

The Origin, Process, and Advantages of Recycling and its Benefit to the Environment

Anqi Zhou*

Department of shanghai, Shanghai Southwest Weiyu Middle School, Shanghai, China

*Corresponding author: 15010340119@xs.hnit.edu.cn

Abstract. Environmental issue is a life-threatening problem. Among them the emergencies is municipal solid waste. Currently, the globe creates around 1.3 billion tons of MSW annually, and by 2025, that number is predicted to rise to 2.2 billion tons. We must be able to control garbage in nations while also being able to estimate the output levels of pollution. This passage mainly focusses on the procedures and categories of recycling and its effect on the garbage classification of China. Since we are essentially repurposing garbage and old, useless items to create equivalent new ones, recycling is good for the environment. We are using fewer resources and sending less trash to landfills, which helps to reduce air and water pollution. Every day, the population is growing. Because of this, garbage production is also expanding tremendously. As more waste is produced, more room is required for garbage disposal. Now, it's crucial to remember that there is only a limited amount of space on earth, therefore it's up to us to use it wisely.

Keywords: Recycling; WTE; environment; job; business.

1. Introduction

Recycling is the process of collecting and converting resources into new goods that would otherwise be discarded as garbage. Recycling has the potential to benefit the environment and your community.

The main three sections of procedures are collecting and sorting, washing, manufacturing, and purchasing new products which are made from recycled materials. The first step is collection. Several methods can be conducted including curbside collection, drop-off centers, and even deposit programs. Those be done at any location such as restaurant, school, company and so on. However, there is one point should be paid attention to is that all the rubbish that is not separated will not recycle. For example, if you put the plastic waste into the normal trash bin, it will not be recycled because no one know plastic is in there [1].

After collecting all the trash, then it goes to the sorting. Different plastic has different sorting criteria. Those criteria are strict and needed to follow. For instance, plastics, due to different types, colors or even the ways it was produced, every plastic is processed in different ways and facilities. Moreover, such sorting usually comprises physical sorting ways by means of sieves, an elimination of large particles. This is necessary especially for foreign materials. The cleaning of plastic comes next. Plastics that successfully completed the preceding stage could not proceed to direct reprocessing. Cleaning is the next step that is necessary to get rid of the pollutants. Cleaning relies on the type of impurities, thus it's a very precise job. For instance, odorous components should be removed using a caustic wash, whilst the most apolar components needed to be removed using detergent or an organic solvent. The fourth step is mechanical recycling, which is also the most complex process. Researchers should ensure the cleanness, safety and the toxic impurities. The purity standard of the sorted ways may not as same as the virgin materials. At a result, the little particles they contain will be removed by advanced machine. There is even more restriction to the food packaging. All the materials it used are not allowed to include toxic impurities. Otherwise, it may appear unpredictable consequences when they go to the market.

At last, the most exciting part, manufacture those raw materials and sell them on the market. There are some common products we can find on the market that is recycled. They are newspapers, steel cans, aluminum and so on [2].

Public awareness of the value of recycling has been raised by the government, and recycling programs have been successful in certain industrialized nations. It will minimize incineration and reduce MSW, since waste separation is a crucial part of a successful recycling management that will improve the quality of recyclables. For example, the MSW recycling rate was 61% in Singapore, 58% in South Korea, 55.8% in Iceland, 42.1% in Australia, 47.8% in Germany, 34.3% in Belgium, and 34.6% in the United States. However, a million tons of MSW are being produced in developing nations. Although governments in poor nations have attempted to institute trash separation policies, these initiatives cannot be successful without the enthusiastic involvement of families in ongoing waste separation operations.

On the other hand, despite significant attempts to promote waste separation behavior, most nations, particularly those in Asia, still struggle with the less practice of waste recycle. Under the current circumstances, separating trash at the source necessitates a behavioral shift, and regulatory elements are crucial to help government authorities accomplish their public policy goals of increasing correctly sorted recyclables and reducing missed-sorted garbage.

2. Recycling Origin and its Development

The first recording of recycling could trace back to the ancient time, in Japan. The fall of the Japanese royal court at the time forces the paper mills to move to private estates. They employed those people to carry on producing paper, and it wasn't long before the practice of recycling discarded paper spread in order to save resources and increase production.

