, this paper summarizes the ecological design principles of green ecological food packaging, so as to better guide the packaging design.

2. Literature Review

In their research of green ecological design, Abdi and others proposed bionics to understand the natural laws, which can effectively guide designers and developers to find new solutions. For example, the production process of self-assembly of shells in seawater inspired scientists in the field of nanotechnology. A national laboratory invented a self-assembly coding program, which can manufacture ceramics in a very low-temperature environment. It not only does not consume energy like traditional high-temperature kiln firing but also can produce ceramic products with high precision [6]. Andiyan and others proposed the technology of using algae to absorb carbon dioxide to produce oil. In the built pilot plant, algae produce about barrels of crude oil per hectare per day. A university also found a catalyst that can turn carbon dioxide into polycarbonate and use carbon dioxide to make biodegradable plastics [7]. Behzadi and others put forward the design concept of “cradle to cradle”: “we should give up the idea of the waste completely so that at the end of the product life cycle, every remaining object should be able to completely recycle the old product and become the production resource of another product to manufacture a new generation of products.” This idea is obviously idealistic. It prefers to use cutting-edge technology to solve problems, neglects the economic cost of production, and does not consider some important social problems, such as the relationship between consumer culture and ecology [8]. Yu and others put forward a simple and clear capital and value model, which provides a new perspective for ecological design. Natural capital believes that, in the future, the solution that can improve the current situation will continue to give priority to the efficiency of various capital, and all pollution will reduce the efficiency [9]. Rossi and others put forward that sustainable design issues, frameworks, strategies, and practices were discussed one by one during the product life cycle process. They pointed out that sustainability needs to look at issues from a system perspective, take the market, ecosystem, social system, and even the whole world as a system, and make clear and accurate choices by integrating various financial, environmental, and social factors [10]. Esmali and others put forward the environmental load and evaluation methods of inorganic materials, polymer materials, metal materials, and functional materials and discussed how to strengthen the comprehensive utilization of wastes of various materials to reduce environmental pollution [11].

On the basis of the current research, this paper puts forward a kind of food packaging design based on green ecology. Through the discussion of the theoretical framework of ecological design and the research on the ecological materials of food packaging, this paper summarizes the ecological design principles of green ecological food packaging, so as to better guide the packaging design and

promote the coordination between products and the environment. The superiority and foresight of green ecological design are reflected through the experimental comparison and tracking of a biscuit food for 7 months.

3. Research Methods

3.1. Theoretical Framework of Ecological Design. The word “ecology” comes from ancient Greek, which means a living place or house. German biologists call the subject of studying the relationship between organisms and their living environment ecology. Nowadays, green ecology has penetrated into various fields, and the scope of ecology is becoming larger and larger. It generally refers to the relationship between something and its environment, such as “social ecology,” “academic ecology,” and “political ecology,” and at the same time, it also uses “ecology” to define or modify beautiful, perfect, harmonious, healthy, and other things, such as “ecological city,” “ecological architecture,” and “ecotourism.” In general, both green packaging and ecological packaging come down in one continuous line from the ideological connotation of sustainable development, and both pay attention to the “ecological” problem in design [12]. Comparatively speaking, the “3R1D” design principle of green packaging was put forward earlier, which was deeply rooted in the hearts of the people. Although the concept of system design was absorbed in later research, and its connotation was enriched; some people still equated it with “3R1D,” which seriously limited the design vision of green packaging [13]. Guided by the idea of “ecological integrity,” ecological design tends to adopt the life cycle analysis method to explore the impact of packaging on the environment and human life from the perspective of integrity. With the deepening of the idea of sustainable development, the connotation of ecological packaging has been further expanded. The design goal of ecological packaging is pointed to the future, and the possibility of human future lifestyle is explored. The research direction of ecological packaging has shifted from “environmental protection” to research on ecological benefits, economic benefits, and social consumption culture. Figure 1 shows the principle of 3R1D.

