

STS Analysis of the Cause and Essence of Waste

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Abstract

The waste problem is closely related to the traditional cognition of human waste accepted by the earth, the invention and use of plastics, the industrialization of social economic structure, urbanization and the development of science and technology. Ecologically, waste is the “external input” of ecosystem. From the view of nature, the waste problem can also be attributed to the anti-natural expansion of modern industrial civilization. Waste is also the end of the chain of “science-technology-product-industry-pollution and waste”. Waste is related to the ideology of industrial civilization. It is believed that it is the right of human beings to obtain resources from nature and discard wastes indefinitely. The ecological cost is placed outside the calculation scope of economic development, and nature is regarded as the raw material storehouse and disposal site.

Keywords

Civilization, Ecosystem, Waste, Urbanization, Environment

1. Introduction

The problem of waste is constantly changing with the progress of human civilization. In the long historical period of the development of human society, due to the small population and low social productivity, waste is not enough to become a problem. With the arrival of industrial civilization society, the social productivity has been improved rapidly, the process of industrialization and urbanization has been accelerated, and the population has concentrated in cities, resulting in a large number of industrial waste and urban living waste. The environment cannot absorb these wastes, which has become an important pollutant that damages the urban landscape and pollutes the environment.

Catherine de Silguy (2005) once pointed out that human history is inseparable from waste. In the early days, people entrusted the task of waste disposal to nature, which was blocked by the process of urbanization and industrialization. As

one of the elements connecting human activities and nature, waste is gradually excluded from the society and unable to join the ecosystem cycle. Yoshida Fumikazu calls the society we live in a “throw-away society”. Under the production mode of “mass demand-mass production-mass consumption-mass waste”, the limited natural resources conflict with the unlimited human needs. A large number of resources are produced into consumer goods and soon become waste. The earth has become a “container” for human dumping waste.

In the traditional society, the relationship between human beings and nature is relatively harmonious. There is no real modern industry but workshop-style handicraft industry, the pollution harm is almost zero compared with the industrial society. All kinds of wastes generated in human society can be absorbed by the surrounding environment and decomposed by microorganisms in the land. The ecosystem has not changed dramatically because of human-made waste. During this period, restricted by traditional social factors such as population, production technology and technical level, the total amount of waste is limited. Most of them use natural resources in an extensive way, without disciplines and industries such as physical synthesis and chemical processing. At that time, the traffic conditions were underdeveloped, and the human activity area was limited. Most of the wastes were dumped in the surrounding environment.

In modern society, with the expansion of the scale of urbanization, more and more people gather in cities. As demand is the internal motivation of human behavior, according to the development mode of “mass demand-mass production-mass consumption-mass waste”, people’s demand for a better life will inevitably lead to the development of more consumer goods. Under the joint action of capital and consumerism, consumption is more and more highly praised by people, and more waste is produced. In modern society, every object exists in a functional environment. With the loss of functionality, it will lose its position in the original society, and then find its position in the waste chain. This is also the result of the interruption of the social process of things. When there is no need for its existence in the social structure, it is classified as waste and becomes the residue of the society. However, people usually only focus on demand, production and consumption, and often ignore the existence of waste in theory and reality.

The waste problem is a multi-dimensional problem involving environment, health, ethics, technology and other factors. The reasons can be analyzed from many aspects such as human traditional cognition, plastic characteristics, urbanization, modern science and technology, social and economic development.

From the perspective of science, technology and society (STS), a systematic study of the waste problem has enriched and developed the existing relevant theories, which is also a further supplement to the understanding of the waste problem.

At present, the problem of waste disposal and its ecological environment problem has become the focus of global attention. The theoretical research on this topic includes the current situation and future trends of waste problem, but

it lacks a certain social perspective and theoretical support, which is basically a situation with more construction and less criticism. The study will be an important resource for the public to examine the current environmental issues and for the government to formulate environmental policies, providing a platform for the public to better understand how science, technology, culture, environment, economy and other factors affect the waste issue.

2. Reasons of Waste

2.1. The Traditional Cognition of Human Waste Accepted by the Earth

The earth has long been regarded as a place for human beings to accept their wastes. Our prehistoric ancestors threw their waste into the earth. When the waste reached the saturation state, they found new places to live and handed over the waste to nature for disposal (de Silguy, 2005).