Due to the first and second World Wars, resource management had to be done in a novel way. Both the US and Great Britain asked the people for assistance when supplies ran out. The 1942 US marketing campaign "Salvage for Victory" urged people to be more considerate about what they tossed out and how they divided garbage. For instance, residents were told to bring used cooking fats to their neighborhood butchers so that they might be reprocessed into explosive fuel. The public does not always favor recycling, though. A substantial article titled "Throwaway Living" appeared in LIFE Magazine in 1955, supporting the notion that single-use objects were the norm and an essential component of contemporary life. The joyful—now ominous—article contributed to a less responsible way of thinking about garbage, which resulted in widespread littering and a lack of shame or environmental consideration [3].

Then, after much research, the Action Plan for a Beautiful and Clean Malaysia strategy AKA ABC—the country's first national waste management strategy—was unveiled in 1987. Such solution tries to cut down on waste generation, but it doesn't have a clear legal mechanism to make it happen. ABC Plan directed the implementation of two further recycling projects in 1993 and 2000. However, these recycling initiatives did not produce recycling or rubbish sorting practices that would continue over time. The Solid Garbage and Public Cleansing Handling Act 2007 has standardized the management of municipal solid waste (MSW) (also known as ACT 672), and mandatory separation and recycling of waste is formally established and pushed in Peninsular Malaysia since 2011.

Once we reach the 21st century, clever scientists find new materials that have the ability to mend themselves. It is clear that this is a wonderful finding since it will help minimize waste in the future. Additionally, a group of Japanese researchers uncovered a type of bacteria that consumes the plastic that is often present in water bottles. The video secretes an enzyme that converts the PET to create an intermediate molecule that is absorbed by the cell and then further broken down to provide the bacteria with carbon and energy to thrive.

On the other hand, e-waste also accumulates to a large amount because the fast development of technology. Consumer electronics are recycled in excess of 585 million pounds, up more than 25% from 2011 and 125 million pounds. A novel semiconductor has been developed by a Stanford engineer and her team that is biodegradable in addition to being as flexible as skin. Future e-waste generation may be significantly reduced because to this breakthrough technology. It is evident that waste classification positively impacts the environment and economy in the long term, but due to

current objective issues facing Chinese society, these benefits are not sufficient in the near term [4]. Nowadays, recycling takes an essential part of a country's development. Take China as an example, garbage collection in three steps is a significant component of the circular economy in China. China will actively promote green growth, encourage resource recycling, and minimize energy and material consumption under the direction of the "Scientific outlook on development 2018". It is now a prerequisite for China's internal sustained economic growth. "To put the ecological civilization in a prominent position and integrate into the economic construction, political construction, cultural construction and social construction in all aspects and the whole process, we build a beautiful China and realize the sustainable development of the Chinese nation. "

The four main categories of garbage in China at the moment are recyclable waste, hazardous and harmful waste, cooking waste, and else waste. Waste that can be recycled, namely, waste made of paper, plastic, glass, metal, and cloth; hazardous and toxic trash, such as used paint, batteries, fluorescent tubes, mercury thermometers, and expired medications. Waste from the kitchen, such as leftover fruits, vegetables, fish, plastic bags, etc. Other garbage, such as toilet paper, waste soil, tile ceramics, in addition to the other sorts of garbage.

2.1 Compare WTE and Recycling

These four categories are used in the rubbish classification to support China's economy and ecology. Direct material recovery and post-treatment energy recovery are two advantages from an economic perspective. Recycling recyclable materials at businesses or industries, following real-time collection and sorting by waste trucks, can result in large financial gains. For instance, 1 t of waste paper can be recycled to produce 850 kg of paper, 300 kg of wood can be saved, and 74% less pollution overall compared to equal production 0.9 tonnes of steel may be created from each tonne of recovered scrap steel, which is 47% less expensive than smelting ore.

However, recycling has more advantages compare to other method to reuse the waste. Here, it is essential to mention another method----- Waste-to-Energy. The waste-to-energy process, often known as WTE, is the method of turning garbage into a fuel source or electricity from waste after it has undergone basic treatment. Energy recovery in the form of WTE. Most WTE processes either result in the production of a commodity that can be burned, such as methane, methanol, or synthetic fuels, or they directly create electricity and/or heat through combustion. Discarded items including paper, plastic, and glass make up municipal garbage. More than 90% of the waste materials that are dumped in landfills and incinerators may instead be recycled. Burning these priceless resources to produce power inhibits conservation efforts and encourages people to produce more garbage. It was necessary to talk about a variety of WTE and recycling-related topics. Incinerators consume a wide range of reusable materials and produce only a small quantity of energy. In contrast, recycling and composting can save up to five times the amount of energy generated from waste combustion. waste energy in the United States, for example, by not recycling aluminum and steel cans, paper, and plastic is equivalent to the annual output of 15 medium-sized power plants. Companies that operate incinerators frequently promote "waste-to-energy" as a green energy source. Contrary to wind, solar, or wave energy, however, garbage is not produced by endless natural processes. Burning trash poses risks to the environment and public health. Massive levels of pollutants that poison the air, land, and water and eventually make their way into the food chain cannot be prevented by even the most sophisticated technologies. In addition to being a significant source of carcinogenic pollutants, incinerators also release minute dust particles that can impair breathing, cause irregular heartbeats and heart attacks, and hasten mortality [5].

