Research on the Application of Environmentally Friendly Packaging Materials in the Sustainable Development of Logistics

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Abstract. With the quickening of environmental pollution control in China, the concrete measures of "plastic limit" and "plastic ban" were put forward one after another. At the same time, the Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste will be formally revised and implemented in September 2020. This fully demonstrates the importance we attach to ecological protection and sustainable development of the environment and our determination to control environmental pollution. At present, with the popularization of e-commerce, the fragmentation of consumption, the penetration of online shopping in rural areas is getting bigger and bigger, and the express delivery industry is showing explosive growth. Especially under the epidemic, consumers' consumption behaviors and consumption patterns have changed greatly. Network consumption behavior increased significantly, carton, plastic bags and other packaging products demand increased significantly. It consumes a lot of resources, such as paper and plastic products, and also produces a lot of packaging waste. Through the analysis and comparison of several disposable plastic packaging materials in green logistics, the importance of green packaging in green logistics is discussed, which has a strong inspiration for environmental protection and the development of green logistics.

1. Introduction
The newly revised Law of the People's Republic of China on the Prevention of Pollution by Solid Waste will take effect on Sept 1, 2020. The goal is to promote solid waste pollution prevention in China. Development, low carbon life, emphasis on the construction of ecological civilization. Article 68 of the Solid Waste Law stipulates that "products and packaging materials shall be designed and manufactured in accordance with national cleaner production requirements." Express delivery, sales and other industries should give priority to the use of recyclable and easy to recycle packaging materials, optimize packaging, reduce the use of packaging materials, and actively recycle packaging materials. Countries encourage and guide consumers to use environmentally sound emission units. Article 69 states that the State prohibits and restricts the production, sale and use of non-lethal plastic bags and other secondary plastic products, such as single-use plastic products such as plastic bags, and facilitates the adoption of alternatives such as recycling, recycling and biodegradation. Therefore, logistical constraints include: lack of comparability; Lack of comparability; Lack of comparability; Lack of comparability; Lack of comparability; Lack of comparability; Lack of comparability; Lack of comparability; Lack of comparability; Lack of comparability. And a ban
on single-use plastic packaging products, the use of green packaging or reduced packaging is a prerequisite for the sustainable development of logistics.

2. The connotation of logistics green packaging
Logistics packaging is actually a general term for containers and other materials used to maximize the protection of the product and promote the transportation and sale of the product. Therefore, in addition to meeting the needs of safety and convenience in the process of commodity transportation, logistics green packaging can also be harmless to the ecological environment and human health, and can be repeatedly used and recycled. That is to say, resource saving, environmental protection of packaging materials in line with the sustainable development of green logistics packaging.

1) The implementation of packaging should be reduced.
2) Packaging should be easy to reuse, easy to recycle.
3) Packaging waste naturally tends to deteriorate.
4) Packaging materials are harmless to human body, in life.
5) Can not cause environmental pollution and public hazards in the whole life cycle of packaging products.

3. The necessity and feasibility of green packaging

3.1. Necessity
At present, the plastic packaging material is light in weight, high in strength, strong in impact resistance, easy to form, good in viscosity, transparent, moisture-proof, beautiful, chemical stability, and the packaging material has corrosion resistance and other excellent properties. The Achilles heel of plastic packaging is that it does not degrade naturally. In order to strengthen the control of plastic pollution, which occupies land and pollutes the air and water, the General Office of the State Council issued Circular No. 72 [2007] on restricting production. "In all stores, shopping centers, markets and other retail outlets, the plastic bag purchase payment system cannot provide plastic bags for free."

The ban is aimed at raising public awareness of environmental protection and reducing or restricting the use of plastic bags, including through the payment system. However, 12 years later, with the increase of population, especially after the new outbreak of pneumonia, many residents stay at home every day to buy food and shop online, in the past, supermarkets and shopping centers paid to buy plastic bags, but the online transaction was free. Consumption of single-use plastic products is also increasing in China. China consumed nearly 60 million tons of plastic in 2017. In 2019, China produced 80 million tons of unprocessed plastic plastics. About 30% of plastic is used in the packaging industry, while a small proportion is effectively used.

As a material and technical guarantee for food in these areas to meet consumer concerns about food safety and advertising, companies often repackage, with plastics accounting for about 80% of packaging materials.

With the development of new consumption modes, the design and use of green packaging materials cannot keep up with the pace of logistics, resulting in serious excessive plastic packaging and environmental pollution.

