



Optimum solution for plastic waste reduction in Kabul city

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Conference Proceeding

Open Access

Published

ABSTRACT

Kabul is the capital of Afghanistan, with a higher population density compared to other major provinces in this country. As a result, more waste is generated including organic, plastic, and many other types of waste. This paper focuses on plastic waste generation problems created due to this waste and feasible and sustainable ways to reduce, reuse, and recycle these types of waste. It is very well known that plastic wastes are nondegradable and cause different types of problems such as blockage of water channels (streams and rivers) as well as many other environmental issues. This research suggests some feasible and effective ways to reduce plastic wastes in the city of Kabul. A survey to find the volume of plastic waste was done, which has not been done before. The findings of this survey and review of other existing literature enabled us to propose a practical and realistic solution for these environmental and social problems in the city of Kabul. This research will also help policy makers to make decisions based on accurate data and analysis.

Keywords

- Plastic waste
- Environmental pollution
- Plastic alternative
- Plastic waste reduction
- Waste recycling
- Waste reuse

Received: January 17, 2020; Revised: March 16, 2020; Accepted: March 20, 2020; Published: June 12, 2020

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1. Introduction

The composition of plastic is from polymers, small units of monomers that are joined together in a chain by the process of polymerization and make polymers. The polymers generally contain carbon and hydrogen with other elements such as oxygen, nitrogen, chlorine, or fluorine.

Plastic waste disposal is pointed out as a most difficult task, and according to a study, plastic can remain stable about 4500 years on earth without any degradation [1]. The annual global production of plastic is 300 million tons [2]. Germany and Denmark were primary adopters of plastic bag bans in most retail stores in 1991 and 1994. However, since 2002, countries in Africa, Asia, and the rest of Europe have steadily introduced bans (South Africa, Bangladesh, and India) or levies (Ireland) on plastic bag consumption. In most cases, national approaches have been undertaken. Several countries in Africa and Asia completely banned the use of plastic bags [3].

According to [4] countries with coastal borders discharge plastic into the world's oceans with the largest quantities estimated to come from rapidly developing countries (e.g., India and China). However, both India and China have already introduced bans

of plastic bags. In 2002, India banned the production of ultrathin plastic bags ($b20 \mu\text{m}$) to prevent clogging of municipal drainage systems and to prevent the mortality of cows from ingesting plastic bags containing food. However, enforcement of bans remains a problem [5].

The International Convention for the Prevention of Pollution From Ships (MARPOL 73/78) was signed in 1973, although a complete ban on the disposal of plastics at sea was not enacted until 1988. Even though 134 countries agreed to eliminate plastics disposal at sea, research has shown that the problem of marine debris has worsened since MARPOL 73/78 was signed. This may be because the marine debris problem is related to incorrect disposal of waste on land. Many nongovernmental organizations (NGOs) conduct monitoring research on marine debris to increase awareness [5]. Many studies have shown that it consists primarily of plastics with a continuously increasing global annual production of 300 million tons [2].

Some research mentioned a minimum of 5.25 trillion plastic particles weighing 268,940 tons afloat in the sea, but this figure does not include debris on the



seafloor or beaches. The increasing use of single-use products, uncontrolled disposal of litter along with poor waste management and recycling practices are the main reasons for the accumulation of litter in the sea. Increasing quantities of litter are lost from municipal waste streams and enter the oceans [6].

Kabul is the capital of Afghanistan and due to a dense concentration of population has more pollution than the other provinces. Therefore, the amount of wastes increased, especially plastics waste that is very hazardous for environment and illnesses including different forms of cancer, birth defects, infertility, immune system problems, childhood development issues, pregnancy complications, heart, brain, liver diseases, diabetes, lead, cadmium, and mercury poisoning.

The main reason for blockage in water channels in Kabul is plastic bags and plastic bottles that cause problems in the winter season. The bed height of channels is low and around six to seven (6-7) meters from the road surface. When the waste blocks the water channels, water cannot flow properly into the channel and then flows outside of the channel to the surface of the roads. To prevent these occurrences, the government should closely monitor this to reduce the generation of plastic waste.

