

Plastic Waste Management! A Step towards Climate Change Adaptation and Sustainable Development in District Swat, Kpk, Pakistan

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Abstract: *The non-degradable nature of plastic bags is posing a wide range of serious environmental and health deteriorations and hence are considered to be a big problem in waste management. This study was carried out to determine the popularity, usage, disposal and environmental impacts of plastic bags in Mingora city District Swat, Khyber Pakhtunkhwa Northern Pakistan. A semi-structured questionnaire was used to collect the data from 203 randomly selected respondents. The results indicated that despite of age, gender and occupation most of the respondents 68.5% were using plastic bags for their groceries. About 44% of the respondents were using 20-30 bags per week and this is why 32% of the solid waste was composed of plastic waste. The study further revealed that the easily availability 50.7% and low price 38.9% is responsible for such an extensive use of plastic bags in the study area. The most common impacts of plastic bags in District swat identified in this study were blockage of sewage and drainage system leading to less durable road pavements 52.5%, human health problems 28.6% and animal deaths 10.3%. So beside awareness allot of efforts are needed to bring forward an effective law against the production, distribution and use of plastic bags in the country and the existing burden of plastic should be managed in effective ways like these plastic waste may be used as a substitute of conventional blacktop of roads which not only will contribute to sustainability of roads by enhancing durability but will also be a step towards climate change adaptation.*

Keywords: Plastic bags; Plastic waste management; Climate change adaptation; Sustainable development

1. Introduction

The earth which is the ultimate home for all organisms, nature, and even nonliving constituents is today aggressive for the survival, the way it gets polluted, reveals that in some coming hundreds of years it will be nearly impossible for organisms to live on it (Darji, 2012). The rate of waste is increasing repeatedly with time including Common food wastes, plastics, paper, cardboard, wood, leather, glass, tin cans, and textiles, yard wastes etc (Tchobanoglous and Kreith, 2002). But 11% of the municipal solid waste (MSW) was proposed to be plastic bags, in the year 2005 (Tchobanoglous and Kreith, 2002). And was predicted by U.S EPA to be increased by 50% (by weight) by the year 2000 (EPA and Curlee et al., 1991). About 54% of the world's plastic production is polyethylene and polypropylene (Plastics Europe MRG, 2008). Which is widely used not only for packaging but also for protecting, serving and disposing all kinds of consumer's goods and due to non-biodegradable nature, can stay unchanged for about 4500 years. There for it is linked with different problems like breast cancer, reproductive and genital abnormalities' and even can affect human sperm count and quality. (Verma, 2008). After a short services it is obvious for the plastic bags to become waste (Clapp et al., 2008). World watch Institute estimates that about 100 billion polyethylene bags are thrown away each year after being used (for hauling away trash and garbage, for carrying groceries and for other routine purposes), with less than 1% being recycled (Vaughn, 2009). In Pakistan the estimated per Annum production of plastic waste is about 1.23 million tons and this amount of plastic waste is of great concern (shah et al, 2008). Aim of the current study was to determine response of residents towards the usage & disposal of plastic, to

assess their adverse environmental impacts, willingness of people to stand against plastic bags and to propose a sustainable way of plastic waste management in District swat, Khyber Pakhtunkhwa, Pakistan.

2. Materials and Methods

2.1 Study Area

Swat Valley, as shown in **Fig. 1**, is an administrative district in KPK, northern Pakistan. The valley stretches from 34° to 36° north latitude and from 71° to 73° east longitude geographically. in the temperate zone of the northern mountain ranges with an altitude ranging from 500 to 6500 m above the sea level (Khan et al., 2013b; Qasim et al., 2011; Rahman and Khan, 2011). Mean monthly summer temperature ranges between 14.81°C to 31.39°C in April and 15.63°C to 31.48°C in August. While, the mean monthly winters temperature ranges from 8.7°C to 23.70°C in October and 2.6°C to 17.1°C in December (Nafees and Asghar, 2009). 1.25 million is the total population of the region, with an average density of 248 people per km² and for domestic and agricultural purposes the water sources are the Swat River, various springs, tube wells, and dug wells (Khan et al., 2013b; Qasim et al., 2011).

