

(KAP) Survey on the usage of plastic bags, their disposal and impacts on the environment: A case study in the Capital Secretariat, Sana'a, Yemen

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Abstract— Research and policy interest in questions of environmental pollution is growing, especially plastic bag pollution. This international concern on the effect of plastic pollution in general lead to the announcement of the theme "beat plastic pollution" for the World Environment Day 2018. The situation is indescribable in economically poor countries like Yemen where trash disposal and recycling are not highly regulated the proliferation of plastic bags has created dramatic environmental pollutions and health problems. In Capital Secretariat, most people use plastic bags for shopping purposes and keeping Qat. However, their excessive use leads to a large amount of plastic bag waste. the objective of this survey was to assess and gain an understanding of the usage of plastic bags, their disposal and environmental impacts in Sana'a city. this study used a semi-structured questionnaire to collect data from 200 randomly respondents. Data analysis was done to the collected data and the results presented in tables and figures to highlight the major findings. this study found out that the larger proportion (162, 81.0%) of the respondents used plastic bags more frequently than any other plastic products regardless of their age, occupation, and economic and educational status and without any gender discrimination. Easy availability (100, 50.5%) and lack of alternative materials (78, 39.0%) were the main reasons for the widespread utilization of plastic bags products. Among the practices used for disposal of plastic bag wastes ,open dumping to surrounding areas (110, 55.0%) was the widest practice used by almost all the residents of the city .the major problems caused by plastic bags pollution were human health problems (115, 57.5) deterioration of natural beauty of the environment (114), blockage of sewage line(90, 45.0%) and animal death (33, 16.5%). Range of Recommendations are provided including the establishment of a recycling plant, creation of awareness and carrying out educational campaigns on the hazards that are occasioned by plastic bags, the use of environment R's (Reduce, Reuse and Recycle) and support of policies, legislation, programs, and voluntary activities to minimize the effect of plastic bags pollution.

Index Terms— Capital Secretariat, plastic bags waste, environmental pollution, disposal practices, voluntary action.



1 INTRODUCTION

As plastic pollution is having significant impacts on our planet, human beings are encountering numerous environmental challenges and problems, such as global warming, glaciers melting, water pollution. In order to make our planet sustainable, everyone has responsibilities to find ways to solve or diminish these problems in our real life, not only because of our life dependency on conditions and quality of the environment, but also for moral reasons of responsibility for our next generations. The earth is over polluted and host of lands are covered by waste, even the oceans have been polluted by plastics and other harmful materials (1). Beyond that, scientists have compounded a large amount of artificial materials and chemical substances, which have no natural analogies. For this reason, it is difficult to make predictions about the degradation effects and the influence these substances would have on aquatic or terrestrial ecosystems (2). The plastic carrier bag, plastic shopping bag PSB, or simply known as plastic bag is popular means of carrying goods when making purchases in Yemen. The plastic bag since its introduction has become very popular with consumer and retailers. It has been in use by consumers worldwide since the 1960s when it was invented by a Swedish engineer Gustaf Thulin and patented worldwide by

celloplast; well-established company in plastic processing in 1965(3,4). The bags rapidly became popular among retailers and consumers worldwide in recent decades due to their functionality, strength, and low cost (5) They are highly useful material and their purpose is by and large increasing as more new products are continually developed for the market to meet demands of retailers and consumers (6) because of this They are available in huge numbers and varieties across the world (7). The use of Plastic carrier bag by consumers is a form of social change (8). No accurate statics have been seriously made on the number of plastic bags produced so far, but today about a trillion plastic bags are being nonchalantly used worldwide every year (9). It is estimated that about 96 per cent of all plastic bags are thrown into landfills(10) It is also believed that after their entry into the environment, plastic bags can persist up to 1000 years without being decomposed by sun light and/or microorganisms(11).the rate of degradation depends on both the composition of the bag and the environmental situations of the receiving environment(12).plastic bags take much longer to break down in water than on land, thus compounding impacts from a plastic bag persistent over time(13). White pollution is an appellation of environmental

non-degradable Plastic garbage (especially plastic bags) (14). The widespread usage of plastic bags has caused white pollution in the country. The Plastic bag pollution problem has attracted great political and public attention especially when it connects closely to environmental problems Polyethylene plastic bags are usually stable and resistant to degradation. Even though the polyethylene will naturally fragment and biodegrade, but this process is estimated to takes up to one thousand years (15). The key ingredients in plastic bags are petroleum and natural gas and 4 percent of the world's total oil use in production. Polyethylene is made from ethylene and its non-renewable resource; hundreds of the years take to break down. Polyethylene is pleasing to manufactures because it can be converted into any shape, size, form and color (16). There are two types of polyethylene High Density Polyethylene (HDPE) and Low Density Polyethylene (LDPE) are the most commonly known forms (figure 1). Other types of polyethylene include Linear Low Density Polyethylene (LLDPE), Medium Density Polyethylene (MDPE), and Very Low Density Polyethylene (VLDPE) (17). On average, LDPE bags weigh 15 grams whereas HDPE bags weigh 6 grams (18). HDPE bags lack robustness and therefore contribute to littering problems more than the LDPE alternative: the bags break easily, causing the reuse value to diminish instantaneously, conceivably provoking their immediate discarding into the litter stream. Also, in many countries, consumers travelling longer distances or carrying heavier loads must use two or three HDPE bags at a time when one LDPE bag would suffice (19). A HDPE singlet bag is estimated to persist as litter for two years before it is reduced to small particles, and will float in water for six months before sinking (20).

