

SIGNIFICANT REDUCTION OF THE VOLUME OF RECYCLABLE WASTE FROM PLASTIC AND PAPER BY COMPOSTING

Ștefănescu Camelia Monica¹

Abstract: An increase in the use of the materials for packaging is present all over the world, with a degree of increased use of materials reported by the vast majority of the developed countries. With all that sorting in the household becomes almost universal valid, sorting can be enhanced by complementary methods. Citizens of each locality can support the reduction of waste by simply composting them. This paper seeks to analyse the effects of composting by citizens of each recyclable waste (mainly paper and plastic petals). The survey was made on a family consisting of 4 people, and then by analogy is extended to a locality than approximately 150,000 inhabitants.

Of course it would be preferable in Romania to have appliances in which the animals are introduced and the population to receive a modest amount for their recycling. The effect would be double, in the population, that the population would no longer throw the pet into rivers, lakes, streets, and significantly reduce the volume of recyclable waste from the population. Thus, the municipality could make significant savings in terms of transport to recycling companies or, where appropriate, to the landfills where they are collected. It also avoids the pollution of flowing and storming waters, where thousands of tons of pets are collected annually, which implies a huge cost for their collection.

Keywords: plastics, threat foe environment, recycling

1. INTRODUCTION

Waste, in general, but especially those of plastic and paper, in particular, is currently inimicable faster than men. They have a life much longer and I suppose sometimes hundreds or even thousands of years before the total breaks down, as a form of reintegration in nature. It is well known that the mountains of waste increase by a few meters in each year, and they contaminate water, air and soil. Thus reduces significantly the resources in the raw materials, representing a symbol of a company that does in a manner Impermissible use of natural resources. Such some consequences which is reflected against of which a product.

Tree felling, unnecessary and sometimes lead to unjustified slipping of land, to climate change, which is very visible and perceived by the whole world of mankind. erosion is one of the phenomena which play the most important role in the degradation, even the

destruction of the soil. All countries are threatened by erosion, heavy rainfall causes millions of tonnes of Earth in the rivers, canals, and large, while the wind expands without any intermission area desserts. This phenomenon led to the destruction of two billion hectares of land, or 15% of all continental areas, or 24% of the total land cultivated today. In the same way, erosion also affects soil quality. Thus, at the Stockholm Conference (1972) it was shown that one sixth of the agricultural land of the Earth became marginal or unfit for regular exploitation, and more than one-third lost 50% of humus in less than a century of use.

In the recent past, not very far away waste produced by people were not a significant problem because the rural population, mostly used in most of the waste that produces, was used in agriculture, certain packaging is reused very often, Worn clothing and other textile products are to be reused, objects created by man were made of materials degrading straw, wood (in all forms), textile plants, or from animal fibers. All they have done is that the environment is able to pick up the projector, breaks down and even in the cycles of life most of the waste of humanity [1].

The products of various metals and then recently plastics, asbestos, glass fibers, or other non-biodegradable materials are a practical creation of the last century and have now made the amount of waste that is hardly destructible to multiply and accumulate unceasingly. Their degradation when they occur produces an extremely strong pollution - for example, lead, mercury, zinc batteries that can be insidious in all environmental elements with strong negative effects both in the long and short term.

2. THE GLOBAL PROBLEM OF PLASTIC AND PAPER WASTE

2.1 The concept of waste to energy

It is known that in Romania the recovery of waste energy is not exploited to the maximum, it is unfortunately still used to eliminate it to a very high degree by storage. The justification for the deposit is

¹ Politehnica University of Timișoara, Faculty of Civil Engineering, Department of Hydrotechnical Engineering, Splaiul Spiru Haret, no.1A, Zip code 300022, Timisoara, Romania, e-mail: achim_camelia@yahoo.co.uk

that, to a large extent, the population's affordability for the payment of waste disposal charges is low. Recycling them requires huge investment costs, which, unfortunately, cannot be borne by the country's economy and by the population at all [1].