At present, there are mainly the following problems in commodity logistics packaging:

1) Excessive packaging. According to the definition of packaging, the basic functions of packaging are shown in the description, protection of products, convenient transportation and promotion of four functions. In order to prevent the damage of goods during transportation and distribution and the promotion of goods, the logistics center of goods distribution has excessive packaging. This is not only a waste of plastic resources, but also an increase in logistics costs.

2) Environmental pollution. Plastic is a high polymer, stable performance under normal temperature and pressure. As a result, they have become the most popular packaging material in the logistics industry. There are more than 20 common types, which are difficult to classify. For example, PE, PP, PVC, PET and other plastics are difficult for professionals to distinguish by their senses, and more difficult for
ordinary people to identify and distinguish. Therefore, plastic waste, especially the disposable plastic used for logistics packaging, after completing its packaging task, most of it goes into domestic garbage and is disposed of in landfills. The waste plastic can not be degraded for decades or even hundreds of years, occupying valuable land resources. In recent years, incineration treatment of domestic waste has been promoted throughout the country. The biggest secondary pollution problem is the emission of dioxin pollutants in incineration flue gas. Dioxin is difficult to decompose in the soil with rain water. It not only harms animals, plants and crops, but also enters the human body through the food chain, causing serious damage to the liver and brain, causing liver disease and even cancer. The waste plastic in domestic garbage incineration is the main source of dioxin.

To sum up, it is imperative for the logistics industry to restrict and prohibit the disposable plastic packaging of commodities, and the promotion and use of green packaging in logistics is imminent.

3.2. The feasibility of green packaging

3.2.1. Ecological civilization construction and legal requirements. During an inspection tour in Henan Province in September 2019, Xi Jinping pointed out that we should pay attention to conservation and environmental protection, put an end to excessive packaging, waste and environmental pollution. Since the National Development and Reform Commission and the Ministry of Ecology and Environment issued the Opinions on Further Strengthening the Control of Plastic Pollution (NDRC [2020] No. 80), Hebei, Jilin, Yunnan, Tianjin, Guangdong and other provinces have successively announced the requirements of banning and restricting plastic products, and formulated the schedule and roadmap. In April, Hainan's Department of Ecology and Environment issued a notice on the pilot work of banning the production, sale and use of single-use non-degradable plastic products. A pilot "ban on plastic products" will be organized in key industries and local areas from April to November 2020, and a total ban will be implemented across the island from December 2020. On May 6, 2020, the People's Daily, titled "from the" limit "to" ban ", gradually replace disposable plastic products classification, comprehensive countdown to "ban" in hainan. Hainan is the first to say "no" "white pollution" of the province. On September 1, 2020 implementation of the new solid waste law for "ban", "plastic limit" and provides the powerful legal support.

3.2.2. Application of green packaging materials and technology. At present, there are many kinds of packaging in logistics distribution, such as cold and hot plastic film packaging, soft plastic turnover box packaging, plastic turnover box packaging, bag packaging, non-woven packaging and so on. Thermoplastic film is widely used because of its simple packaging. For example, 85% of cigarette distribution centers in the tobacco industry use disposable plastic film packaging. This kind of cigarette distribution packaging in the tobacco industry only consumes about 16,000 tons of disposable plastic film every year. The waste plastic is basically unable to be recycled and enter the domestic market as waste.

In order to reduce the environmental pollution of disposable plastic packaging materials, looking for recyclable, recyclable, biodegradable alternative products has become a consensus. Currently, the commonly used packaging alternatives are as follows:

1) PP honeycomb sheet calcium forming box (soft plastic rotating box). It can be recycled up to 100 times. It's easy to fold. Honeycomb material is light, strong buffer and pressure resistance, waterproof and moisture-proof. Cartons do not get wet easily, have a low rate of breakage, and can be folded.

2) Foldable plastic turnover box. It can be recycled for more than 500 times. After folding, it can save more than 75% of the storage space. It can be easily assembled without packaging tape in 10 seconds. Waterproof and moisture-proof performance is good, the load of a box can reach 25kg.

3) Flexible packaging bag (chemical fiber) can be recycled, long life. The combination of software and hardware, high loading rate. Resilient packaging can show separate cases. Household packaging, high distribution efficiency.
4. Comparative analysis of green packaging