provided by the retailer for the carrying or transporting of goods, but does not include a carry bag which complies with prescribed design criteria' .after the plastic bag has served its original purpose[transportation] consumers usually view the bag as undesirable items(23).when plastic bag are sent to landfill they become incorporated into the waste mass within the landfill, contributing to the increasing size of waste at the landfill(24).the number of plastic bag is effectively accumulative due to plastic bag durability and life span as litter. Accumulation of plastic bag wastes causes environmental pollution that can be manifested in number of ways. one of these problems is deterioration of natural beauty (25). Another common problem associated with plastic bag wastes is the impact on agricultural sector. As the plastic bag is non- biodegradable and almost non-compostable (26), it stays in the soil for an excessively long period of time thereby causing unimaginable harms to the agricultural sectors. The agricultural crops cannot grow where the plastic bags stay because their roots cannot move around due to the ever present of plastic bags. It is really amazing that the thin plastic bags are so strong that the roots of trees are unable to pierce it to find its way inside the soil to find nutrients. The most significant negative impacts of the plastic bags on agriculture are: reduction in soil fertility, decrease in nitrogen fixation, huge loss of nutrients in the soil, decrease in crop harvest, disparity in flora and fauna on soil. These negative impacts of plastic bags in fact reduce soil fertility to a great extent and thus reduce agricultural production to a great quantity (27). Their health impacts include cancer and acting as "endocrine disruptors" that affects the reproductive system of human and other living organisms, (28).in several poor and developing countries these bags are frequently used to carry food items. This practice can cause serious health problems since some carcinogenic agents could be generated during chemical reactions that take place in plastic materials (for example, coloring agents) and the food items due to temperature variations (29). In recent reports, it has been mentioned that reuse of plastic bags can cause cross contamination of foods by microorganisms(30).moreover ,plastic bags are also used for disposing of human and other domestic waste which makes human health more risky as compared to "open" disposal of theses wastes(31) blockage of sewerage systems is becoming a common problem in cities and towns of developing countries .this, in turn, creates foul smells and favorable habitats for mosquitoes and other vectors that could spread a large number of diseases such as encephalitis, dengue fever and malaria(32). Furthermore, the Environment Protection Heritage Council (EPHC) report says that the threat to animals is through ingestion and entanglement by plastic litter, and that both marine, livestock, and wildlife are at risk. Plastic bags can have a devastating effect on wildlife; birds can become entangled in the bags and different species of sea life can die from ingesting plastic bags which they mistake for food



- HDPE or High-Density Polyethylene
 - Crinkly shopping bags, milk bottles, juice and soft drink bottles.
 - HDPE can be hard to semi-flexible, it is moisture resistant, opaque, easily processed and coloured.



LDPE or Low-Density Polyethylene-
 -Thick shopping bags, glad-wrap, squeeze bottles and irrigation pipe.
 -LDPE is a soft, flexi, waxy surface that is translucent and scratches easily.

Figure 1. Main Plastic Bag Types (21)

While these distinctions are necessary for identification and recycling in practice, it is easier to define plastic bags by their function or use rather than material type, size, or shape for research and policy as specifications such as these are easily avoided(22).the environment protection and heritage council have proposed the definition of "A plastic bag means a carry bag, the body of which comprises polymers in whole or part,

(33). Terrestrial plastic bag litter does not appear to be a major problem for wildlife (34). However, livestock have been known to consume plastic bags, causing illness and fatalities (35). Plastic bag waste, when broken down, can also affect hormone levels of animals when it passes through the food chain, which can eventually affect humans too (36). This necessitates for proactive measures in order to safeguard animal species against extinctions (38,37). Furthermore, plastic bags required significant quantities of both energy and raw material. Most of the energy is from non-renewable resources, such as fossil fuels (39). Feedstock energy is part of resource input that ends up in the polymer rather than being used as a fuel. In other words, feedstock energy is the energy consumed to produce the High Density Polyethylene (HDPE). It is usually an accumulation of the energy used to extract, manufacture and transport the raw materials (40). From one research result, it uses about 95 KJ of natural gas, 120 KJ of petroleum, and 80 KJ of coal to make a single plastic bag (41). Another research found that 1500 plastic bags use 159 MJ in fuel production, 171 MJ in fuel use, 16 MJ in transport, and 418 MJ in feedstock, for a total of 763 MJ. This equates to 508 KJ in total energy use for each bag (42). The production and transportation of plastic bags not only consumes energy, but also depletes resources and generates global warming emissions (43). Air pollution caused by the emission of toxic chemicals and CO₂ during the manufacturing of plastic bags is a significant part of the environmental impact of this product. The manufacturing of two plastic bags produces 1.1 kg of atmospheric pollution, which contributes to acid rain and smog (44). In the attempt to reduce the problems on the environment from the nonchalant use of plastic bags, some countries such as Australia, Italy, United States of America, Tanzania and Ireland have resorted to the imposition of tax or to a ban on the production and use of plastic bags for shopping or other purposes (21) (figure 2). Voluntary Plastic Bag Action have also been adopted in some countries such as Portugal, Singapore and Thailand in order to reduce plastic bag problems in environment (45). Different reports showed that plastic bags are still causing environmental pollution also human and health damages in urban and rural areas of different cities in the world (46). For instance, a retrospective study by Riyad and Maher (2014) that was conducted in Sana'a and its surrounding areas of Yemen, on the impact of plastic bags on the environment, indicated that the city contained a very large amount of plastic bags which led to distorted environment and reduced aesthetic view of the city (47). Due to all aforementioned reasons similar problems which are happening in different parts of the world because of plastic bags are also expected to be common in the Capital Secretariat. The present study was, therefore, initiated to assess usage of plastic bags their disposal and impacts on environment in Capital Secretariat, Northern Yemen.



Figure 2. Distribution of plastic bags policy in the world [48]

2. MATERIALS AND METHODS

Description of the study area

This present study was carried out in the Capital Secretariat, northern Yemen (figure 3). The importance of which is the political and historical capital of the Republic of Yemen, where it is concentrated Ministries, institutions, government departments, Arab and foreign political bodies, as well as commercial and industrial activities. The latitudes and longitudes of The Capital Secretariat is located 21-15 north of the Equator and 12.44 East of Greenwich, at an altitude of 2150 meters above sea level. It is surrounded by two mountains (Mount Nokom to the east and Mount Aiban to the west). The Capital Secretariat is also surrounded by Sana'a province from all sides. The area of the Municipality of the capital is about (390) square kilometers distributed to ten districts, according to the administrative division for the year 2004. The climate is Mild in summer and cold in winter, and the average temperature in the summer at night about (12 C), at a time may rise the daytime temperature to more than (30 C), while in winter the average day temperature is about (22 C), while The minimum temperature is about 2 degrees Celsius and sometimes drops to minus 6 degrees Celsius. The summer rains fall in medium quantities and winter rains fall but in rare and rare quantities. The amount of rainfall falling during the year is 170.0 mm, according to the main monitoring stations in 2004. According to the Final Results of the General Population Census 2004 it has a total population of (1747834) and the population grows by 5.55% annually. Its population is 8.9% of the total population of the Republic.