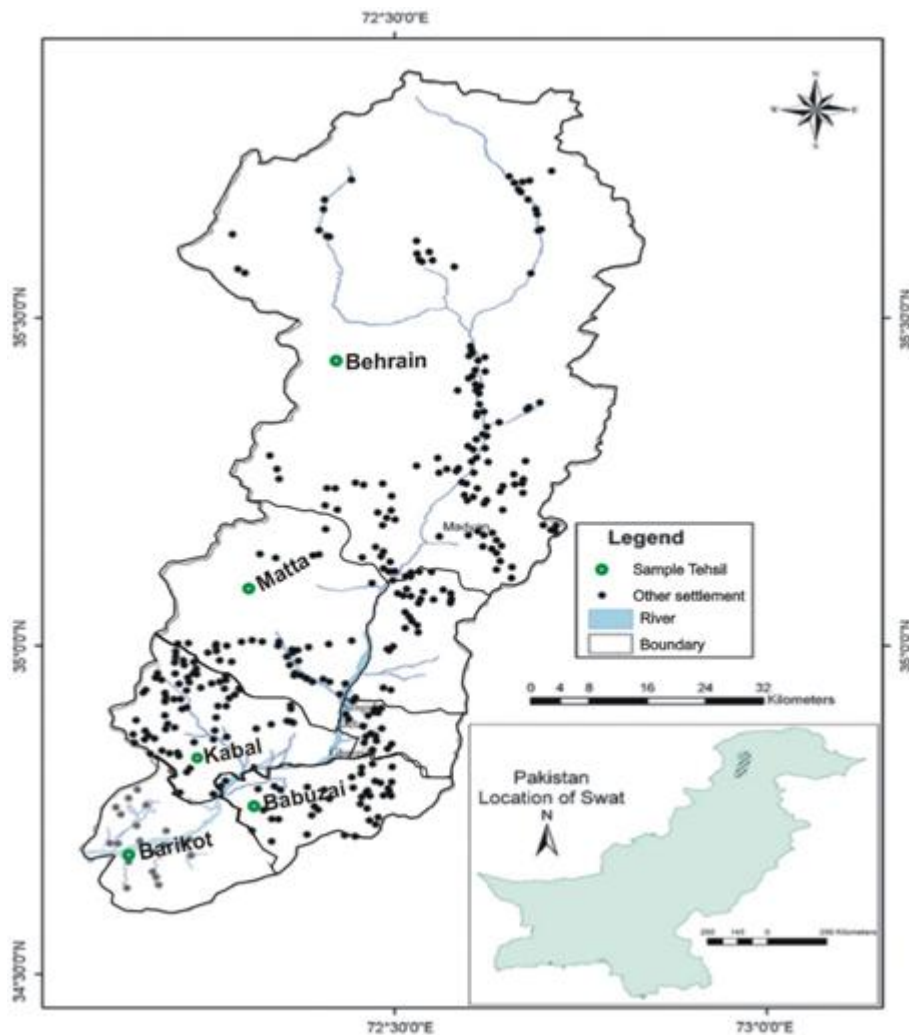


Figure 1: Location map of the study area (modified after Khan et al., 2013).

2.2 Methodology

By using random sampling technique (Adane and Muleta, 2011) and specific survey procedures formulated by WHO (1996), 50 randomly selected solid waste representative samples were analyzed to determine solid waste generation and composition and to enquire the perception of community people a questionnaire survey was conducted from 197 randomly selected house hold representatives from different selected areas of District Swat, regardless of their age, gender, educational background and occupation. The respondents constituted about 79.3% males and 20.7% females among which (55.2%) were students, 13.3% government employees, 19.7% related to privet business and 11.8% others, the males showed more willingness to be interweaved and to fill the questioners as compared to the female respondents while the illiterate and those who were not able to attempt the provided questioners were helped by the interviewers.

3. Results and Discussions

3.1 Quantity and Composition of house hold garbage in the study area

House hold garbage can be defined as The unwanted materials produced by single- and multifamily homes,

apartment complexes, and other dwellings consist of food and other types of organic waste; paper products and cardboard; plastics; textiles; leather; yard clippings; wood; glass; metal; ashes; and various bulky items such as tires, televisions, furniture, and appliances (Vaughn, 2009). According to our study about 50.2% of the respondents produced 10-15kg of house hold solid waste, 25.1% produced less the 10 kg ,while 17.2% produced 16-20kg and 7.4% produced more than 20kg of house hold solid waste per week shown in Table 1. In Pakistan the estimated per annum production of plastic waste is about 1.23 million tons and this amount of plastic waste is of great concern (shah et al., 2008). According to U.S EPA (1991) Plastic waste constituted about 7.3 % of municipal solid waste by weight and large percentage by volume and was predicted to increase by 50% (by weight) by the year 2000(EPA and Curlee et al.,1991). According to our study in Mingora city 34% house hold garbage constitute plastic waste, 23.8% organic waste,10.3% paper waste and 31.9% other waste materials as shown in (Table 2).