Compared to recycling, "waste-to-energy" facilities provide very few jobs. Recycling is essential to millions of trash workers around the world. According to studies, this industry generates 10–20 times more jobs than incineration. Over 800,000 US employment are currently supported by the nation's recycling businesses, with a national rate of less than 33%. Building incinerators will eliminate employment opportunities for informal trash workers, such as waste pickers, recyclers, and haulers, in developing nations such as the Philippines. unskilled workers perhaps are able to migrate

to this environmentally friendly employment with investment in recycling, reusing, and composting [6]. Their earnings come from the creation of power, heating, the disposal of waste, and incineration. Additional revenue can be generated by turning trash into fertilizer, producing biogas, and turning fuel from waste. Costs associated with trash operation and management also include those associated with transportation, electricity, water, personnel, materials, and equipment maintenance.

Engineering investment expenses for processing MSW (sometimes referred to as municipal solid waste) include costs for constructing, buying, and maintaining facilities. In China, composting and anaerobic digestion of food waste more successfully recycle electricity and heat energy than incineration only, according to Yano's research. This means that, from an economic aspect, kitchen trash is processed using anaerobic fermentation or composting to produce usable energy rather than disposing of it in a conventional refuse landfill. Nevertheless, composting results in the production of leachate, waste residue, and greenhouse gases. Transporting leachate and waste leftovers to a landfill for specific processing is necessary. Trash burning could result in electricity.

However, fly ash, residue, and waste gas are produced during incineration. Fly ash needs to be stabilized using waste-activated carbon before being compacted, transported, and disposed of at a hazardous waste dump. The materials that aren't utilized are gathered and dumped at a landfill. The filter waste gas once it satisfies the quality standard. Waste which are capable of recycled may be reused to make money at a station for resource recycling and processing. A special landfill is utilized to manage hazardous waste. Special rubbish does not participate in the disposal of other wastes in order to preserve environmental quality. Other trash is thrown away in landfills but doing so emits leachate and greenhouse gas emissions. GHGs are generated throughout the whole life cycle.

2.2 Effects on other fields

Additionally, rubbish sorting is crucial in other industries. For instance, the energy and emissions generated during the treatment process were primarily responsible for the environmental advantages. Electricity generation made the most contribution to the environmental advantages, whereas diesel usage and transportation had minimal effect. The main reason landfills produced much more GHG than the other treatments were because of their direct emissions (233 kg CO₂ eq). More specifically, MSW may harm the ecosystem at every stage of its existence. Leachate and odor are produced during garbage storage, which helps bacteria grow. GHGs are produced during trash transportation when diesel is used (e.g., CO₂ and CO). Additionally, because the waste contains water, extrusion, jolting, and transporting create leachate that produces odor. Landfill gas, leachate, dioxins, and fly ash are all byproducts of waste disposal that damage the soil, water, and air. Nevertheless, these issues are able to resolve by classifying garbage to make the waste components easier to manage in terms of storage, transportation, and treatment, hence lowering pollutant discharge.

What's more, the economic benefits of recycling including creating more jobs. The study, from a global perspective, "More jobs, less pollution" shows that almost 2.3 million jobs while reducing pollution by 2030 would be created by a 75 percent domestic recycling rate [7]. Recycling, in fact, it is a labor-intensive and integrated work. Every fine process requires people to focus on. Recycling businesses have heavy demand for varying degrees of skilled and semi-skilled employees to perform recycling industry jobs in collecting materials to sell the products. Usually, those workers are classified as sorters, plant managers, and technicians and mechanics worker. Skilled personnel play an essential role in the industry including sales and logistics.¹ In addition, another remarkable occupation is drivers. Some countries provide home pickup services employ drivers, also known as recyclable material collectors. Their job is to pick up trash and transport them to an MRF (materials recovery facility) [8]. However, although their existence is so vital to our environment, they do not treat as the way they deserved. A 42-year-old employee was slain on March 1 at a Waste Management recycling facility. He was killed by a one-ton paper bale that fell on him. The Philadelphia Project on Occupational Safety and Health had been receiving allegations of dangerous conditions for years prior to the worker's death at Waste Management's Philadelphia site on March 1. The concerns included employees being ill at work, experiencing poor ventilation, dust, lightheadedness, and even