The main objectives of the research are to find the amount of daily and yearly plastic waste, the percentage of plastic waste which has been landfilled, burned, and recycled in Kabul, and also the amount of CO₂ that was emitted during the combustion of plastic waste. Finally, feasible and effective ways to reduce plastic waste in Kabul are suggested.

2. Proposed solution

The generation of plastic waste is increasing day by day and it is a very critical issue all over the world. Most countries are trying to make feasible policies for the reduction of plastic waste. The conditions overall in Afghanistan are primitive and the majority of Afghans have limited resources and poor economic conditions. Therefore, they burn plastic waste for heating that emit different greenhouse gases into the atmosphere. These gases both affect climate change and have a negative impact on humans' health, especially women and children. The following research was conducted to find feasible and effective ways to reduce plastic waste in Kabul.

According to calculations, the annual production of plastic waste is overhead in Kabul. By increasing the

production of plastic waste, the environmental problems are also increasing and the toxic gases that emitted from the burning of plastic wastes have a negative impact on human health, agriculture, and drinking water. Whereas less amount of plastic waste has the possibility of recycling, plastic is not recyclable more than 2 or 3 times, and most plastic wastes are disposed in landfills or incinerated. To avoid the negative impact of landfilling and incineration, alternative ways that are environmentally friendly, more recyclable, and cost-effective should be considered.

Suggested methods:

- Alternatives to plastic bags;
- Increasing tax of enterprise plastic production;
- Reducing plastic importers;
- Reusing plastic waste;
- Recycling plastic waste.

2.1. Alternatives to plastic bags

There are many environmentally friendly alternatives to plastic bags, such as jute bags, paper bags, biodegradable bags, and reusable bags.

- Jute bags: This is an environmentally friendly alternative to plastic bags because the bags are made from biodegradable material that comes from a plant fiber called jute which mostly consists of cellulose. This is eco-friendly and has no harmful effects on the environment and agriculture. Jute bags are manufactured from jute yarn and are used for packing a wide range of industrial and agricultural goods, such as grains, oilseeds, salt, sugar, and other commodities of suitable configuration. Heavy-duty jute bags or sacks are popular for packaging agricultural commodities. The major raw material required for jute bag production is jute yarn which is a product of South Asia and specially a product of India and Bangladesh. Nearly 98% of the world jute is grown in these two South Asian countries. The cost of one jute bag is 0.25-0.8 \$ and it is a feasible and effective alternative for plastic bag.



Figure 1. Jute bag [7].

– Paper bags: Paper bags are also an environmentally friendly alternative to plastic bags. It has been suggested that the natural fibers of the paper and its recyclability create a positive image of the paper bags. The natural fibers of the paper and the renewable resource used has a positive image, as the increase in the volume of the paper bags, likely to be sent to the landfill, has now taken over a new role in the recycling options which are firmly established. It has been scientifically proven that paper bags are not as harmful to the environment as plastic bags. The cost of one paper bag is 0.1\$ and it is a feasible and effective alternative for a plastic bag.



Figure 2. Paper bag [8].

– Nonwoven bags: Nonwoven bags are a cheaper solution to paper bags. Although it is made from plastic, a nonwoven bag still has the possibility of recycling, is sturdy enough to hold a good number of products, and is an exemplary product.



Figure 3. Nonwoven bag [9].

2.2. Increasing the tax of enterprises plastic producers

One of the best methods that may reduce the amount of plastic waste is increasing the tax for enterprise plastic producers. If the Kabul Municipality increases the amount of tax for plastic producers, they will not be interested in investing in plastic production anymore. Thus, the benefit will be reduced, and perhaps those enterprises will not withstand disadvantages. All enterprise producers want to earn more money and will not be happy to pay high taxes. Maybe those enterprises invest in other fields of business.

2.3. Reduce plastic importers

Recently, the bulk of plastic bags are imported from neighboring countries and most of them are used in Kabul. These plastics hurt humans, agriculture, and the environment. To prevent the use of more plastic bags, the municipality of Afghanistan should make policies for importers. Requiring that only reusable bags are imported or imposing a high tax for the use of plastic imports; this would prevent the import of bulk plastic bags and encourage them to import reusable bags.