Values of ecological design: from the beginning of Zhuang, Zhou, and Mengdie, Chinese traditional culture has used the overall aesthetic concept of “unity of things and myself” to understand the value of human beings. For example, the poet’s “I see green mountains are flattering” is a positive evaluation of nature, while “I see green mountains should be like this” is a positive evaluation of human values based on nature [14]. The only understanding of the intrinsic value of human beings is the excuse that anthropocentrists try to override nature and take their own interest as the center and uncontrolled conquer and plunder nature, which will eventually lead to human self-destruction [15]. Taking human beings as the evaluation standard of all values is a narrow concept that looks at the ecological whole. Therefore, ecological design takes whether it is conducive to the harmonious coexistence of the ecological whole as the ultimate evaluation standard. The green ecology diagram is shown in Figure 2.

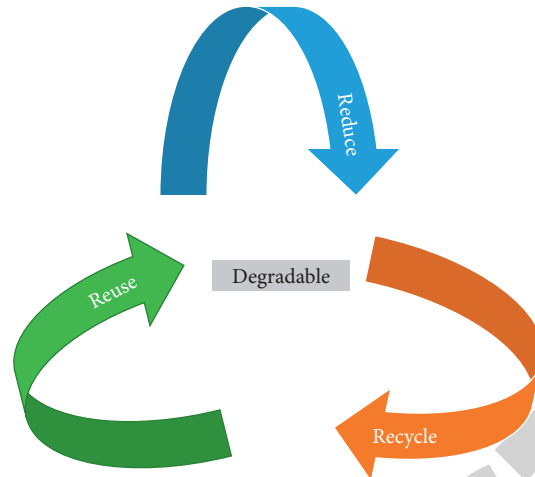


FIGURE 1: 3R1D principle.

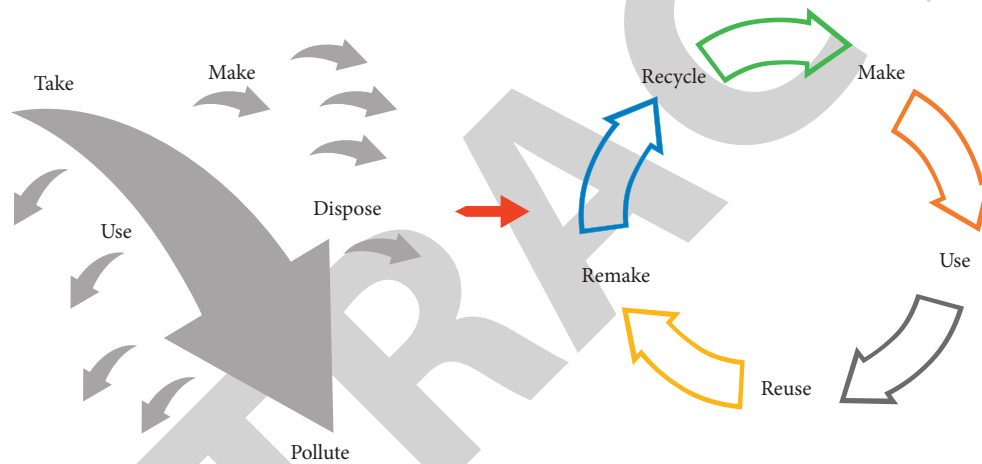


FIGURE 2: Green ecological diagram.

The scientific and technological view of ecological design. Science and technology provide a driving force for the development of social economy and culture and are an important force to promote the progress of human society. The emergence of modern science and the first industrial revolution represented by the steam engine opened the prelude to socialized mass production, initiated modern industrial civilization, promoted the unprecedented development of productivity in Europe, America, and the world, created unprecedented material wealth, and greatly changed the way of human life. Science and technology have gained an incomparably high status and are considered an important driving force in promoting the progress of human society and the only way to understand and transform the world [16]. But it also has many unavoidable drawbacks. Based on physics and chemistry, traditional technology has created rich material wealth for human beings and made great contributions to social development and economic prosperity. It is this technology that is constantly destroying the ecological environment on which human beings depend. Technology is the way in which human beings use science. Like science, technology is the symbol of rational ability [17].

Rationalism and its derived technology are like a cold and ruthless double-edged sword, which not only gives people a lot but also makes people lose a lot. Science and technology do not necessarily lead to ecosystem problems, but the relationship between them cannot be denied. What links the two is the indifferent attitude of human beings towards ecology. Facing the dilemma of survival and development, human beings need to integrate ecological consciousness into the application of traditional technology, and more importantly, they need to invent and create science and technology containing ecological consciousness [18].