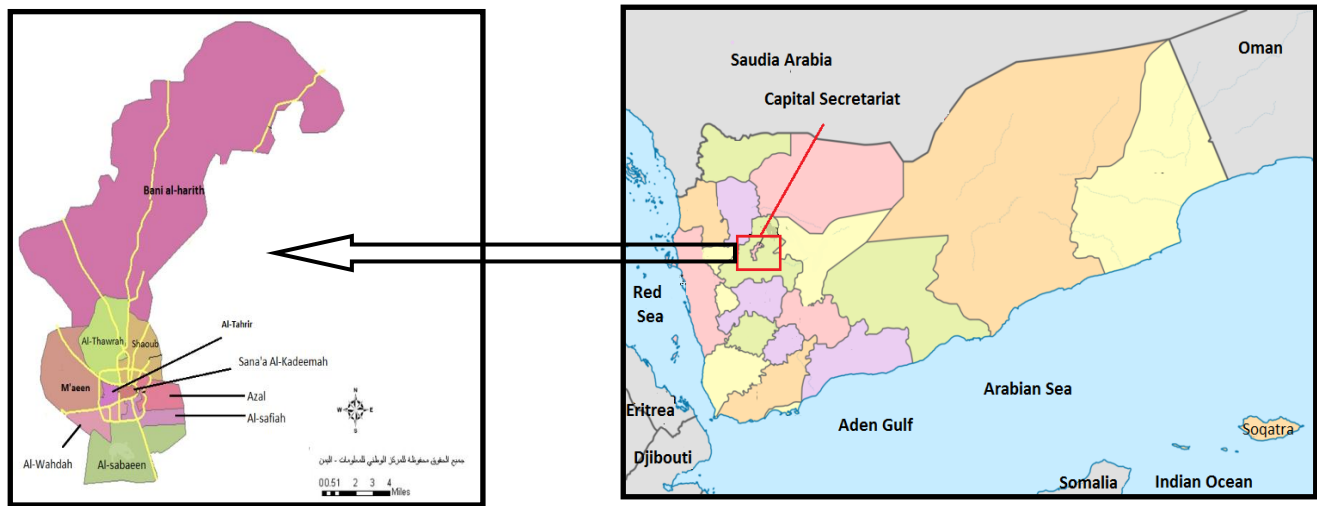


Figure 3. maps showing the relative position of the study area (50,51)

Sampling techniques, data collection and analysis

The field survey was undertaken from March to June, 2018. Information gathered for the study was mainly primary and secondary. There are number of tools used to collect primary data. For this study, questionnaires and interviews were used to learn about people’s beliefs or opinions on the use, disposal and impacts on the environment of plastic bags. An interview is one of the main data collection tools in qualitative research. It is a very good way of accessing people’s perceptions, meanings, and definitions of situations and constructions of reality (51). structured questionnaires were prepared in Arabic consists of closed and open ended questions (appendix1) aimed at eliciting detailed and varied information from 200 respondents that consist of 152 males and 48 females. The number of male respondents was higher than female respondents due to the fact that males showed more readiness to be interviewed and fill the questionnaires provided the respondents (7). Prior to the administration of the questionnaires, conversations were held with the selected respondents to explain the objective of the survey the researchers especially for illiterate and elderly people. Researches that have been done on the topic, scientific papers and other publications were reviewed as secondary data to add to the information gathered. The study also made use of the internet for access to websites that had very useful information on plastic bags. A field visit and a survey to the areas (BabAl_Yemen,Shoab,Al-

daery, Tunisia,Rebat,shmila,Haiell,Madbah,Al-asbahi,AL- Safia ,Al-Tahrir ,Al-Adl ,Haddah,) districts to collect data from the respondents and determine places of accumulation of plastic bags and .The data collected were statistically analyzed using SPSS software. The results are presented in tables and figures to highlight the major findings. Although this study did not involve chemical analyses of the plastic bag wastes or involve toxicological analysis, it builds strength on the fact that plastic bags pollution must to be a very Important issue for all the sectors of the society.

3. RESULTS AND DFISCUSSION

Table 1 shows the demographic characteristics of respondents involved in this study from 200 respondents (152, 76.0%)were males and (48, 24.0%)were females. close to half (41.0%)of the respondents had high school education, (32.5%) had higher education, while (7%)were illiterates. The results of our study also indicated that, 32.5% of the respondents were students, 16.5% were employed by the government sector. Majority of working class (45.0%)were employed by the private sector.

Table 1
 Demographic characteristics of respondents (N=200)

Variable	Categories	No.	%
Sex	Male	152	76.0
	Female	48	24.0
Age	<20 years	47	23.5
	20-29 years	81	40.5
	30-39 years	39	19.5
	≥ 40 years	33	16.5
Educational background	Illiterate	14	7.0
	Primary education	39	19.5
	High school education	82	41.0
	Higher	65	32.5
Occupation	Student	65	32.5
	Gov't employee	32	16.0
	Private business	90	45.0
	Others	13	6.5
	Total	200	100%

Plastic bags and factors responsible for increasing trend of their usage

Of the 200 respondents, the largest proportion of them (121,60.5%) used plastic bags in high frequency as compared to other plastic products. This was followed by the usage of plastic liquid container 20 liter (114,57.0%) from our observation this was because of the increasing of water price, and poverty, drinking plastic bottles (46,23.0%), Plastic buckets, bins and barrels and plastic shoes usage was the same (41,20.5%) (table 2). the local studies showed that the main consumption is from the small bags that are about than 15 microns thick. Which are used to carry merchandise

that are 1000 gm. or less (47) These results revealed that majority of the respondents in each category use plastic bags in their daily life. The results also indicated that usage of plastic bags is high among residents of Capital Secretariat .and the residents noticed the increasing (90.50%) trend of usage of plastic bags from time to time (figure.1) This observation agrees with a survey results which states that, majority of the city residents of Sana in Yemen widely used plastic bags in their daily life activities (47).

