

The Impact of Plastic Bags on the Environment: A field Survey of the City Of Sana'a And The Surrounding Areas, Yemen

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Abstract: Thousands of plastic factories are producing tons of plastic bags which are very popularly used by the people for shopping purposes because of its ease, cheapness and convenience of use but their very hazardous negative impact is never highlighted or, at the very least, openly discussed in a more serious tone. The situation is worsened in Yemen as economically disadvantaged country. Many countries have banned plastic bags due to public concern over the serious negative impact on the environment and agriculture, especially, in agricultural countries, such as Yemen, Bangladesh, India, Pakistan, South Africa, etc. In this research paper, we surveyed the field for the city of Sana'a and recorded of the where about of those plastic bags accumulated.

The number of factories producing plastic bags and discuss the causes and effects and reviewed a range of solutions for a clean environment for us and our future generations. The isolated microbial strains were identified based on their cultural morphological and biochemical study.

Keywords: Pollution of the environment, city of Sana'a, plastic factories, Plastic bags, impact on agriculture ,non-biodegradable, alternatives to plastic bags.

1. INTRODUCTION

Plastic bags have been introduced in 1970's [1] and gained an increasing popularity amongst consumers and retailers. They are available in huge numbers and varieties across the world. It is estimated that around 500 billion plastic bags are used every year worldwide [2,3]. This widespread utilization is attributed to their cheapness and convenience to use. The vast majority of these bags are discarded as wastes usually after a single use. It is also believed that after their entry into environment, plastic bags can persist up to 1000 years to degrade and hence pose a disposal challenge without being decomposed by sun light and/or microorganisms [4,5]. Accumulation of plastic bag wastes causes environmental pollution that can be manifested in number of ways. One of the problems is deterioration of natural beauty of an environment [6]. Another common problem associated with these wastes is death of domestic and wild animals. This necessitates for proactive measures in order to safeguard animal species against extinction [7-9]. Blockage of sewerage systems is becoming a common problem in cities and instruments such as levies and taxes to restrict the use and production of plastic bags [10-14]. Though, they are not as such effective, voluntary initiatives have also been attempted in some countries to reduce plastic bag use and/or plastic bag problems in environment.

Different reports [15] showed that plastic bags are still causing severe environmental pollutions and also human and animal health damages in urban and rural areas of the country. Some of the basic reasons could be poor waste management and perhaps lack of awareness about the negative impacts of plastic bags [16].

The plastic bags were the most used plastic materials in Yemen. They are used to bag solids and liquids. They are used heavily to wrap Gat and almost everything. Previously, paper and cotton bags and local baskets were used to bring different merchandise from the marketplace. Ceramic pots and glass bottles were used for liquids. These bagging utilities disappeared almost completely because they could not compete with plastic bags especially in price. Currently, the plastic

bags are doing the same jobs in a cheaper and more efficient manner. They are versatile, clean, beautiful and practical [17].

The use of plastic bags increased dramatically and can be found everywhere. They are so light that wind can take them everywhere. They are too cheap to be collected, reused or recycled. The spread in the Yemeni environment these plastic materials, brought about polluting and environmental damage are numerous and especially bags of them even mentioned some researchers that the plastic is a (National flower of Yemen) [18] because of the proliferation of plastic bags in Yemen has become the scene of environmental replaced ridicule, there are those who call on the plastic bags volatiles in the air [19](Flying Yamani), and others describe the intensity of its deployment in the streets of cities and markets and different places (Figure 1a, b).



Fig 1a: flower the Yemeni



Fig 1b: The impact of the plastic bags on the wild animals.

Recently, the Yemeni towns have witnessed intensive cleaning attempts. Many plastic products were collected by poor families for recycling. However, this was not practical in case of these thin plastic bags they are too thin to be caught and too cheap to be collected. Hence, these plastic bags are the most dangerous environmental pollutants in Yemen. They are not only give an ugly shape of the beautiful Yemeni environment but also pollute soil and prevent aeration, kill plants and animals. They are seen all around at sight-seeing sea shores and killed sea life fish and coral reefs.