However, competent authorities are aware of the need to introduce new techniques and technologies for waste management. Not having the knowledge and experience to integrate such technologies at national level, the Ministry of Environment aims to support the concept of waste to energy over the next few years, taking into account the following aspects:

- the need to implement a viable separate collection system at source and waste recycling in order to meet the obligations assumed as an EU Member State;
- Romania has a thermal treatment capacity in the cement industry (co-incineration / co-processing) of about 600,000 t of waste annually, which represents about 7% of the generated quantity;
- reducing the quantities of municipal waste that is stored.
- Romania needs to replace the bulk of the heat generation facilities for large localities with centralized heating, which can be done using thermal energy recovery systems, which can consume about 15% 20% of the amount of waste generated;
- the obligation to implement active programs for compliance with the waste hierarchy;

2.2 THE CURRENT ISSUES REGARDING PLASTIC AND PAPER WASTE

At our planet's level, the population growth rate requires decision-makers to adopt strategies to provide food, housing, work, etc. to all people. Doubling the world's population is taking place in an increasingly short period of time. It took 80 years (1850-1930) to increase the world population from 1 billion to 2 billion. It is estimated that 42 years (1975-2017) will be needed for an increase from 4 to 8 billion. The example given above is reflected in Table 1.

Table 1. Population growth rate over the history of mankind

Number of inhabitants (billions of inhabitants)	Year	Period of population doubling (years)
1	1850	Until 1850
2	1930	80
4	1975	45
7.5	2017	42

Human society has increased the range of resources used and the extent of resource exploitation by nature. A very concrete example justifying the above is the example set forth below. If only 29 chemical elements were used in the seventeenth century, there were already 62 chemical elements used in the nineteenth century, so that today all known elements exist on Earth. Thus, three resources - the earth, the water and the air - remain fundamentally and permanently necessary, conditional upon human existence itself. It is natural,

therefore, that the state of these resources and their mode of use are, first and foremost, a major concern for humanity.

The composition of the waste in a large city in 2018 is given in the fig 1:

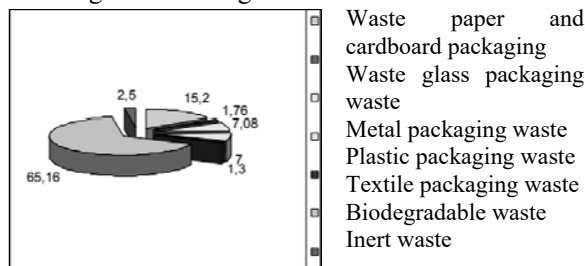


Figure 1. The composition of the waste in a large city in 2018

From the graph above, the total value of paper and plastic waste accounts for about a quarter of the total waste, so selecting and collecting efficiently requires urgent action, with the population playing an important role here [2].

3. COLLECTION AND RECYCLING OF PAPER AND PLASTIC

For the collection of plastic and paper waste a very large area is required. In addition, the decomposition of waste is done in hundreds of years, so it is imperative to reduce the volume of this waste. Besides the measures to be taken by the management of each locality, namely to collect, compost and recycle waste paper and paper as efficiently as possible, the population of each locality can make a significant contribution to this by composting every pet in the glass and cardboard boxes, not by throwing them into the collection racks in their original state.

3.1 Recycling of the paper. Recycling process

Paper is one of the most recyclable waste (40% of the community waste is paper), so its recycling is very important. Recicland paper saves the forest and for every ton of recycled paper, we save 30,000 liters of water, energy consumption is reduced by about 25% and atmospheric pollution is 80%, which is why recycling of paper and cardboard is very important. As a result of human activities, there is an enormous amount of waste, from which waste paper and pet stores occupy an important place. All this amount of paper waste can be reused / recycled to produce other paper products

Stages for recycling paper are:

- grinding and mixing them with certain chemical compounds in order to obtain the paper pulp.
- diluting the resulting mixture with water and passing it through a centrifuge to remove plastics, wood, stone, glass, adherent materials, paper clips, etc. from it.
- pressing the resulting paste to remove the water from it;
- the kneading process.

During the kneading, the fibers in the paste are rubbed together, the ink and the ink begin to get out of the material, and under the action of the chemical compounds, the paper paste, gray and dirty initially, begins to enter the bleaching process. Next, the paste is passed through fine webs that will retain sticky particles and other impurities. In the next step, in the container in which the paste is added, some chemical compounds are called surfactants, which make the clap like a detergent. Ink particles, dirt, glue and other impurities stick to the clam and float to the surface where they are taken, leaving the paste clean.

- washing the paste, pressing and kneading it;
- discoloration;
- adding chemical compounds that remove any pigment from the paste that could give it a color tint

To produce a ton of ordinary paper, between 2 and 3.5 tons of wood are used, ie approximately 20 trees are cut. From the pulpwood fibers resulting from a chemical boiling process, the paper is obtained. By recycling a ton of paper, 17 trees are saved.