The problem of “waste pollution” only appeared after human society entered the industrial civilization society. Waste is a symptom of the modern “throwaway society”, which is deeply influenced by consumerism. On August 1, 1955, Tolev published the article “throwaway living” in American *Life* magazine. For the first time, he proposed and used the term “abandoning society”, which is commonly used to describe the consumption patterns and values of modern people. When consumption becomes a habit, the durable property is no longer the most fundamental pursuit of products, and “one-off” and “fast consumption” become the mainstream values (Scanlan, 2005). David Harvey pointed out that since the early 1960s, we have entered a new era. The use of disposable items has become the driving force of society. It means not only that we can throw away the products we produce, but also that we can throw away the values, production methods, stable relations, attachment to things, buildings, places, nations, as well as the behaviors and existence accepted by the public type.

The fact that the earth has become a “natural dumping ground” is explained by two aspects: the traditional cognition of human culture and the nature of the earth.

First, the interaction between the subject and the object often produces specific concepts and understandings, which are gradually deepened through the interaction between the subject and the object. Humans have treated the earth as a “natural dumping ground” since prehistoric times, and once the concept and cognition have been formed, they will be strengthened through the habit, and taking for granted the earth’s acceptance of human-generated waste. The habit of discarding waste to the earth formed by human beings for a long time has deepened the impression that the earth is a natural dump.

Second, in terms of its own material nature, the earth is the objective conditions for human production and life. It is generally believed that pollutants entering the earth can gradually reduce the harm degree and toxicity of pollutants through diffusion, decomposition and other functions in the earth, or change the

form of pollutants through sedimentation and other effects, exist in the earth in a specific form, and temporarily withdraw from the biological cycle chain. The earth itself has a certain digestion capacity, and it can maintain a balanced state in a specific period. However, when the waste material changes and the amount of waste exceeds its acceptance capacity, the waste problem in this area will erupt.

2.2. Properties of Plastics

The waste problem is closely related to the invention and application of plastics. Plastic is the product of the development of modern science and technology. Only in the 20th century, it has made great progress. Now it has penetrated into all fields of society, and people have begun to re-understand the world through plastic. According to the report released by Roland Geyer (2017), human beings have produced 8.3 billion tons of primary plastics so far, and by 2015, plastic waste has reached 6.3 billion tons. Of the 6.3 billion tons of waste plastics, only 9% has been recycled, 12% has been incinerated, and the other 79% has been piled up in landfills and natural environment. If the current production and waste management model continues to develop, by 2050, 12000 metric tons of plastic waste will exist in landfills or natural environment.

Plastics was produced in the second half of the 19th century. In 1869, John Wesley Hyatt nitrated natural cellulose and used camphor as plasticizer to make Celluloid, the first plastic variety in the world. After the 20th century, plastic products appeared one after another. In 1907, Leo Baekeland, an American known as the “father of plastic”, created the first completely synthetic plastic, which opened the plastic era. The great demand for plastic products during and after World War II stimulated the large-scale research and development of plastic products, thus opening up the plastic industry.

It is generally believed that plastics has the characteristics of light weight, strong plasticity, low corrosion resistance and low price. It is precisely because of these advantages that plastics has become one of the widely-used materials beyond wood and metal. But on the other hand, these advantages are also limiting the development of plastics, which is the main reason for its harmfulness.

Corrosion resistance means that plastic is difficult to decompose. It may take 200 - 400 years for the plastics buried in the soil to be completely degraded to achieve inorganic mineralization. The ability of the earth to digest waste is limited. The accumulated plastic can only be gathered under the ground. With the accumulation of years, it will have a bad impact on the public environment. It can be said that the R & D, design and production of plastics lacks ecological and holistic understanding. Fundamentally, most of the plastic R & D and application industry only focus on the use of plastics during the period of “consumer goods”, for its entire production cycle, especially the follow-up of “consumer goods” is ill-considered.

Plastic is widely used because of its low price, which makes it a material that can be discarded everywhere, and constituting one of the most important sub-

stances that are discarded in the “throwaway society”. The disposal of plastic waste should break through the default configuration of traditional waste disposal habits. According to the traditional waste disposal habits, when the function of a product is exhausted, people discard it into the nature. Because its components come from the nature, it can be degraded and absorbed by the natural ecosystem, and will not cause waste accumulation. But this method is not suitable for the disposal of plastic waste. If the same disposal method is adopted, it can only cause long-term and large-scale accumulation of plastic waste in the earth, thus causing damage to human public health and ecological environment. At present, the recycling cost of waste plastics is three times that of new plastics, so its recycling and reuse value is still questionable.