We will present this research in order to provide a vision to address the effects on our environment, we have surveyed the field for the city of Sana'a, to confine the whereabouts of plastic bags and the quantity of production and daily consumption of these bags and microbes accumulated therein.

2. MATERIALS AND METHODS

Description of the Study Area

The study was conducted in Sana'a City, north Republic of Yemen. The area of the province around (11877) square kilometers divided into sixteen Directorate, and the county seat area kindergarten, and agriculture is the main activity of

the inhabitants of the province of Sana'a, and the cultivated land in the many of the most important agricultural crops of coffee, fruits and vegetables of different kinds, and occupies Sanaa province ranked second among the provinces of the Republic in the production of agricultural crops.

The results of the census for the year 2004 (1,707,586) people and the population is growing annually at a rate of (2.07%), As is the population accounted for 4.7% of the total population of the republic [20]. The average altitude of the city is 2200 m above sea level with a temperature range of 10 to 29 °C.

A field visit and a comprehensive survey of the areas (Al-hassbh, shoap , naqem, Bab al-Yemen, Al-Sinainah, Sauan, Al-daryi Western, Rabat, mathabh, Shamlan, Soad hanash, azar, and Al-Zarkain), (Figure 2) to confine places of accumulation the plastic bags, as well as the amount of daily consumption of those plastic bags.



Fig 2: Position of the study area

Plastic Pages Sample Collection

The plastic pages sample were collected from local field visits to survey and find out to isolate bacterial species in places of accumulation of plastic bags (Qat market, Gardens, and Medicaments Factories) for isolation and identification of bacteria present in sample collected.

Identification of Isolates

The methods used in the identification and characterization of isolated bacteria include Gram stain followed by microscopic examination, motility test and biochemical tests according to [20-22]. The isolates were identified by Bergeys Manual for determinative bacteriology [23].

3. RESULTS AND DISCUSSION

The size of the horrible pollution of plastic bags can be illustrated by simple calculations using the information from the Ministry of Industry and Trade. If the average weight of the plastic bag is ten grams and the number of bags distributed in the Yemeni market is 5.4 billion bags then the plastic bags waste is fifty four billion grams which is fifty four thousand metric tons per year [20]. These materials are accumulating in the environment and no attempts were made to get rid of them. So in ten years the amount will become astonishing and there will be more than 500 million tons of plastic bags waste in the Yemeni beautiful environment. More plastic bags will be added every day, causing more environmental pollution and more misery everywhere.

The survey results indicated that, majority of the city residents widely used plastic bags in their daily life activities. Some of the main reasons attributed to the widespread usage were low price, easy availability and light weight.

These findings are consistent with other reports describing that light-weight, cheap price, excellent fitness for use and resource efficiency as main reasons for widespread utilization of plastic bags by billions of customers throughout the world [24].

We like that confirm that we Yemeni more human beings destructive to our environment due to the excessive use of plastic bags and even the most consumed, where in addition to their use in shopping. We use it heavily in keeping qat. Every one of us consumes per day, including at least three sacks and throws away the plastic bags without any guilt [18], and [25], and here the (Figure 3), shows the amount of plastic bags used for the sale of Qat in Yemen in 2012.