2.4. Reuse of plastic waste

The simple way to reduce plastic waste is to reuse plastic bottles. This method is an economical and effective way to suggest for Kabul. In this case, Kabul citizens can reuse plastic bottles with new innovations and ideas. It is a new initiative method that, if used by developing countries, can reduce much of the plastic bottle waste. The following methods are suggested for the reduction of plastic waste in Kabul:

– Enhancing the green area: For making a green area in a house, Kabul citizens should use plastic bottles as a vase. Considering the cost of a vase, this

method can save the amount of a vase and its many environmental benefits to prevent plastic waste.

- Construct house: One of the other reusable methods is to build a house/room from plastic bottles.
- Making essential accessories: From plastic bottles, numerous essential accessories can be made and used in everyday life. This method is important for Kabul citizens because the majority of Kabul citizens lives in poverty and cannot afford to purchase essential accessories. This option is only limited by the imagination of the people who decide to reuse plastic bottles into essential accessories. They can make any accessory they want, so reuse of plastic bottles is cost-effective and with environmental benefits.

2.5. Recycle of plastic waste

As mentioned earlier, it is impossible to remove all usage of plastic in our modern life, because without plastic we face many other problems. Therefore, a lesser amount of plastic should be produced, but for additional purposes, the alternatives bags are suggested. In the case of plastic bottles, suggestions for reusing them are already mentioned. In the case of recycling plastic waste, we suggest some points that the municipality of Kabul should consider.

- The government of Afghanistan should establish several recycling companies that should recycle plastic wastes. At least 60 percent of plastic waste should be recycled which is generated in Kabul daily. For example, one company which is active now can recycle 7 tons of plastic waste daily. The daily total generated waste in Kabul is 107.5 tons, so if the goal is to recycle 60 percent, we need to construct 8 companies with the same capacity.
- For the collection of plastic waste, the government should establish a collection team and start public awareness to educate people not to burn plastic bottles.
- The government should pay a subsidy to recycling companies to buy plastic waste from people.
- The government should enforce plastic production companies to build a plastic recycling site.
- The government should consider public incentive works so that people do not burn plastic waste and sell them to recycling companies. For example, the government of Australia made an incentive for their citizens that if anyone disposes of a plastic bottle in a designated container, they would be

considered to receive from the government a free ticket to the cinema.

These suggestions were feasible and effective ways to reduce plastic wastes in Kabul. Additionally, these suggestions can reduce the negative impact in the environment, be cost-efficient for Kabul citizens, and pave the way for the reduction of poverty and unemployment.

3. Methodology and analysis

To know the consumption of plastic per year, the amount of plastic consumption per day should be known. To determine the daily plastic consumption, we need to determine the number of active shops in Kabul, because these shops are the main distribution points of plastic wastes. Therefore, all distribution points have been divided into eight categories:

- 1- Supermarkets
- 2- Bakeries
- 3- Butcheries
- 4- Cloth stores
- 5- Restaurants
- 6- Wedding halls
- 7- Peddlers
- 8- Pharmacies

Data Collection: To find the plastic consumption per day in Kabul, first, the number of shops is located and counted. According to the Federation of Afghanistan Craftsmen and Traders central council (FACT), an approximate number of shops are mentioned below.

Table 1: Number of shops in Kabul.

No	Type	Number of shops
1	Supermarket	70,000
2	Bakery	2,200
3	Butchery	2,000
4	Cloth store	30,000
5	Restaurant	1000
6	wedding hall	105
7	Peddler	50,000
8	Pharmacy	14,695
	Total	170,000

The above table shows the different types of shops with numbers which are available in Kabul City. The approximate data are found in FACT reports. These are the shops that have a valid license from Kabul

Municipality. The exact numbers of shops are not specified, because many shops are too far away from the city or are small shops that are not currently registered to Kabul Municipality.

Survey: The consumption of plastic from shops of different categories vary from each other. For each category, a separate survey was done. This survey helps to find the amount of plastic consumed per day in Kabul, and the results are shown in the below tables.

Table 2: Data of survey from 20 supermarket.