3.2 Plastic products commonly used

Like in other countries of the world a large amount of plastic products are used in Pakistan commonly. Due to the industrial revolution, Plastic is widely used not only for packaging but also for protecting, serving and disposing all

kinds of consumer's goods. Which is non-biodegradable and can stay unchanged for about 4500 years. And there for it is linked with different problems like breast cancer, reproductive and genital abnormalities' and even can affect human sperm count and quality (Verma, 2008). According to this study most of the respondents about 79.8% were using plastic bags as compared to other plastic products in their daily use followed by plastic containers which is 13.8%, 4.9% of the respondents were using plastic shoes while 1.5% of them were using other plastic made products for different purposes as shown in **figure 3**

3.3 Trend of Plastic Bags

Plastic bags are commonly used for carrying groceries in most of the countries including Pakistan. Since its introduction trillions of plastic bags have been produced which depletes our nonrenewable resources (chemicals, energy and petroleum based products). The U.S alone uses over 100 billion bags annually which is equivalent to throwing away about 12 million barrels of oil per year while South Africa uses about 8 billion plastic bags per year (Bashir, 2013). Like in other parts of the world most of the people in District Swat are using plastic bags for their groceries as they are cheap, light, easily available and easy to be carried. According to our study about 68.5% of the respondents used plastic bags to carry their stuff, followed by fabric bag which is 24.1% and paper bag is used by 5.9% of the respondents in Mingora city as shown in **figure 4**.

3.4 Number of plastic bags used per week

Like other Asian countries, the trend of using plastic bags for carrying groceries is increasing day by day in Pakistan as compared to paper and fabric bags. The study showed most of the respondents 44% used about 20-30 bags per week followed by 32% who used more than 10 bags per week and 21% of the respondents used more than 30 bags per week shown in (**table 2**) which will ultimately become a part of solid waste after a single use and will play a role in deterioration of the environment and other problems in District Swat.

3.5 Possible reasons behind the excessive use of plastic bags

Table 2 indicates 44.8 % of the population used about 20-30 plastic bags in there different activities per week which become a part of the house hold garbage after a single use, and hence contributes to increase the plastic content in the Municipal solid waste and will remain un degraded for a very long time to pose different negative environmental impacts. We tried to find the possible reasons for such excessive use of plastic bags in District Swat. The results showed 50.7% of the respondents used plastic bags because of easy availability, 38% used plastic bags due to the lower or no cost (for the consumers), followed by 7.9% who suggested lack of awareness in the community for the excessive use of plastic bags in the study area shown in **figure 5**.

3.6 Mode of Disposal of the house hold garbage /solid waste

It is obvious to dispose the solid waste including plastic waste after its short services. But most of the urban areas in Pakistan and other countries of the world are facing problems due to inadequate disposal facilities for the solid wastes and hence commonly one can see open dumps of wastes not only in residential areas and road sides but also on the river banks in Mingora city. The fact behind this is that 35.5% of the respondents dump their house hold garbage in open areas followed by 25% who bury there house hold garbage and 27.6% of the respondents used to burn there house hold solid waste as shown in the **Table 2** and **Figure 6**.

3.7 Environmental impacts of plastic bags

After disposal a plastic bag remain for a long time in the environment and take about over 1,000 years to degrade by photo degradation a process in which sun light breaks down the plastic bags into smaller toxic particles and hence pollute air, water and land by producing toxic substances into the environment. Hundreds of thousands of animals like sheep, goats, crows, fish, turtles etc ingest plastic bags and get killed (Bashir, 2013). Beside this in many countries like Pakistan one can see the plastic bags hanging in the trees and bushes, floating in the lakes and rivers, and scattered in the public recreational parks and roads. Like other cities of Pakistan, Mingora city is also a victim of such problems due to plastic bags. According to our study most of the respondents about 52% reported the blockage of sewage /drain system due to plastic bags which directly or indirectly leads to the destruction of road pavements, 28% reported human health problems as they provide breeding sites for mosquitoes which are responsible for spreading diseases like dengue and malaria etc in Mingora city, 10.3% of the respondents reported animal death due to suffocation and ingestion of plastic bags in the study area and 8.4% respondents reported other problems like destruction of natural beauty and affecting tourism as shown in **Figure 7**.