The life cycle analysis is the evaluation method of ecological design. It is obviously not feasible to count and calculate such huge and complex data manually. At present, there are many commercial software that can be used for life cycle analysis, most of which are general-purpose software, and there are also functional modules integrated with computer-aided design software. The selection of life cycle assessment software should focus on the following aspects: first, the database sources are rich and authentic. There are multiple source databases to choose from, complete basic data on production raw materials and energy and process

data in relevant production fields. Second, the database is extensible. The database provider can constantly update data and allow users to add professional data in the production field by themselves, with the freedom to improve and modify existing data, parameters, and specifications [19]. Thirdly, the function of scenario modeling is flexible. It can complete the modeling of a complex process chain and provide a general process chain model. Fourth, the computing module structure is clear and transparent. It can trace back each result to find problems. Fifth, the evaluation indicators are comprehensive and can provide analysis reports in different formats [20]. Sixthly, the software has a friendly interface and is easy to learn and use. Although life cycle analysis is difficult, it is still the best way to evaluate ecological benefits by completing the evaluation in design and production. Life cycle analysis only focuses on the impact of the consumption of natural resources on the environment. If a complete evaluation of ecological design is carried out, it is also necessary to remove stress from economic and social factors. In this regard, it is difficult to form a generally recognized quantitative analysis method. The general ecological cycle is shown in Figure 3.

3.2. Ecological Materials for Food Packaging. Most of the original ecological packaging materials, ancient packaging, have written records, or have been preserved in kind, the method has been passed down to the present, are food packaging. They usually use uncut natural materials, and their forms are simple and natural. In the eyes of some people, nature is a model of simple design. It is true that ancient food packaging not only made full use of natural materials such as bamboo, wood, rattan, and grass, reflecting the traditional cultural wisdom of harmonious coexistence between man and nature but also carried the desire of modern people for harmonious ecology, which was in line with the ideal of returning to nature and returning to nature for modern people who were tired of industrialized urban life [21]. From the perspective of protecting food and facilitating circulation, modern packaging is more than 100 times more advanced than the ancient original ecological packaging, but from the perspective of ecology, the original ecological food packaging seems to be more “ideal.”

Modern ecological packaging materials, science and technology have always been the main driving forces for the development of packaging materials. Scientific and technological rationality makes the research, development, and production of materials excessively pursue excellent physical and chemical properties and use performance and rarely consider energy consumption, environmental pollution, and harm to human health in this process. With people’s attention to ecological issues, packaging materials with the words “green,” “ecological,” and “degradable,” for example, the global plastic application field is mainly the packaging field, accounting for 40% of the market, and the global plastic pollution is also mainly from the packaging field, accounting for 59%. Packaging plastics are not only the main source of white pollution but also have the characteristics of one-time

(if recycled, the number of cycles is high), difficult to recycle (use and abandoned channels are scattered), low requirements for performance, and high requirements for impurity content. Figure 4 shows the distribution of global white pollution sources.

It has also been noted that paper bags require several times more energy than plastic bags, and recycled plastic bags are times that of paper bags, so plastic bags are more environmentally friendly than paper bags. The disposable plastic water cup and coated paper cup are analyzed by the life cycle assessment method. The results show that although the plastic cup has disadvantages in resource energy consumption and degradability, it has a relatively small impact on the environment in its whole life cycle. Due to the imperfect theory and method of ecological benefit evaluation, which material is more environmentally friendly has become a very complex problem, and even experts are difficult to make convincing conclusions. Based on this situation, appropriate packaging materials should be selected according to the characteristics of the packaging object in the design, packaging with best performance and largest quantity should be produced with the least materials as far as possible, and new natural recyclable packaging materials should be developed at the same time.