No. of survey	Small plastic bag (Kg)	Large plastic bag (Kg)	Small bottle (Pcs)	Large bottle (Pcs)
1	1	0.3	60	66
2	1	0.5	200	100
3	0.1	0.05	20	15
4	0.1	0.06	30	10
5	0.1	0.05	15	10
6	1	0.5	10	2

7	0.7	0.1	36	20
8	0.3	0.2	50	35
9	0.5	0.2	60	30
10	1.2	0.5	80	50
11	0.5	0.2	40	25
12	0.6	0.2	30	15
13	2	1	120	80
14	1.5	0.7	80	55
15	1.5	0.5	50	25
16	0.4	0.1	20	10
17	0.8	0.2	35	15
18	1.2	0.7	45	42
19	1.5	0.8	60	25
20	1	0.2	50	20
Average	0.85	0.353	54.55	32.5

Graph 2 shows the consumption of different types of plastic waste at the supermarket in Kabul city.

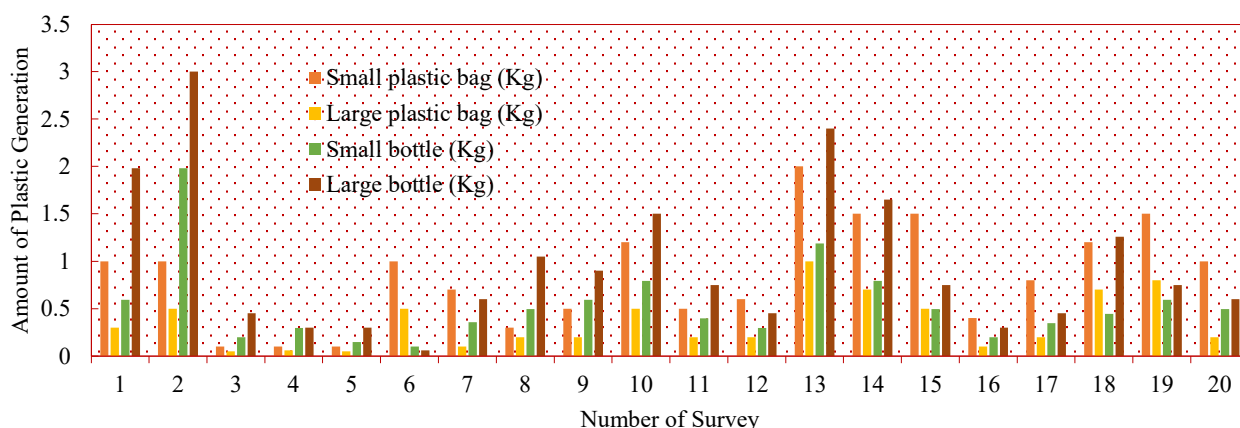


Figure 4. Amount of plastic waste generation from 20 supermarkets.

Data Analysis: After the survey, the daily generation of plastic waste of all these eight shops is calculated. Next, the daily average generation of SPB (Small Plastic Bag) is 80,408.08 Kg, LPB (Large Plastic Bag) is 49,597.00 Kg, and the total of the plastic bags generation is 130.01 tons/day and the average generation of plastic bags per year is 47,451.85 tons. The average generation of SB is 38,959.97 Kg, LB is 68,565.00 Kg, and the total amount of bottles becomes 107.52 tons and the yearly generation of total bottles is 39,246.61 tons.

Table 3: Daily and yearly plastic waste generation.

Type	Daily Average (kg)	Total Daily (Ton)	Yearly (Ton)
Small plastic bag	80,408.08	130.01	47,451.85
Large plastic bag	49,597.00		

Small bottle (Pcs)	38,959.97	107.52	39,246.61
Large bottle (Pcs)	68,565.00		

According to municipality research, Kabul citizens combusted 20% of plastic bags and the remainder becomes urban waste. Therefore, the total amount of plastic bags generated is 26 Ton/day, and of those plastic bags wasted, a total of 15% is recycled. According to the total consumption of Kabul citizens, a total of 15.6 tons of plastic bags are recycled. The remaining generated plastic bags are landfill, and the amount of landfill is 88.4 tons/day.