coughing up blood. The above issues are partially brought on by employers' disregard. Worker safety is not provided when delivering things like hazardous chemicals, animal carcasses, or human waste. As a result, a 2015 study by public health professionals titled "Sustainable and Safe Recycling" discovered industrial workers who work in recycling suffer injuries more than twice as frequently. In addition, fifteen recycling workers lost their lives while performing their jobs between 2011 and 2013 [9].

The instances clearly illustrate the awful working circumstances recycling workers currently face. Small groups of people fearlessly take a stance and defend their legal rights. As a result, some rebels find employment. The recycling staff at ACI formally elected to join the ILWU in October 2014. ACI management worked with a committee chosen by employees to seek a reasonable agreement rather than contest the verdict. The outcomes improved working conditions and remuneration at ACI and helped pull families out of poverty. By July 2019, earnings that were \$8 per hour will be above \$20. Sick pay, holidays, vacations, and family health insurance are now benefits that employees receive. Thanks to an active health and safety committee that meets every three months with strong voice from workers, safety improves to a large extent.

In addition, for our common people who are benefit from recycling should not look on with folded arms. That news also warns people to pay more attention to these minority and take some action to improve their living conditions. It is recommendable for people to do more research or project related to recycling. Advertising them to the public horizon and call for more people from different social status to support them. What's more, some journalists ought to criticize the less regulation of some recycling companies to strive for better working place for the recycling workers.

3. Summary

This essay mainly focusses on the recycling and talks about its origin, development, procedures, advantages compare to WTE and the effect on the environment and other fields. Lots of research, news, reporter or the public media show people the benefit of recycling, it is indeed a suitable solution to the world sustainable goal.

It proposed for a long time ago and developed in variety formations. With the supporters from only one person raised it to the many professional scientists invent new materials to improve it, recycling gradually goes to public horizon and goes to maturity. Its advantages are apparent and outstanding among other methods especially Waste-to-Energy approaches. The utilization of waste in the recycling is higher than WTE and it can save more resources, almost 5 times than WTE. Another thing is recycling does not harm people healthy. However, the WTE does produce the gas which is detrimental and toxic both to plants and humans. Maybe it is easy to conduct WTE in the beginning, but the subsequent effect is long lasting and harmful. Comparing them in the job creating, the recycling could provide more occupations for unemployed people and create more social benefits.

In the future expectation, recycling depends largely on lowering the quantity of items processed concurrently and raising the purity generated within the process of recycling. From one view, supported by conservation rather than consumption, is the standardization of materials across products. This helping people reduce and redefined the waste [10]. The future of recycling also heavily depends on government and business collaboration. According to the government, immediate environmental improvement was not possible. However, it improves the quality and sustainability of life for everyone in society. Although recycling initially has a high cost to the business, as more people are becoming aware of its importance, subsequent effects could potentially be beneficial. Sum up, despite of some obstacles, it is convincing that recycling would complete its system and has a bright future.

References

- [1] Ovi Sara. Step by Stecop Process of Recycling Plastic | Greentumble, 2019.

- [2] Hintons Skips UK Ltd. Hinton's Waste, 2018.
- [3] Hintons. Busch Systems Resource Center. A Brief Timeline of the History of Recycling, 2016.
- [4] Sara Muznik. 9 reasons why we better move away from waste-to-energy, and embrace zero waste instead, 2018.
- [5] Kate Bailey. Zero Waste Creates Jobs." Eco-Cycle, 2019.
- [6] Harmony. How the Recycling Industry Creates Jobs – Harmony, 2018.
- [7] Liming, Drew. Careers in Recycling: U.S. Bureau of Labor Statistics.
- [8] LiveAbout. How Recycling Creates New Jobs, 2022.
- [9] ILWU. Recycling Is Important – and Recycling Workers Deserve Better Conditions, 2016.
- [10] Recycle Track Systems. The Future of Recycling - Looking to 2020 and beyond, 2020.