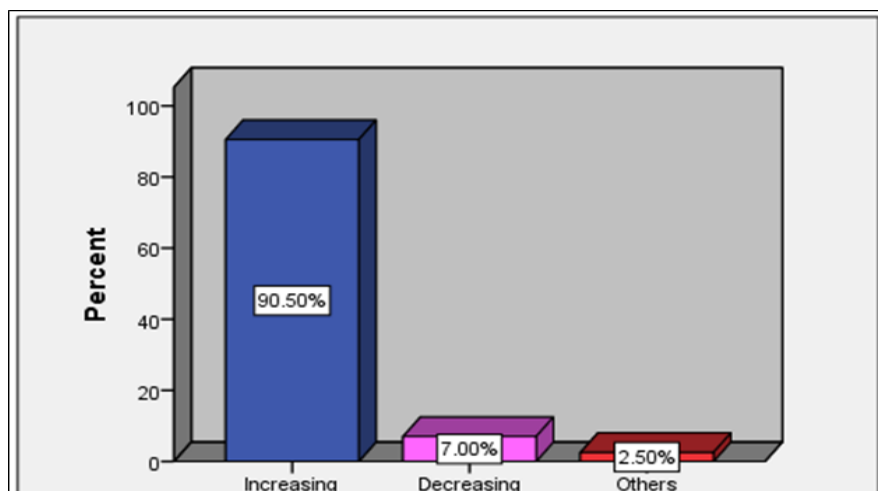


Figure 4. Trend of usage of plastic bags

Table 2.
Types of plastic products commonly used in capital Secretariat

Variable categories	Plastic bags (No. (%))	Plastic containers (No. (%))	liquid drinking bottles (No.(%))	Plastic buckets, bins and barrels (No. (%))	Plastic shoes (No. (%))
Sex					
Male	121(60.5)	92(46.0)	33(16.5)	22(11.0)	23(11.5)
Female	41(20.5)	22(11.0)	13(6.5)	19(9.5)	18(9.0)
Age					
<20 years	33(16.5)	26(13.0)	12(6.0)	6(3.0)	11(5.5)
20-29 years	63(31.5)	49(24.5)	19(9.5)	17(8.5)	12(6.0)
30-39 years	34(17.0)	22(11.0)	6(3.0)	10(5.0)	6(3.0)
≥ 40 years	32(16.0)	17(8.5)	9(4.5)	8(4.0)	12(6.0)
Educational background					
Illiterate	13(6.5)	7(3.5)	3(1.5)	3(1.5)	6(3.0)
Primary education	34(17.0)	16(8.0)	11(5.5)	8(4.0)	10(5.0)
High school education	62(31.0)	50(25.0)	18(9.0)	17(8.5)	17(8.5)
Higher	53(26.5)	41(20.5)	14(7.0)	13(6.5)	8(4.0)
Occupation					
student	49(24.5)	38(19.0)	16(8.0)	10(5.0)	10(5.0)
Gov't employee	29(14.5)	16(8.0)	8(4.0)	8(4.0)	8(4.0)
Private business	72(36.0)	52(26.0)	18(9.0)	15(7.5)	18(9.0)
Others	12(6.0)	8(4.0)	5(2.5)	8(4.0)	5(2.5)
Total	162(81.0)	114(57.0)	46(23.0)	41(20.5)	41(20.5)

Some of the main reasons attributed to the widespread usage were Easy availability (100, 50.5%) , lack of alternative materials (78, 39.0%) and low price(58,29.0%) (Table3).these findings are consistent with our observations that almost all supermarkets and retailers distribute plastic bags free of charge to their consumers for carrying solid and liquid items also a survey conducted in Mumbai showed that majority of the respondents used and preferred plastic bags because they get it free from tomato vendors(53).for instance, a survey in the city of Sidney, showed that 64% of customers of supermarkets use free plastic bags(54) This suggest that cheapness and free distribution of these materials by retailers and supermarkets owners are believed to be the main reasons for the wide-

spread usage and problems off plastic(7). This argument is consistent with the results of similar surveys in other big cities in the world (55). another report showed that the modern society have high preference for plastic bags over other possible alternatives (56). though durability (39,19.5%) and light- weight (37,18.5%) were mentioned as additional factors for widespread utilization and excessive usage of plastic bags in the Capital Secretariat, their contribution was found to be less important than as compared to other factors. In another report revealed that light-weight, cheap prices, excellent fitness for use and resource efficiency are main reasons for widespread utilization of plastic bags by billions of customers throughout the world .

Table .3
Factors contributing for widespread utilization of plastic bags in (capital Secretariat)

Variable categories	Low price (No. (%))	lightweight (No. (%))	easy availability (No. (%))	Lack of alternative materials (No. (%))	durability (No. (%))
Sex					
Male	35(17.5)	32(16.0)	68(34.0)	60(30.0)	29(14.5)
Female	23(11.5)	5(2.5)	32(16.0)	18(9.0)	10(5.0)
Age					
<20 years	10(5.0)	13(6.5)	19(9.5)	14(7.0)	9(4.5)
20-29 years	27(13.5)	13(6.5)	44(22.0)	37(18.5)	12(6.0)
30-39 years	13(6.5)	4(2.0)	23(11.5)	9(4.5)	8(4.0)
≥ 40 years	8(4.0)	7(3.5)	14(7.0)	18(9.0)	10(5.0)
Educational background					
Illiterate	8(4.0)	2(1.0)	6(3.0)	6(3.0)	6(3.0)
Primary education	13(6.5)	6(3.0)	19(9.5)	13(6.5)	8(4.0)
High school education	19(9.5)	17(8.5)	42(21.0)	28(14.0)	15(7.5)
Higher	18(9.0)	12(6.0)	33(16.5)	31(15.5)	10(5.0)
Occupation					
student	18(9.0)	15(7.5)	30(15.0)	26(13.0)	9(4.5)
Gov't employee	10(5.0)	7(3.5)	13(6.5)	14(7.0)	5(2.5)
Private business	24(12.0)	15(7.5)	49(24.5)	31(15.5)	19(9.5)
Others	6(3.0)	0	8(4.0)	6(3.0)	6(3.0)
Total	58(29.0)	37(18.5)	100(50.0)	78(39.0)	39(19.5)