2.3. Urbanization and Development of Modern Science and Technology

With the rapid development of large-scale urbanization and modern science and technology, the total amount of waste produced in industrial society is increasing rapidly.

The city has been regarded as the source of pollution since its birth, facing many problems, such as pollution, health and public health. Waste can also be generated in a long agricultural society, but the problem that waste becomes a perplexing problem is accompanied by the emergence of cities and the expansion of development scale. Compared with agricultural society, the problem of waste has become an aspect of the development of urbanization (Melosi, 2005).

Since the 1990s, the study of urban environmental history has become a new phenomenon in the study of environmental history. Joel Tarr, Martin Melosi and others have broadened the interface between human and nature, and regarded waste as a side of urbanization development. Tarr (2002) developed the theory of “urban metabolism”, which regards the city as an ecosystem: it not only needs clean air, water, fuel and raw materials from the outside to ensure the operation order, but also exports a large number of living and industrial wastes. With the expansion of the city, the scope of pollution is also expanding. He and Dupuy & Tarr (1988) take urban pollution as the core research content and integrates waste disposal network into Urban Networks. Joel Tarr (1996) believed that pollution is not unilateral. Water, air, soil and other pollution interact and permeate each other. Pollution is a kind of “cross-media pollution”. One treatment method often brings other series of pollution problems. Pollution only changes the form, transfers from one place to another, from one medium to another. In fact, the problem has not been substantially solved by “processing”. Melosi emphasized the role of technology in the evolution of cities, and believed that the waste problem was the result of large-scale production and population concentration in modern industrial society. This problem also existed before modern society, but it could not become an important social problem. After the industrial revolution, the industrial cities continued to expand scale, industrial agglomeration and the concentration of population makes this problem an im-

portant social problem. By studying the problems of urban pollution and population, geographical location, climate, politics, economy and social conditions, he believes that the solution of waste problem mainly depends on the source of control rather than various collection and treatment facilities.

Before the industrial society, the predecessors of waste were mostly composed of natural resources, such as natural plants, minerals, fabrics, etc. They come from nature, could also return to nature and participate in the process of ecosystem cycle. After the 19th century, with the development of disciplines such as organic chemistry and physiology, the components of waste precursor became more complicated. The wastes generated in the modern industrial society including a variety of artificial materials such as plastic products, glass products, heavy metals, etc., which will show contradictions in the process of being consumed by nature, and nature cannot be compatible with these artificial materials.

Taking the component analysis of disposable medical supplies as an example, the components are mainly PVC (Polyvinyl Chloride Polymer) general plastics. Since it first entered the field of disposable medical supplies in the 1960s and 1970s, it has been the main material for making disposable medical supplies. When the total amount of these wastes accumulated to a certain amount, which is beyond the bearing range of the biosphere, the ecological balance of nature will be destroyed, and various environmental problems will follow.

3. The Essence of Waste Issue

3.1. "External Input" of Ecosystem

In 1866, Ernst Haeckel first proposed ecology in his book *Generelle Morphologie der Organismen*. After Haeckel, some scholars have also interpreted the concept differently. It is generally believed that ecology is a science that studies the laws and regulations of the balance of energy and matter between organisms and their environment. In the 1930s, A. G. Tansley, a British plant community expert, first put forward the concept of ecological system, which is a unified whole formed by continuous material circulation and energy flow between all living things (i.e. biological communities) and their environment in a certain space. Factors such as producers, consumers, decomposers and non-living substances constitute the ecosystem. The circulation of each substance can be carried out at the three levels: biological individual, ecosystem and biosphere. The ecosystem contains two parts: living component and non-living component. They interact and influence each other. The whole human society is a part of the ecosystem, which carries out the circulation transformation and circulation of material energy through the interaction with the ecological environment.

Ecosystem is a dynamic and open system. There are continuous flow of energy and material circulation between organisms, organisms and ecosystems, ecosystems and the whole biosphere. When the ecosystem is in equilibrium, the input and output of material and energy are almost balanced. The ecosystem, as a feedback system, has the functions of automatic adjustment and self-regulation

to keep itself stable. The ecosystem has a certain degree of resilience to the “external input” imposed by humans. If the “external input” exceeds the limit of ecosystem, that is, exceeds a certain ecological threshold, the regulation system will lose its function.