3.8 Is Plastic waste and climate change affecting the durability of our roads infrastructure?

The study found plastic waste particularly the plastic shopping bags are responsible for the clogging and blocking of sewerage system in Mingora city and leads to overflow of waste or rain water to the roads and hence affecting the durability of roads infrastructure. Because changes in water content and temperature, especially excess moisture, in pavement layers combined with traffic loads and freezing and thawing can significantly reduce pavement service life (Lay, 1986). Due to global warming and climate change (Krishnamurti, 1987 and Rao, 1976). Precipitation and thermal regimes in Pakistan have suffered changes especially in the recent two decades (Rasul et al., 2005). Precipitation over land generally increased between 30°N and 85°N, but notable decreases have occurred in the past 30-40 years from 10°S to 30°N (Bates et al., 2008). So the role of Plastic waste and climate change in affecting the durability of our roads infrastructure is very obvious and hence heavily increase the maintenance cost.

3.9 Plastic waste management and climate change adaptation

The survey results showed about more than 80% of the respondents were in favor of banning plastic shopping bags and other disposable plastic products but only stopping the production and usage is not going to solve the problem, efforts are required to get rid of the load already created in our environments. For this purpose we can use the plastic waste in such a way which not only reduce the plastic waste load but also improve our roads durability and make it able to cope climate change and also provide opportunities to reduce oil usage, carbon dioxide emissions and the quantities of waste requiring disposal. According to (Amit et al., 2012) addition of plastic polymers to the road pavement decrease the cost and also reduce pressure on landfills as well increase rate of waste reusing to strengthen road pavement. This not only make the roads resistive against permanent deformation, but also enhance the service life of the road pavement, reduce viscosity, improve stability and stiffness, crack, fatigue, abrasion improved and reduce the thickness of the road pavement (Jiqing et al., 2014).

4. Conclusion and Recommendations

After a careful review of the current study it can be easily concluded that In spite of a good level of awareness, and willingness to ban the plastic bags in the country, the use and improper disposal of plastic shopping bags in district Swat is at an alarming stage, which seems to be responsible for the for different environmental, public health and sewerage system's problems in District Swat. Their short life holding groceries does not justify their long lasting presence in the environment. So the 1st step in this case should be educating and convincing the people to limit or totally refuse the use of plastic bags and to encourage the use of alternatives like fabric or paper bags for their groceries. Secondly the free distribution of plastic bags by the retailers should be strictly discourage by the government through laws and legislation on local and national levels. And the use of plastic waste in the construction of roads infrastructure should be encouraged all over the country as plastic waste management and climate change adaptation activity.

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Figure 4: Types of shopping bags commonly used