Of particular importance here is the population. An enlightening example would be that of a box of dimensions of 90x50x20, so an initially occupied volume of 0.09 m³. If this box was composting by its owner its final dimensions, after composting it would be about 90x70x5, ie 0.03 m³. It can be noticed that the composting of a box has made space savings of about 66%. This calculation can be extended to a family of 4 people. A further study was then conducted with the consumption in a month of a 4 person family. The table below shows the values in cubic meters of the paper consumption per month of that family[2].

We mention that these calculations are just estimates, not accurate, the consumption of paper varies from one family to another. In addition, the paper is not the subject of a company study that results in a quantity of paper waste, so these results will only show the importance, the need for population involvement in composting this waste paper. All this data is also valid for plastic and sheet waste.

In table 2 average paper consumption of a family of 4 people was made.

Table 2 Comparing the resulting paper volume from a family of 4 people before and after composting

Nr. of people	Type of packaging	Nr. boxes / month	Volume in the initial state (m ³)	Volume final state (m ³)	V _i -V _f (m ³)	Total initial state volume (m ³)	Total final state volume (m ³)	Economics through composting (m ³)
4	Large boxes	2	2x90x50x20=0.18	2x90x70x5=0.063	0.117	0.4	0.15	0.25
4	Medium boxes	5	5x40x25x15=0.075	5x40x25x5=0.025	0.05			
4	Small cartons	7	7x25x15x10=0.02625	7x25x20x3=0.0105	0.0105			
4	Milk boxes	15	15x25x10x10=0.0375	15x15x10x5=0.01125	0.0026			
4	Another		0.05	0.016	0.033			

From the above table, we draw some conclusions about the space economy a 4-person family can make in a month, then in one year. All these calculations will be made to a block of 90 apartments, then to a population of 150000 inhabitants.

In a month this family of 4 people would save space of 0.25 m³. Thus, in a block of 90 apartments,

assuming that each apartment has an average of two people, the space economy per month will be 11.25 m³, and in a population of 150000, making an average of 2 persons / family, the economy of space would be about 9375 m³ / month. If we divide this amount into the capacity of a bin where these wastes are stored until the collection machines arrive, the need for bins would be three times higher. Due to this fact, the insufficient number of bins leads to the dumping of these wastes near the bins, and hence an environment where the papers are scattered everywhere.

Thus, the space economy per year at a large locality could be 11250 cubic meters, which is reflected in 102272 bins, so it would take a third of the total number of compactors. Thus spending would be reduced to a third, which is not a small thing. Hence, transport costs would also be diminished, the environment would not be full of discarded paper[2].

At present there are capacity bays of 1.1m³ and smaller located in different areas by sanitation agencies. Separate collection of paper and cardboard waste should also extend to the population not only at the level of economic agents, as a very large amount of paper and cardboard can be recovered. The volume / weight ratio for paper waste is relatively small. This waste is a widespread component of municipal waste, so recycling of paper and cardboard is expected to be an opportunity to reduce the impact on forests and the environment.

Paper recycling greatly depends on the quality of paper waste collected. These types of wastes are easily contaminated with other types of household waste, especially liquids. It is recommended to collect paper and cardboard waste in special containers with a narrower opening to make it difficult to introduce other types of waste. The main types of waste paper and recyclable cardboard are: quality paper, mixed paper, newspapers and magazines, corrugated cardboard [3].

Main uses of recycled paper: paper pulp substitution, construction products (gypsum plasterboard, waste gas).

The steps of a correct collection imply: collect maps that can no longer be used in packing or writing, etc.. crushing cardboard boxes to occupy a smaller space, Storing in a specially arranged place for paper collection.

3.2 Plastic recycling

These objects continue to have a major impact on the environment. In addition to breaking very slowly, plastic bottles destroy the natural resources that we have at our disposal. Although activists' awareness actions have forced many industries to use other materials in the manufacturing process, plastic continues to be a danger to the environment. For this reason, many of us are looking for ways to recycle plastic bottles. With the help of creative ideas, we can prevent these objects from getting into landfills or in the living environments of plants and animals.

Plastic bottle recycling tricks are gaining more and more popularity in various parts of the world.

This environmental trend is adopted by people of all ages, including children.