3.3. Ecological Design Principles of Food Packaging

3.3.1. Reduction Design. “Reduction” design is a preventive measure to prevent waste and environmental pollution for each link in the life cycle of packaging. The main method is to reduce the volume of packaging itself, simplify the production process, choose new degradable packaging materials, nontoxic packaging materials, and lightweight packaging materials, so as to achieve the saving of packaging production materials, to reduce energy consumption in production and transportation, to reduce waste discharge during production, and to reduce the total amount of packaging waste generated after consumption and to avoid harm to human health. As the volume of packaging is mainly controlled by products, enterprises and designers in Japan and other developed countries have been committed to breaking through the limit of “short, small, thin, and light,” and the product structure is becoming smaller and simpler, laying the foundation for the “reduction” design of product packaging. Due to their own characteristics, except for some special foods such as aerospace food, most foods in daily life have little room to reduce the volume. However, there is still much room for improvement in the “reduced” design of food packaging.

3.3.2. Reuse Design. Reuse design means that products and components still have functions similar to the original use or can derive new uses after losing their original use. Therefore, food packaging design should not only focus on the function of packaging in the circulation process but also consider the use of packaging waste. There are two types of reuse: planned reuse and unplanned reuse. The former means that the

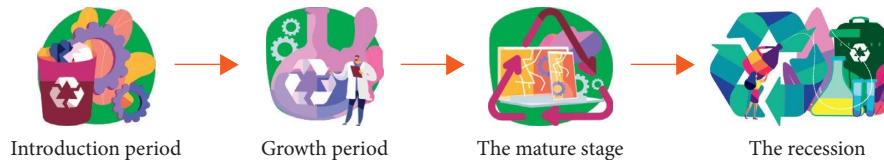


FIGURE 3: Ecological cycle diagram.

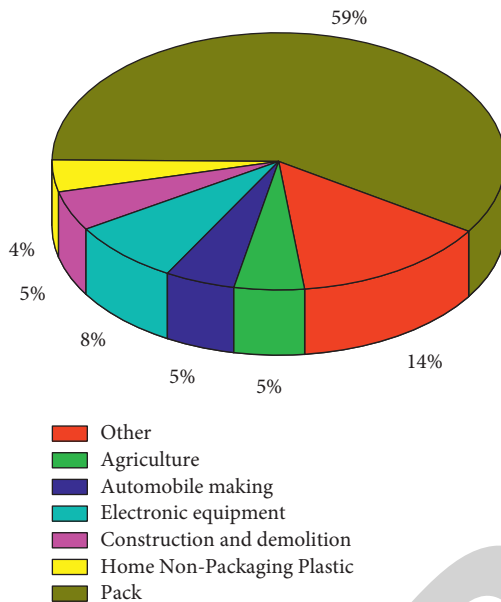


FIGURE 4: Distribution of global white pollution sources.

packaging or components can be reused as expected in the design, including not only continuing to play the original function but also the preset function completely different from the original. Unplanned reuse refers to the use derived from packaging that was not expected at the time of design. It is often created spontaneously by consumers to give new life to waste and make it have the value of reuse. Of course, the new functions derived from it must meet the needs of consumers and be accepted by society and the environment. Food is a one-time consumer good, which generally has a clear and limited shelf life. In particular, fresh food takes very little time from production to the consumers' table. Therefore, the life cycle of packaging is relatively short, resulting in a large amount of packaging waste. Migros company in Switzerland is a chain enterprise of food department stores and supermarkets. In its original business methods, it has put forward effective "environmental protection methods." This method examines the product development plan from the perspective of economics. The most important point is to "make the best use of all materials and substances to reduce resource and energy consumption." The planned reuse of packaging is an important defense line to prevent the waste of resources and environmental pollution in the process of production and consumption. Designers should actively follow the principle of "making the best use of everything" and try to prolong the life of food packaging [22].

3.3.3. Recycling Design. Recycling and reuse design are to enable enterprises to recycle and recycle products into production raw materials or recycle them after treatment through recycling channels. The premise of recycling design is to ensure that packaging waste can be recycled. The recovery rate of waste is affected by the economic value of the material, the difficulty of recovery, the recovery cost, and the recovery channel. Generally speaking, packaging made of a single material has a high recycling value, such as metal packaging, plastic beverage bottles, packaging cartons, and cardboard, which are the most favored waste products by waste buyers. However, it is difficult to recycle packaging made of two or more different materials. For example, the composite packaging material made of paper, plastic, and tin foil cannot be degraded naturally. Landfill and incineration are bound to bring environmental pollution. Packaging waste can only be treated through recycling. However, because of their low-cost, lightweight, convenient use, safety, and health benefits, plastic paper composite packaging materials have been widely used in liquid food packaging all over the world and are increasing significantly every year.