Disposal of Plastic Bag Waste and Places where plastic bag wastes commonly found at capital

This section discusses the methods used by the respondents for plastic Bag waste disposal and the most polluted places by plastic bags wastes. It is obvious that at the end of their short service life, plastic bags become wastes (58). The results indicated that throwing to the surrounding areas (open dumping) (110,55.0%) and burning (47,23.5%) to be the common practices to dispose plastic bag wastes (table .4). of these practices, indiscriminate throwing of the wastes to the surrounding areas was used by majority of the residents. these findings are consistent with another survey conducted in Jimma City, Ethiopia (7). The results (and observations) are consistent with other reports stating that in several cities of the country and also in cities of other parts of the world, especially in developing countries people prefer open dumping as a preferred means of disposal of plastic bag wastes, usually after a single use(59).as indicated in

(table 4), burning is another common method of disposal of plastic bag wastes. Some of the respondents added that they saw this practice during the strike of cleaning workers as the last option to get rid of plastic bags and other solid wastes. Of the female respondents, those respondents (21,10.5%) who burn plastic bags wastes were higher as compared to those females (15,7.5%) who throw plastic bags wastes to the surrounding areas. The logical reason could be that many women use plastic bag wastes for carrying fire ,another possible reason is that some women (6,3.0%) reuse plastic bags as garbage bags or shopping bags. Respondents were asked based on their observation about the most polluted places by plastic bags wastes. Market places (157, 78.5%), Crowded residential areas (89,44.5%) and roadsides (89,44.5%) were the most polluted places by these wastes This is supported by our observation that, there was plastic bags wastes at places like parks, market places especially in Qat and vegetables markets,

outdoor markets and crowded residential areas (47). also plastic bag constituted a larger share of plastic wastes in several residential areas in the Capital Secretariat (P). This

was followed by Waste dumping sites (57,28.5%), Parks (45,22.5%), sewage (drain) lines (41 , 20.5%) and any open places(35 , 17.5%).(figure 2.) (appendix 2).

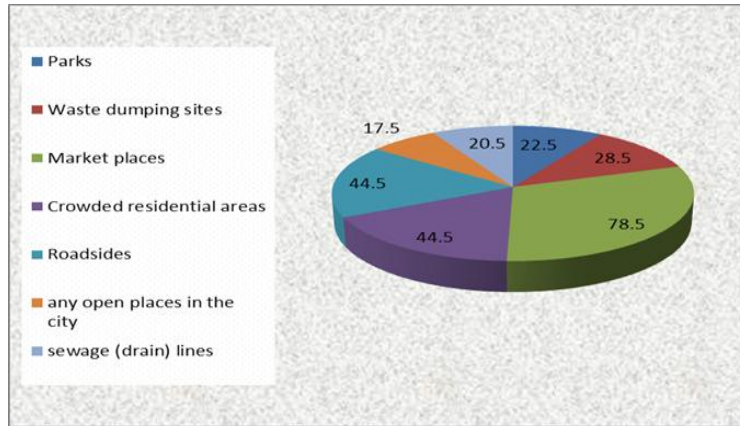


Figure .5 Places where the most plastic bags waste commonly found in the capital

Table .4
methods of plastic bags waste disposal in the capital secretariat

Variable categories	Open dumping (No.(%))	Burying (No.(%))	burn (No.(%))	Reuse (No.(%))	Other (No.(%))
Sex					
Male	95(47.5)	16(8.0)	26(13.0)	14(7.0)	1(0.5)
Female	15(7.5)	6(3.0)	21(10.5)	6(3.0)	0(0.0)
Total	110(55.0)	22(11.0)	47(23.5)	20(10.0)	1(0.5)
Age					
<20 years	26(13.0)	9(4.5)	9(4.5)	3(1.5)	0(0.0)
20-29 years	45(22.5)	10(5.0)	19(9.5)	7(3.5)	0(0.0)
30-39 years	20(10.0)	3(1.5)	10(5.0)	5(2.5)	1(0.5)
≥ 40 years	19(9.5)	0(0.0)	9(4.5)	5(2.5)	0(0.0)
Total	110(55.0)	22(11.0)	47(23.5)	20(10.0)	1(0.5)
Educational background					
Illiterate	5(2.50)	0(0.0)	7(3.5)	2(1.0)	0(0.0)
Primary education	17(8.5)	1(0.5)	18(9.0)	2(1.0)	1(0.5)
High school education	45(22.5)	17(8.5)	11(5.5)	9(4.5)	0(0.0)
Higher	43(21.5)	4(2.0)	11(5.5)	7(3.5)	0(0.0)
Total	110(55.0)	22(11.0)	47(23.5)	20(10.0)	1(0.5)
Occupation					
Student	31(15.5)	12(6.0)	14(7.0)	8(4.0)	0(0.0)
Gov't employee	20(10.0)	3(1.5)	4(2.0)	5(2.5)	0(0.0)
Private business	56(28.0)	7(3.5)	20(10.0)	5(2.5)	1(0.5)
Others	3(1.5)	0(0.0)	9(4.5)	2(1.0)	0(0.0)
Total	110(55.0)	22(11.0)	47(23.5)	20(10.0)	1(0.5)

problems and environmental impacts of plastic bag wastes

as mentioned in the previous section that burning is commonly used method of disposal of plastic bag wastes in the study area. However, this burning should not be encouraged for several reasons such as greenhouse emissions that cause climate change (60) and release of toxic organic compounds into the environment that cause different health risks such respiratory health problems. Current research indicates that backyard-burning of waste including plastic bag wastes is far more harmful to our health than previously thought. It can increase the risk of heart disease, aggravate respiratory ailments such as asthma and emphysema, and cause rashes, nausea, or headaches, damages in the nervous system, kidney or liver, in the reproductive and development system (61). When such plastics are burned, harmful quantities of dioxins are emitted. Dioxins are the most toxic to the human organisms. They are carcinogenic and a hormone disruptor and persistent, and they accumulate in our body-fat and thus mothers give it directly to

their babies via the placenta. breathing the contaminated air directly. In wildlife, the range of effects associated with these pollutants includes cancer, deformed offspring, reproductive failure, immune diseases and subtle neurobehavioral effects. Humans can be exposed indirectly just like wildlife (62). Although burying was mentioned as an additional used disposal practice for disposing of plastic bag wastes in the study area. however, this method shouldn't be considered as a correct way for disposing of plastic bag wastes. This is because the plastic wastes have potential to leach their chemical compounds and toxins into soil and water bodies, which can be passed to humans, resulting serious health hazardous. In the long term they can also reduce planet growth near sites where used to bury them as a result of restricted movement of both air and water in the soil (63). the result of our survey indicated that majority of the respondents (165,82.5%) think plastic bag wastes cause problems, (20,10.0%) of the respondents think no, and (15,7.5%) had no ideas (figure 6).