Also Kabul citizens generated 20% of the plastic bottles before they are added to waste. Therefore, a total of 21.5 tons of plastic bottles are generated per day, and when a plastic bottle comes to waste, a total

of 97 % is recycled. According to the total generated by Kabul citizens, a total of 83.4 tons plastic bottles are recycled. The remaining generated plastic bottles are landfill, and the amount of landfill is 2.58 tons/day [9].

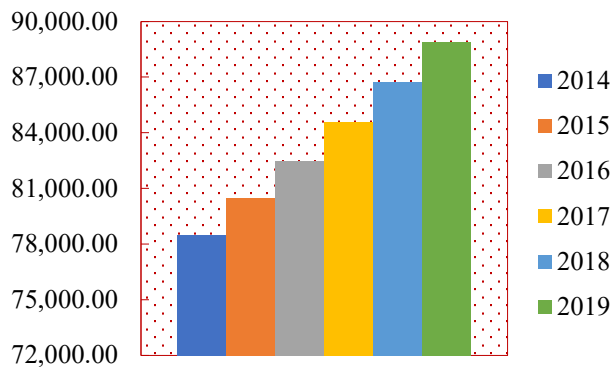


Figure 5. Annual generation of plastic waste (ton/year).

4. Results and discussion

Plastic waste increases day by day and creates different kinds of problems around the world. All countries are trying to solve this problem by making clear policies for implementation. Afghanistan also faces this problem, and this research can pave the way to reduce the negative environmental impact to keep a greener environment and increased quality of life. The main question which comes to our mind is why this problem increases in Kabul?

- Kabul citizens use plastic bags and plastic bottles in their life for different purposes. These include using bags to keep and carry fruits, vegetables, and other foods, and plastic bottles for storage and use of liquids.
- Plastic products are cheap and affordable.
- Plastic waste is used for heating homes.

Besides, the government of Afghanistan currently does not have any serious penalty or a clear policy to control plastic waste in the country, especially in Kabul. Therefore, this research was conducted to decrease the bulk of plastic waste by making policy and alternatives for plastic products. Also, to protect the green environment, the government should decrease the cost of electricity, gas, and wood. If the cost of these fuels decreased, the majority of people would not want to burn plastic waste for heating and cooking due to the better quality of life provided by the other fuel alternatives. The burning of plastic creates different greenhouse gases (GHGs) that are emitted

into the atmosphere. These GHGs not only cause global warming but also have a negative effect on human health. The main purpose of this research is to find the feasible and most effective ways to reduce plastic waste in Kabul.

Plastic waste is the biggest problem worldwide, but especially in Afghanistan, with the worst concentrated in Kabul. This research suggested effective and feasible ways to reduce plastic waste. The most important points mentioned are those below:

- The amount of plastic waste generated in Kabul daily and annually is determined.
- The percentage of landfilled, burned, and recycled plastic waste in Kabul City is determined.
- The content of Carbon dioxide (CO₂) emitted during the combustion of plastic waste is also detected.
- Feasible and effective ways to decrease large amounts of plastic waste are suggested.

These important findings can help the government to monitor and implement the best way to decrease a major portion of plastic waste in Kabul.

5. Conclusion

The production of plastic waste is excessive in Kabul, and plastic waste causes numerous problems in our everyday life. The amount of daily usage of plastic bags is 130.01 tons, with 107.52 tons of plastic bottles generated in Kabul. Approximately 26 tons/day of plastic waste and 21.5 tons/day of plastic bottles are burned by citizens. This burning creates 0.285 tons of CO₂ per day, so this statistically affects the environment. The amount of 88.4 tons/day of plastic bags and the content of 2.58 tons/day of plastic bottles are discharged as landfill. The landfill of plastic waste has a negative impact on underground water and pollutes the quality of drinking water. Only the amount of 15.6 tons/day of plastic bags and 83.4 tons/day of plastic bottles are recycled. Therefore, the effective ways suggested to reduce the production of plastic waste in Kabul are: alternatives for plastic products, enhancing tax, decreasing the importing of plastic, reusing, and recycling. If these alternatives are used instead of the continued use of plastic bags, there are more advantages. In terms of cost, it is a little bit expensive, but the government can give subsidies to reduce the usage of plastic. Also, the government of Afghanistan should make it a

priority to reduce plastic waste for a cleaner city and a more green-friendly environment.

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