In the modern industrial society, humans have produced many unnecessary elements and artificial compounds that were not originally found in nature. Some of them are chemically stable and not easily decomposed, becoming part of the biogeochemical cycle. Synthetic materials such as plastics, rubber and heavy metals are widely used. The process of discarding them as waste is the process of material circulation into the ecosystem. In this process, when the total amount of material and energy input of waste exceeds the limit of ecological threshold, that is, when the input and output of energy and material reach the ecological threshold, it will cause the fracture between energy flow and material circulation flow, which will not only harm human health, but also cause a huge threat to the entire ecosystem.

3.2. Anti-Natural Expansion of Industrial Civilization

The essence of the waste problem is fundamentally the anti-natural expansion of modern industrial civilization. Under the background of industrial civilization, culture has an anti-natural cultural form. On the one hand, culture or society should always create a different existence from nature according to human needs. On the other hand, the development history of culture or society is inconsistent with that of nature. [Holmes Rolston \(2000a\)](#) mentioned that culture was created to resist nature, and culture and nature are contradictory. Every organism has to fight against its environment, and the culture intensifies this confrontation. People living in culture have realized the law of nature, that is to say, they have conquered and controlled nature. Humans have reshaped and changed the living world into a collection of cities. But this process contains some dialectical truths: the theme is nature, the antithesis is culture, and the synthesis is culture existing in nature. The nature of culture is endowed with anti-nature characteristics. This is an unavoidable problem when scholars at home and abroad discuss the issues of man and nature, nature and anti-nature. As Yu Mouchang, a Chinese scholar, pointed out, since the first stone axe was made and used by humans, we have been expecting to be masters of nature. In order to realize the survival of human beings, they must change nature, which is anti-natural in this sense. In this context, anthropocentrism is the basis for human beings to understand the world and transform the world, and as a value to guide human practice, under the guidance of this value, humans have achieved some success, but such success is short-lived, because the “anti-nature” nature of this value leads to adverse consequences, and fundamentally feeds back to human beings, making them trapped in a predicament.

The modern industrial civilization, which is dominated by the value of anthropocentrism, regards man as the center of nature on the basis of the mechanical

view of nature and the binary opposition of subject and object in the relationship between man and nature. The value of nature is reflected in meeting people's needs, that is to say, usefulness. It is human's right to demand for unlimited resources from nature and discard waste. Nature has become an object that can be disposed of according to human needs. Nature has become a tool for human beings to meet their needs. "Humans arrogantly believe that 'humans are the scale of all things', but these natural things have existed before humans. This valuable world, the world that human beings can evaluate, is not valueless; on the contrary, it produces value. Of all the things that we can imagine, nothing comes closer to the ultimate existence than it". The nature is regarded as the raw material storehouse, energy storehouse and waste disposal site, and becomes the final place of all waste (Holmes Rolston, 2000b).

The production mode of industrial civilization aims at capital, especially capital proliferation, with the main characteristics of "high input, high consumption, high output and high pollution". The corresponding production mode is "mass demand, mass production, mass consumption and mass waste". The ecological cost is placed outside the calculation of economic production. Nature is the resource base of human beings. Humans do not consider the bearing limit of nature and do not need to be responsible for nature, which directly leads to the unlimited expansion and destruction of nature. According to the logic of the view of nature of industrial civilization, the non-human beings in nature have no intrinsic value. It is reasonable and proper for human beings to use and dispose of them without any moral responsibility. According to this statement, the use of natural resources in the process of human production is to make the resources reflect "value". The waste after the consumption process is discarded, and there is no need for any explanation of nature (land, atmosphere, waters). They are unconditionally subject to human's will without reason.

Fundamentally speaking, the relationship between man and nature under the background of industrial civilization highlights the human side and drives nature out of human society. In essence, human beings belong to and exist in nature.