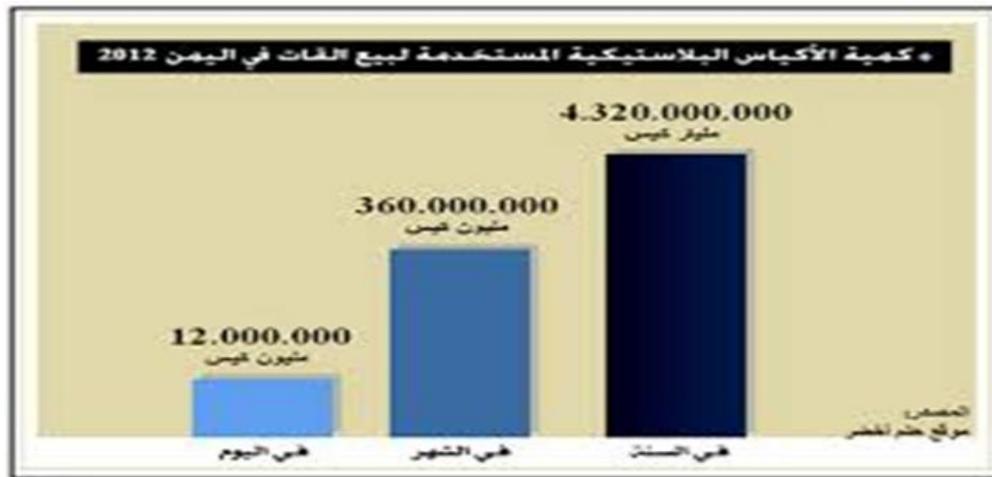


Fig 3: The amount plastic bags used for the sale of Qat in Yemen in 2012

Located the plastic bags in the city of Sana'a, in the main lines of the ways leading to the city of Amran, where there are dumps and incinerators the capital well as the entrances and exits of the regions of the city of Sana'a especially in markets of (Qat and vegetables) and in public gardens and in the islands of the streets (Figure 4)



Fig 4: Plastic bags in (a) market qat (al-Sinainah), (b) the streets islands (al-hassabeh), (c) Garden Revolution (al-hassabeh)

The local consumption of plastic bags has increased to the extent that the local factories failed in fulfilling more than 40% of the local requirements and the rest 60% was imported [20] The local studies showed that the main consumption is from the small bags that are about than 15 microns thick. These are used to bag consumables and merchandise that are 1000 gm or less. Because of its small thickness and light weight these bags can be taken by wind to high levels and usually end up on a tree branch or hinged to a wall or going back and forth, flying in the air. These flying bags are the most disgusting, they are too many around Qat markets in all villages, towns and cities.

There are statistics indicate the presence of 70 facility for the production of plastics industry operates under government license, while statistics indicate for the management of industrial control of the Ministry of Trade and Industry on the presence of 26 factories operating in Yemen, mainly on the production of bags and sheeting plastics of various kinds and

spread of these plants in five governorates (Sana'a, Aden , Taiz, Hadramout, Hodeida) to the presence of small labs operating in violation of the law and spread in unknown locations in the provinces of the country and in the capital Sana'a, there are 32 factories and laboratories where the 18 plant operates without a permit as reported by the General Authority for Environmental Protection [26].

And established site (dream green) initiative called the initiative a dream green has the initiative to get rid of 680 thousand plastic bag a day in the capital Sana'a, where he finds the population of the capital Sana'a, forced 3 times a day to buy bread and loaf hot from about 1370 a bakery and this bakery consume nearly 680,000 thousand daily bag to fill baking, this means that the furnace in the capital Sana'a consume 244.8 million per year.

There are also statistics on the amount the plastic bags consumed during the sale of qat carried out by site (dream green) in Yemen reach an estimated to 12000.000 million bags per day consumed in the month 360,000,000 million bags and this shows that the bags consumed per year for the sale of qat 4,380 Billion bags per year (Figure 5a,b).



A



B

Fig 5: The plastic bags on (a) the street, (b) rubbish dumps

Through a simple comparison between what is happening in Yemen especially in the capital, Sana'a, and what is happening in the UAE especially Abu Dhabi from the spread of the bags plastics where there is in the United Arab Emirates 98 factories and that the amount of the plastic bags that are produced locally equivalent to about 120 thousand tons (85%), while what is imported from the bags reached 20 thousand tons of 15%, making the Abu Dhabi Authority for the Environment in collaboration with major shopping centers to make Abu Dhabi free of the plastic bags in a move that limit their use, especially since the number the plastic bags that are consumed locally reach 11 billion and 600 million bags per year and Hume catastrophic threaten the environment [27].