Plastics occupy about 12% of the volume of landfills, which is why incineration of waste has become more and more attractive for energy recovery but with negative effects on the atmosphere due to the resulting combustion gases. Selective collection of plastic discourages waste incineration, reducing incineration profitability and direct benefits to air quality.

About 4% of a country's energy consumption is used to produce plastic because of its use in many areas. Plastics recycling saves significant quantities of water, oil and natural gas needed to produce a new plastic. The energy saved by recycling a single bottle of plastic feeds a 60 W bulb for 6 hours.

Plastic wastes brought to processing plants are generally contaminated with foreign materials, such as food, causing the use of granulators and other equipment used in sorting and recycling of materials.

Collection centers can ensure compacting and packaging of plastic waste in order to reduce transport costs so that the value of the materials used can cover the costs of collection, processing and transport [3].

Products made from recycled plastic have a cheaper cost of manufacturing than raw materials. Plastic was invented in 1980 by Alexander Parkes, which has been widely used in recent decades. The plastic is made of petroleum, petrol and coal; Currently there are about 40 types of plastic, each having a chemical composition and different properties. Plastic residues are used in larger quantities for oil refining residues that would otherwise be burned. The steps of a correct collection imply: washing of plastic objects; crushing them to occupy less space; storage in special places for plastic collection.

The most common methods are:

- deposit system: developed for glass and PET bottles, aluminum containers, etc.
- Packaging Consignment System: obliges household consumers to return the packing to the collection points designated by the producers. A future advantage of this system is that it makes it more responsible for traders and producers to collect packaging waste for recycling.

The funds collected will also be used to encourage the recycling of packaging waste (in the private sector PET collection is subsidized by the packaging fee).

3.3 Recycling plastic bottles in the world

With 20 empty PETs, you can buy a subway trip in Beijing, China's capital, thanks to recycled plastic bottles installed in underground stations.

The PET is introduced into the car is compost in 20 seconds, and in order to get a free trip, it takes 20 PETs. 1 metro ticket costs 0.25 Euros. The supplier company plans to install another 3,000 compost machines in several Beijing subway stations, schools, or shopping centers. The same procedure can also be used for aluminum doses. "

The over 20 million inhabitants of Beijing, considered one of the world's dirtiest capital cities, produce about 18,000 tons of household waste daily.

In Germany, plastic bottles are recycled to shops. In the markets, at the entrance, there are large recyclers for plastic and glass containers. You receive 25 eurocents per recycled plastic bottle. You get 1 euro (one euro) for every 4 bottles recycled. Mineral water that cost 13 cents glass, 1.05 bin of 6 bottles, recycled, gets back 1.50 euros back, in the form of a bill spent in the store.

In Istanbul, Turkey, a car provides water and food to community dogs in the city in exchange for recycling PETs, writes reporters.net. A brilliant method that at the same time can recycle plastic bottles and feed homeless animals.

Turkish company Pugeidon has recently created a car that distributes food and water in exchange for PETs that are the payment for this service. Every time a PET is introduced into the car, solid animal feed falls into containers that dogs and even cats have learned very quickly to eat [3].

4. CONCLUSIONS

The calculations made for the composting of plastic bottles by the citizens of an urban community are similar to the computation made for paper composting. The difference is that, by compressing the plastic bottle, the volume occupied by it in the end would be slightly higher than by composting the paper. But the differences are insignificant.

Therefore, the role of a family in reducing the volume of waste paper and plastic is very high. If all the calculations we report to a block of 90 apartments, then to an entire city, there would be a huge savings in the number of on-site waste collection and composting equipment. Thus, their number would be reduced to less than half. This would entail reduced transport costs, much higher efficiency and, implicitly, lower costs for collecting this waste. The population would thus pay a lower fee, this waste would no longer pollute the environment in which we all live.

In order for this to happen, the population should be educated in this respect and, ultimately, it may even be obliged to do so by imposing an additional fee on the volume of waste produced by each association of tenants.

All this can not be done from one day to the next, it requires the involvement of the entire community, including the media. Education must begin in schools, children need to be aware that it is very important that the environment we live in is clean.

REFERENCES

- [1]<https://casaecologicaintrevissirealitate.wordpress.com/2014/12/08/colectarea-depozitarea-si-reciclarea-deseurilor/>;
- [2]<http://www.reciclarecolectare.ro/articol-colectarea-depozitarea-si-reciclarea-deseurilor/>;
- [3]Course support, Associate Professor. Dr. Florian Grigore – Rădulescu, Bucharest;