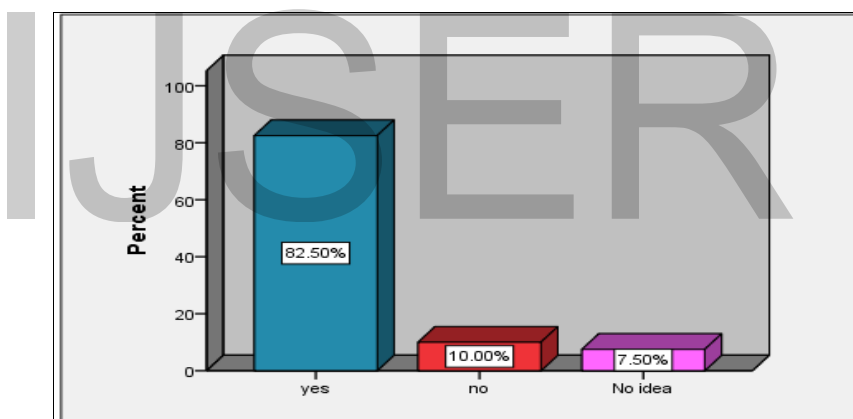


Figure .6 Level of awareness about the problems caused by plastic bag wastes

This implies that a good number of the respondents are aware of the problems associated with plastic bags on the environment. Although, the researchers acknowledge the level of awareness of the majority of respondents on the issue, the minority of respondents who suggested no or no idea, raises concern that can undermine efforts in achieving activities or policies to solve these problems in the future. therefore, efforts are very needed to sensitize every member of the society about the many-fold problems caused as a result of plastic bag wastes indiscriminately introduced into the environment. The data given in (table 5) showed that the major problems caused by plastic bags pollution were human health problems (115, 57.5%) deterioration of natural beauty of the environment (114), blockage of sewage line (90, 45.0%) and animal death (33, 16.5%). These hazards

affirm the report on environmental problems of plastic bag wastes in other countries (36). The impacts of plastic bag waste on human health are perhaps the most serious of the effects associated with plastic bags (6). as they provide breeding sites for mosquitoes which are responsible for spreading diseases like dengue and malaria (64). another common problem identified from the survey is deterioration of natural beauty (or littering) (114). This could be attributed to the open dumping culture of the residents so this suggests that 'uses and throw-away' to be a custom among the residents of capital. Plastic waste littering is common in most cities in developing countries. Once they become litter, they find their way into waterways, parks, beaches, and streets(2here). Plastic bags can be carried by wind from where they are dumped to distant places. This is

due to their negligible weight and structure which makes it possible for them to be filled up with air just like balloons, and get blown and dispersed over large areas (65). And can create serious damages in large urbanized areas of the world (66). This problem can effect a very important sector like tourism (67). blockage of drain systems (90, 45.0%) was also mentioned as a serious problem next to health problems (115, 57.5%) and deterioration of natural environmental beauty (114). The accumulation of plastic waste in drainage system in the cities prevents the free flow of water, thereby creating breeding grounds for vectors of various diseases such as dengue, malaria, yellow fever and several forms of encephalitis (68). This situation can be seen in capital especially during rainy months, and gets more attention in social media and national TV channels. For instance, to support this finding it was reported by the Asian News, in 2005 that the city of Mumbai, India experienced massive monsoon flooding, resulting in at least 1,000 deaths, with

additional people suffering injuries, was attributed to plastic bags clogged the city's storm drains and prevented the monsoon rains from leaving the city drains(69).also in Bangladesh Huge amount of plastic bags were lying in the street, which severely blocked the drains and waterways, causing serious drainage problems . It was estimated that about 80% of the city's waterlogging was caused by the polyethylene blocking the drains (70). Animal death (33,16.5%) was mentioned as an additional problem caused by plastic bag wastes in capital. Hundreds of thousands of animals like sheep, goats, crows, fish, turtles etc. ingest plastic bags and get killed(73).Plastic bags (especially those wastes containing food leftovers), during the time of shortage of food are eaten by cows, stray cattle, ruminants which results in complications of digestive system and health of animals and this could lead to death of the animal and economic loss to their owners if it is not treated timely as it has been observed in developing countries of Africa and India (7,74).

Table .5
Problems associated with plastic bag wastes (Capital Secretariat).

Variable categories	Animal death (No.(%))	Human health problem (No.(%))	Blockage of sewage (drain) systems (No.(%))	Deterioration of natural beauty of environment (No.(%))	Other (No.(%))
Sex					
Male	25(12.5)	79(39.5)	70((35.0)	83	24(12.0)
Female	8(4.0)	36(18.0)	20(10.0)	31	7(3.5)
Total	33(16.5)	115(57.5)	90(45.0)	114	31(15.50)
Age					
<20 years	2(1.0)	18(9.0)	17(8.5)	23	3(1.5)
20-29 years	14(7.0)	48(24.0)	37(18.5)	43	10(5.0)
30-39 years	7(3.5)	27(13.5)	15(7.5)	22	9(4.5)
≥ 40 years	10(5.0)	22(11.0)	21(10.5)	26	9(4.5)
Total	33(16.5)	115(57.5)	90(45.0)	114	31(15.5)
Educational background					
Illiterate	2(1.0)	8(4.0)	2(1.0)	9	1(0.5)
Primary education	6(3.0)	24(12.0)	20(10.0)	20	8(4.0)
High school education	8(4.0)	40(20.0)	33(16.5)	43	8(4.0)
Higher	17(8.5)	43(21.5)	35(17.5)	42	14(7.0)
Total	33(16.5)	115(57.5)	90(45.0)	114	31(15.5)
Occupation					
Student	6(3.0)	38(19.0)	26(13.0)	35	7(3.5)
Gov't employee	9(4.5)	22(11.0)	20(10.0)	23	6(3.0)
Private business	13(6.5)	46(23.0)	39(19.5)	46	17(8.5)
Others	5(2.5)	9(4.5)	5(2.5)	10	1(0.5)
Total	33(16.5)	115(57.5)	90(45.0)	114	31(15.5)