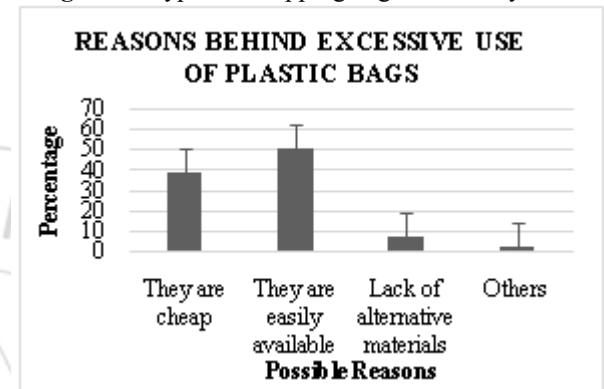


Figure 5: Reasons encouraging the excessive use of plastic bags



Figure 2: General composition of solid waste

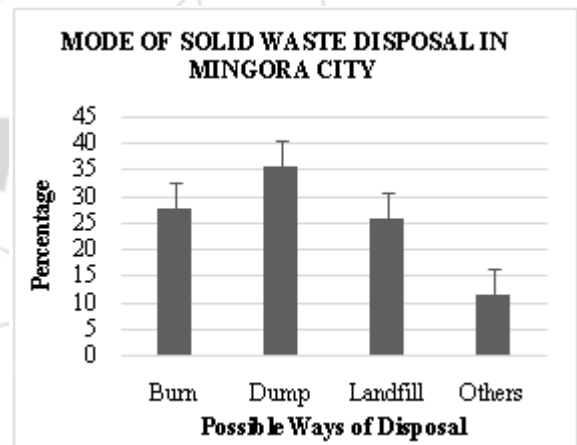


Figure 6: Mode of waste disposal commonly adopted

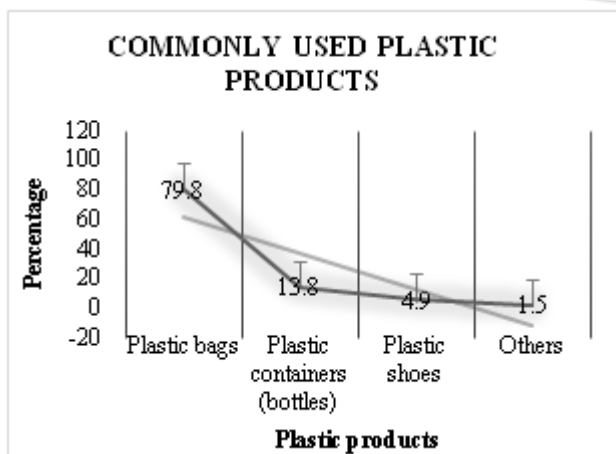


Figure 3: Plastic products commonly used

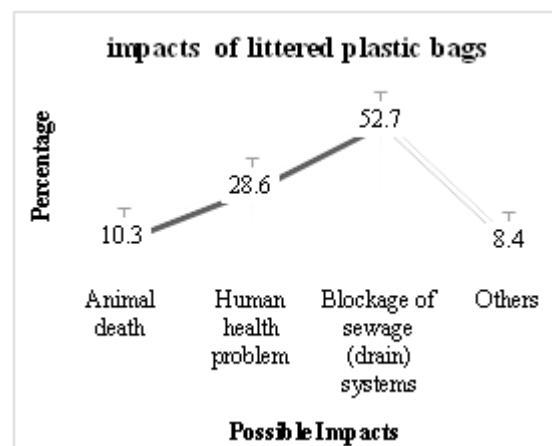


Figure 7: Impacts of littered plastic bags

Table 2: Data Table

Quantity of solid waste produced per house hold Mingora City				
	Frequency	Percent	Valid Percent	Cumulative Percent
<10kg	51	25.1	25.1	25.1
10-15kg	102	50.2	50.2	75.4
16-20 kg	35	17.2	17.2	92.6
>20	15	7.4	7.4	100.0
Composition house hold garbage in Mingora City				
Paper waste	25	10.3	12.3	12.3
Plastic waste	102	32	50.2	62.6
Organic waste	62	23.8	30.5	93.1
Others	14	31.9	6.9	100.0
Plastic products commonly used in Mingora City				
Plastic bags	162	79.8	79.8	79.8
Plastic containers	28	13.8	13.8	93.6
Plastic shoes	10	4.9	4.9	98.5
Others	3	1.5	1.5	100.0
Types of shopping bags in Mingora City				
Plastic Bag	139	68.5	68.5	68.5
Fabric Bag	49	24.1	24.1	92.6
Paper Bag	12	5.9	5.9	98.5
Others	3	1.5	1.5	100.0
Number of plastic bags used per week				
>10	65	32.0	32.0	32.0
20-30	91	44.8	44.8	76.8
<30	43	21.2	21.2	98.0
Others	4	2.0	2.0	100.0
The possible reasons for excessive use of plastic bags				
They are cheap	79	38.9	38.9	38.9
Easily available	103	50.7	50.7	89.7
Lack of alternatives	16	7.9	7.9	97.5
Others	5	2.5	2.5	100.0
Mode of Disposal of the house hold garbage /solid waste in Mingora City				
Burn	56	27.6	27.6	27.6
Dump	72	35.5	35.5	63.1
Landfill	52	25.6	25.6	88.7
Others	23	11.3	11.3	100.0
Environmental impacts of plastic bags in Mingora City				
Animal death	21	10.3	10.3	10.3
Human health problem	58	28.6	28.6	38.9
Blockage of sewage systems	107	52.7	52.7	91.6
Others	17	8.4	8.4	100.0