3.3. The End of the Chain of Science-Technology-Product-Industry-Pollution and Waste

In the society of industrial civilization, there is a positive feedback chain from science, technology to products and industries, namely 1) put forward scientific explanation; 2) propose technical intervention plans; 3) invent new products; 4) form new industries. After that, there will be two situations, one is that 5) will produce negative effects; 6) supplementary explanation or reinterpretation of science; 7) adjust the technical intervention programs; 8) upgrade products; 9) industry development; 10) new negative effects ... Tian, S. (2017) believes this cycle continues until the chain breaks down. Second, the positive feedback chain operates in the specific natural and social environment, and its products follow the "first principle of factory ecology" and "law of pollution and waste cycle of

scientific and technological products”. In short, the product will produce pollution during the production process, which will affect the ecological environment of the supply area of raw materials at the front end, become waste after the loss of the use value of the product, and cause various waste problems at the end. In the real world of life, this chain is often expressed as “the chain of pollution and waste in science and technology industry”. In the past research on science, technology and society, scholars generally paid more attention to the first half of this chain, the “science and technology industry chain”, and the second half of this chain, the “pollution and waste chain”, is also worth discussing.

4. Discussion and Conclusion

Traditionally, waste management was initially local. At that time, materials were scarce, and the communities inhabited by humans were not large. Correspondingly, the small amount of waste generated is not dangerous in human habitation. However, with the development of the industrial revolution, in the era of big industry, humans have gathered in cities and produced a large number of wastes. Individuals can't deal with all kinds of wastes produced without threatening the living environment. In the late 19th century, large cities began to regulate waste collection and treatment measures to prevent its threat to public health.

Before the industrial revolution and even industrial civilization, the issue of waste was a reflection of the division of urban and rural areas. Martin Melosi pointed out that waste is also produced in agricultural society. Compared with the waste in the industrial society, the waste in the agricultural society may only bring sensory aversion and inconvenience to the urban residents and urban managers. Then, the emergence and development of cities and industries have made the waste problem gradually prominent and become a threat to the health and ecological environment of people living in the city.

Before the industrial civilization, human beings gathered in cities in a scattered way. The overall picture of space and scale of cities has been changing with the development of human activities. At that time, the generation of waste was based on the self-sufficient economy, and people at that time were not so keen on capital and consumption as modern people. Relatively speaking, the amount of production would not exceed the range of residents' consumption. During the period of industrial civilization, with the birth and development of capitalist mode of production, the social productivity has made remarkable progress, and the population has begun to increase substantially. At the beginning of the 19th century, the population has reached 1 billion. In the early 20th century, the population reached 2 billion. In the middle of the 20th century, it reached 2.52 billion. In the early 21st century, the population was close to 6.2 billion. By 2016, the world population reached 7.2 billion. The United Nations predicted that by 2050, the population would reach 9.1 billion. With the rapid increase of population and the deepening of urbanization, the quantity of waste is almost increas-

ing exponentially.

People's living world and nature form a unified whole, that is, the ecosystem. In this system, biology and environment interact and constrain each other. They maintain a relatively stable dynamic balance in a certain range. When the flow and transformation of material and energy in the ecosystem breaks, and the "external input" reaches a certain degree of accumulation beyond the bearing range of the ecosystem, it will face the risk of collapse.

The literature selected in the study is limited, and the theoretical aspect is still in the research stage. In addition, the impact of urbanization on waste can be further deepened and become the research object in the future. Besides, the research on "the chain of science-technology-product-industry-pollution and waste" is not deep enough and needs further research.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

- de Silguy, C. (2005). *History of Human Beings and Their Garbage*. Tianjin: Baihua Literature and Art Press.
- Dupuy, G., & Tarr, J. A. (1988). *Technology and the Rise of the Networked City in Europe and America*. Philadelphia: Temple University Press.
- Geyer, R., Jambeck, J. R., & Law, K. L. (2017). Production, Use and Fate of All Plastics Ever Made. *Science Advances*, 3, e1700782.
- Melosi, M. V. (2005). *Garbage in the Cities: Refuse, Reform, and the Environment*. Pittsburgh: University of Pittsburgh Press.
- Rolston, H. (2000a). *Environmental Ethics: Duties to the Value in the Natural World*. Beijing: China Social Science Press.
- Rolston, H. (2000b). *Philosophy Gone Wild*. Changchun: Jilin People's Press.
- Scanlan, J. (2005). *On Garbage*. London: Reaktion Books.
- Tarr, J. A. (1996). *The Search for the Ultimate Sink: Urban Pollution in Historical Perspective*. Akron: University of Akron Press.
- Tarr, J. A. (2002). The Metabolism of the Industrial City: The Case of Pittsburgh. *Journal of Urban History*, 28, 511-545.
- Tian, S. (2017). Be Wary of Scientism at the Critical Point of Science, Technology and Society. *Beijing Cultural Review*, 6, 102-111.