Persons responsible for management of household waste

Figure 7 below shows that within households in the Capital Secretariat, 45.71% of children; 45.18% of mothers and 9.11% of fathers are responsible for managing waste which include plastic bag wastes. It can then be concluded that waste management at the household level is virtually the work of mothers and children. In majority of the households, the mothers clean the homes and collect the rubbish

and the children carry out the final disposal from the homes. In most home, fathers did not play a big role in waste management. this finding is consistent with other findings from different cities (75) this was explained by other researchers. However, they indicated that, in the institution of marriage, it is the duty of the woman to cook, fetch water and clean, dispose of waste and keep the house in order. In addition, since it is the woman who produces

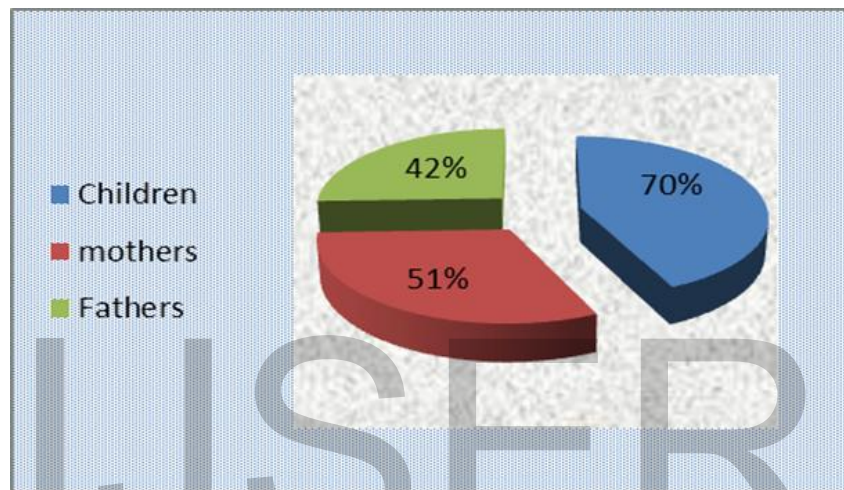


Figure .7 Responsibility for waste management at household level

waste as a result of her domestic activities, it beholds on her to find the means to dispose her waste (76). They argued that since men are normally out of the house most of the time and as such produces less refuse as compared to the other members of the household they are not bothered and

should not be bothered. This is possibly the reason why they were few men involved in plastic waste management at the household level in Capital Secretariat (77).

People perspectives toward the ban of plastic bags

The finding of the present study also indicated that (126, 63.0%) of the respondents support the ban of plastic bags, while (74,37.5%) of them indicated that plastic bags should not be stopped, they do not think that it is practical to ban plastic bags. They think that we can still use plastic bags by making people aware of better disposable methods. They also added that banning plastic bags well cause loss of jobs. However Environmental initiatives by the government will not be effective unless accompanied by public participation (78).

Public participation in environmental management brings numerous benefits (79). A number of studies have dealt with participation of the public in pro-environmental behavior. A large number has focused on recycling behavior (80) .

Table .6
 perspectives about the ban of plastic bags (Capital Secretariat)

Variable categories	should continue (No.(%))	should be stopped (No.(%))
Sex		
Male	57(28.5)	95(47.5)
Female	17(8.5)	31(15.5)
Total	74(37.5)	126(63.0)
Age		
<20 years	29(14.5)	18(9.0)
20-29 years	29(14.5)	52(26.0)
30-39 years	9(4.5)	30(15.0)
≥ 40 years	7(3.5)	26(13.0)
Total	74(37.5)	126(63.0)
Educational background		
Illiterate	7(3.5)	7(3.5)
Primary education	20(10.0)	19(9.5)
High school education	33(16.5)	49(24.5)
Higher education	14(7.0)	51(25.5)
Total	74(37.0)	126(63.0)
Occupation		
Student	30(15.0)	35(17.5)
Gov't employee	9(4.5)	23(11.5)

4. Conclusion

This study was carried out on the usage of plastic bags, their disposal and impacts on the environment in the Capital Secretariat. After a careful review of the current study it can be easily concluded that plastic bags are still widely used by the community of the Capital Secretariat more than any other plastic products mainly due to their easy availability, lack of alternative materials and cheapness. In spite of a good level of awareness of plastic bag wastes problems on, environment, human health and sewerage systems, and willingness to ban the plastic bags in the Capital Secretariat, use and improper disposal of plastic bags is at an alarming stage and caused great pressure on the environment.

Recommendations

The risks of plastic bag pollution are not restricted spatially, temporally or socially but they affect the global community

and the environment and all social classes. They have global consequences. so, it is an urgent thing to reduce the number of plastic bags opportunely and effectively. To raise public awareness, the regional and national different levels of educational curriculums must include the waste management systems from the grass-roots as information resources. In addition to creating public awareness on the importance of a healthy environment, mechanisms of controlling the generation of wastes at the source, alternative disposal ways, establishing additional drop-off areas (landfills) and incineration mechanisms, plastic recycling facilities are also recommended. Helping communities to reduce their exposures to health toxicants will increase the likelihood for a healthy society and clean environment for the coming generations. Government as well as non-governmental organizations should arrange national and international conferences to highlight and seek solutions to

the negative impacts of plastic bags and can also announce through radio, television and print media on the short-term and the long-term harmful effects of plastic bags, "furthermore, youth voluntary activities should be encouraged for its positive and quick impact". It has been seen from many experiences through the world that this problem can be controllable when individuals act reasonably and when there is a public participation as an environmental management tool. The Yemeni government can also encourage people to use environmentally friendly bags which are not detrimental to the environment. the government and the people in the community should focus on integrated and comprehensive approach (prevention, minimization and recycling). From our research we highly recommend the Malaysian program No Plastic Bag Day because it is the best solution to make the public aware about the serious effects of plastic bags. especially if there is any polices in the future including, ban, tax and levy due to the fact that people don't accept roles immediately in this day big companies should be encouraged from all private and governmental sectors.