Now, the functions of disposable plastic packaging and substitute packaging are compared, as shown in Table 1

| Table 1. Comparison of three packing methods. |
|-----------------------------------------------|
| **Compare the project**                      | **Disposable plastic film** | **Foldable turnaround box** | **Flexible cloth bag packing** |
| **Product protection**                       | Easy to puncture, poor strength | Comprehensive protection, low breakage rate | Soft and hard combination, good protection effect |
| **Packing in cloth bags**                    | Single use, single package cost fixed | According to the design times of use, the single packaging cost is far lower than PE film | According to the design times of use, the single packaging cost is far lower than PE film |
| **The shipping cost**                        | Low logistics cost and high loading capacity | Household or classified packing, the loading capacity is reduced, assembly efficiency is reduced | Household packaging, high loading capacity, low logistics and distribution costs |
| **In road management**                       | Poor | RFID and two-dimensional code technology can be used to realize real-time supervision of goods in transit | RFID and two-dimensional code technology can be used to realize real-time supervision of goods in transit |
| **Saving energy and reducing consumption**   | High resource consumption, high energy consumption of packaging equipment | Resource cycle utilization, packaging equipment, low energy consumption | Resource cycle utilization, packaging equipment, low energy consumption |
| **Environment friendly**                     | Poor, producing "white pollution" | Well, resource recycling reduces "white pollution". | Well, resource recycling reduces "white pollution". |

As shown in Table 1, the production cost of each disposable plastic packaging substitute with its own characteristics and advantages is a one-time cost. The plastic wrap can be replaced by a key. Disposable plastic packaging, although the cost is lower, but the delivery is simple, but environmentally friendly. Use a collapsible box or bag with elastic tissue such as packaging material. The original price of purchasing a collapsible flip box or elastic tissue bag is higher than that of single-use plastic film, but when the collapsible box or elastic bag is used many times, the cost of the packaging material will be significantly lower than that of single-use plastic film packaging.

Now the packaging costs of disposable plastic film and foldable turnover box are compared as follows, as shown in Table 2.

| Table 2. Table of cost comparison between membrane and cartons. |
|---------------------------------------------------------------|
| **The name of the company** | **The packing way** | **Annual logistics distribution volume (ten thousand box)** | **Annual packaging expenses (ten thousand yuan)** |
| A company            | Disposable plastic film | 9.7          | 70          |
| B company            | Foldable turnover box  | 11           | 10          |

In 2013, Company B purchased 18,518 turnover boxes, the unit price of which was 1 million yuan, and each box was 54 yuan. The boxes were used for 7 years and could be reused for 3 years. Therefore, taking 10 years as a cycle, when the annual logistics distribution of Company A and Company B is the
same, the purchase cost ratio of disposable plastic film and folding turnover box is 7:1, indicating that the use of turnover box can reduce the logistics packaging cost, save the consumption of plastic and reduce the generation of plastic waste. It conforms to the national industrial policy of clean production and circular economy. Economic continuous cleaner production technologies and processes can further reduce production costs by tapping the potential of packaging equipment.

Table 3 shows the cost comparison of cigarette packaging equipment.

| Packing element       | Disposable plastic film packing machine | Cloth bag packing machine | Turnover box packing machine |
|-----------------------|----------------------------------------|---------------------------|-------------------------------|
| Packing capacity      | Elastic load                           | Elastic load              | Elastic load                  |
| Packing speed (10,000 PCS/hour) | 1.6-1.8                                | 1.8-2.1                   | 1.2-1.5                       |
| Machine power (KW)    | ≤8                                      | ≤5                        | ≤10                           |
| Overall dimension (m) | 4.6 ✗ 3.4 ✗ 1.9                        | 4.5 ✗ 2.6 ✗ 2.5           | 8 ✗ 5.6 ✗ 2                  |
| Drive way             | electric                                | electric                  | pneumatic                     |
| With and without      | have                                   | not have                 | not have                     |
| peculiar smell        | unrecoverable                           | recycled                 | recycled                      |
| Turns                 |                                        |                           |                               |
| Price (ten thousand yuan/set) | 75                                      | 45*                      | 51                            |

* Reduce the investment of newly purchased equipment by using the cost of upgrading the current disposable plastic packaging machinery and equipment.

It can be seen from Table 3 that under the forebank where there is no significant difference in the loading capacity and packaging speed of the packaging machine and can meet the logistics and distribution needs of cigarette packaging, the production cost can be reduced by using green substitute packaging production machinery and equipment. At the same time, packaging materials can be recycled, in line with the concept of ecological civilization construction and development.

5. Conclusion

To sum up, the packaging machinery and equipment should be reformed and adjusted, and green packaging such as cloth bags and turnover boxes should be recycled and reused for many times. After the green packaging reaches a certain use cycle, the packaging cost and logistics cost will be greatly reduced, and the consumption of disposable plastic packaging materials will be reduced from the source, and "white pollution" will be eliminated. Send with cigarette of cigarette, medicine circulation, house express delivery. In the field of transportation and other logistics, it has great practical significance. In the process of distribution and circulation of goods of different shapes and sizes, the choice of green packaging material is likely to replace plastic packaging.

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