4. Result Analysis

Through the research on green ecological packaging design, this paper, based on the actual situation, makes a follow-up analysis of the sales volume, cost, and profit of a biscuit product before and after food packaging design.

Object:

- (1) The original plastic packaging of a biscuit product is not recyclable and environmentally friendly.
- (2) A biscuit product has been upgraded through a green ecological packaging design. It uses recyclable metal packaging, and the packaging bag can be degraded. And, simplify food packaging-related processes to prevent overpackaging and other situations.

The above products have been investigated and analyzed for up to 7 months, as shown in Figures 5 and 6.

Analysis results: from the above comparison chart, it can be seen that, after the green ecological packaging design, although the sales volume of the product has not increased significantly, or even may decline, the cost of the product has been reduced by 20~30%, thus increasing the profit of the product by 30~40%. From this, we can see the advantages of green ecological design packaging. Moreover, the packaging design is environmentally friendly, can be automatically degraded, and can be recycled.

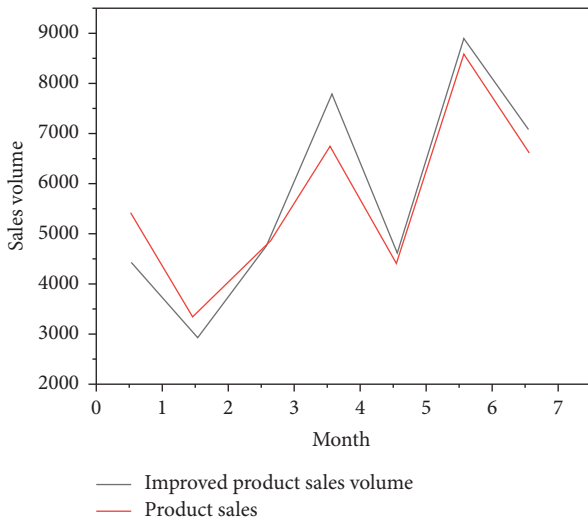


FIGURE 5: Product sales comparison.

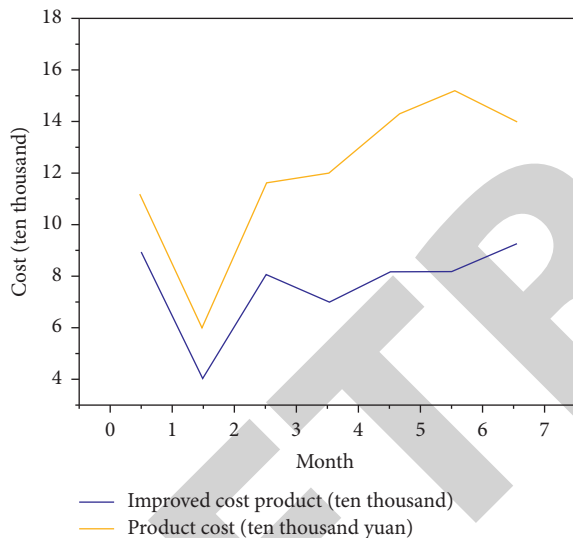


FIGURE 6: Product cost comparison.

5. Conclusion

This paper puts forward a kind of food packaging design based on green ecology. Through the discussion of the theoretical framework of ecological design and the study of ecological materials for food packaging, this paper summarizes the ecological design principles of green ecological food packaging. This paper also summarized the ecological design principles of green ecological food packaging, in order to better guide the packaging design. This paper also compares the sales volume, cost, and profit through the packaging design of a biscuit. After the improvement of the green ecological packaging design, although the sales volume of the product has not changed significantly, the product cost and profit have significantly increased, which shows that the green ecological food packaging design can effectively promote the sales and

trading volume of the product and is also environmentally friendly.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares no conflicts of interest.

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