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APENDIX(1)

مسح على استخدام الأكياس البلاستيكية، كيفية التخلص منها، وتأثيراتها على البيئة
دراسة حالة في امانة العاصمة - صنعاء - اليمن

تحية واحترام.....

يمثل هذا الاستبيان أحد الجوانب الهامة للبحث ويهدف الى تقييم استخدام الأكياس البلاستيكية، والتخلص منها واثارها السلبية على البيئة في امانة العاصمة. وجهات نظركم مهمة للغاية لنجاح الدراسة. يرجى التكرم للتعاون في اعطاء الردود على الاسئلة الواردة في هذا الاستبيان. الردود المتعددة ممكنة. يرجى استخدام علامة "✓".

القسم الأول: بيانات الاشخاص

الجنس: ذكر () أنثى ()
العمر: اصغر من 20 سنة () 20-29 سنة () 30-39 سنة () اكبر من اويساوي 40 سنة ()
المستوى التعليمي: أمي () تعليم ابتدائي () تعليم الثانوي () تعليم عالي ()
المهنة: طالب () موظف حكومي () أعمال خاصة () أخرى (من فضلك، حدد) ()

القسم الثاني: أسئلة الاستبيان

1. ما هي المنتجات البلاستيكية التي تستخدمها بشكل مفرط؟
أكياس بلاستيكية () قوارير بلاستيكية لأغراض الشرب () دبات بلاستيكية لحفظ السوائل، 20 لتر () دلاء بلاستيكية، صناديق، براميل () الأحذية البلاستيكية () أخرى (من فضلك، حدد) _____
2. لماذا تفضل استخدام المنتجات البلاستيكية وخاصة الأكياس البلاستيكية؟
لأنها رخيصة () لأنها خفيفة الوزن () لأنها متاحة بسهولة () لعدم وجود مواد بديلة () لأنها متينة () أخرى (يرجى التحديد) _____
3. هل تعتقد أن نفايات الأكياس البلاستيكية تسبب مشاكل؟
نعم () لا () لا فكرة () _____
4. كيف تتخلص من نفايات الأكياس البلاستيكية؟
الرمي في المكبات المفتوحة () الدفن () الحرق () أخرى (من فضلك، حدد) _____
5. إذا كانت إجابتك على السؤال 3 هي "نعم"، اذن فما هي المشاكل؟
موت الحيوانات () مشاكل صحية الإنسان () انسداد في أنظمة الصرف الصحي (المجاري) () تدهور الجمال الطبيعي للبيئة () أخرى (من فضلك، حدد) _____
6. من هو المسئول عن رمي المخلفات والتي تضم الأكياس البلاستيكية في منزلك؟
الاطفال () الامهات () الاباء () _____
7. أي أجزاء من مدينة صنعاء ملوثة بشكل خطير بنفايات اكياس البلاستيك؟
الحدائق () مواقع التخلص من النفايات () الاسواق () المناطق السكنية المزدحمة ()
جوانب الطرق (الأرصفة) () في الاماكن المفتوحة في المدينة () خطوط الصرف الصحي (المجاري) () أخرى (يرجى التحديد) _____

8. هل سمعت عن تأثيرات بيئية لنفايات الأكياس البلاستيكية على البيئة؟

نعم () لا () لا فكرة ()

9. إذا كانت إجابتك على السؤال رقم 8 هي "نعم"، كيف أو أين؟

من التلفزيون / الراديو () من (المدرسة، الجامعة، المعهد) () من المهنيين () من المواد المنشورة () أخرى (يرجى التحديد)

10. هل استخدام الأكياس البلاستيكية في زيادة أو انخفاض؟

زيادة () انخفاض () أخرى (من فضلك، حدد)

11. إذا كانت إجابتك على السؤال 10 هي "الزيادة"، فما هي الأسباب المحتملة؟

رخيصة (منخفضة التكلفة) () المتانة () التوفر في أي وقت وأي مكان () نقص الوعي

في المجتمع () أخرى (من فضلك، حدد)

12. إذا كانت إجابتك السؤال 10 هي "تناقص"، فما هي الأسباب المحتملة؟

توفر المواد البديلة () توعية المجتمع () زيادة أسعار المواد المصنوعة من البلاستيك () أخرى (من فضلك، حدد)

13. وفقا لرأيك، هل ينبغي الاستمرار في استخدام الأكياس البلاستيكية أو إيقافها؟

ينبغي أن تستمر () ينبغي إيقافها ()

14. إذا كان إجابتك في السؤال رقم 13 "يجب وقفها"، فمن هو المسؤول عن القيام بذلك؟

البلدية (المجالس المحلية) () المنظمات غير الحكومية () الحكومة () الوكالات البيئية () المجتمع نفسه () آخرون (يرجى التحديد)

15. إذا كنت تقول إن الأكياس البلاستيكية لا ينبغي استخدامها، ما هي البدائل التي يمكن استخدامها؟

أكياس الورق () سلال من سعف النخيل () أكياس القماش () أخرى (من فضلك، حدد)

16. تعليقات إضافية إن وجدت

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APPENDIX (2)



Accumulation of plastic bags near roadsides, Madabah



Trees are restricted by plastic bag wastes, Shu-mila



Plastic bags clogging drains, Al-Asbahi



Plastic bags and bottles wastes found on rainwater dam, near vegetable farms lands, Al_Arbaeen street.



Qat markets with high accumulation of plastic bags, Al-Safia.



Impact of plastic bags on wild animals, (72)



Plastic bags wastes creating unhealthy conditions.

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