As well as for damages to marine animals and wild birds that may eat where it was found that about 100 000 animals die as a result of ingestion of plastic bags where the animals eating the plastic bags in the streets and open spaces and grasslands or drums, garbage or those attached to the plants were exposed to the disease and death [18].

Lies the danger of plastics as materials resistant to microbial decomposition and in particular types of polymers formed where the burned resulting in a very strong acid and hydrochloric well as highly toxic compounds [28]. It has been

reported that different cities in the world implemented city-level strategies and policies that ban the use and production of plastic bags [26,29-30]. These can potentially be adapted to the Yemenis context.

Microorganisms Associated With Plastic Pages Samples

The microbial biodegradation was widely accepted and still underway for its enhanced efficiency. Recently, several microorganisms have been reported to produce polyester degrading enzymes. The microbial species are associated with the degrading materials were identified as bacteria (*Pseudomonas*, *Streptococcus*, *Staphylococcus*, *Micrococcus* and *Moraxella*), fungi (*Aspergillus niger* and *Aspergillus glaucus*), *Actinomyces sp.* and *Saccharomonospora* genus[31].

Serial dilution and plating method used for isolation and characterization of the organisms. Hence the isolated organisms were confirmed as *Clostridium sp.*, *Staphylococcus sp.*, *Moraxella sp.*, and *Pseudomonas sp.* the fungal species identified, *Aspergillus niger*, and *Aspergillus flavus* (Figure 6). The bacterial colonies were compared with Bergey’s Manual of systematic Bacteriology (Table 1). The fungal colony were confirmed according to manual of soil fungi [32]. *Aspergillus niger.* and *Aspergillus flavus* were isolated from plastic pages samples and identified based on their morphology and microscopic observation after staining with cotton blue [33]. The isolated fungi were further confirmed by comparing its growth and morphological characteristics with the pure cultures procured from Microbiology Laboratory, Sana'a, Yemen.

Table1: Isolated microorganism of accumulation plastic bags (Qat market, Gardens, and Medicaments Factories)

Characteristics	<i>Clostridium sp</i>	<i>Staphylococcus sp</i>	<i>Moraxella sp</i>	<i>Pseudomonas sp</i>
Gram staining	G+ rod	G+ Cocci	G- Cocci	G- rod
Motility	Motile	Non motile	Non motile	Motile
Catalase	Negative	Positive	Positive	Positive
Oxidase	Negative	Negative	Positive	Positive
Coagulase	Positive	Positive	Negative	Positive

4. CONCLUSION

Through field survey of plastic bags, which we have done in the capital Sana'a and found that the capital containing a very large amount of plastic bags where there are in the streets , roads, the trees, the power cords, most markets in qat and vegetables, where the prevalence of the plastic bags in this way leads to contamination and distortion environment and reduces the aesthetic view of the capital Sana'a, which refers to the environmental disaster in the capital Sana'a only let alone the rest of the cities . Plastic pages waste materials cause serious environment problems, so the waste materials removed by using the microorganism that associated with plastic pages. This method was cheap and effective, so that it can be used widely for the treatment of Plastic pages.

Recommend / Solutions

The economic and technical workers are essential in replacing the plastic bags with other materials, the low price and ease of manufacturing gives it a big advantage on other materials, and other alternatives are proposed.

- Replace the plastic bags, paper bags or cloth
- The production of plastic bags and more durability largest thickening
- Replace the plastic current materials biodegradable where there are kinds of innovative plastic decomposed by ultraviolet (UV) which is added to the composition of starch and thus becomes a biodegradable and do not last in the environment for a long time is that these species did not prove their efficiency in Western countries since the life span of her difficult to define as it relates to the conditions of transport and storage and marketing.

There are ways reflected the development of a proposed special containers for each type of waste (glass, metal, plastic, and paper) and so instead of throwing them in the streets by people defined environmental dangers , raise the level of environmental awareness at the citizen [34].

We have had many of the states to adopt policies that encourage people not to trading the plastic bags, and replacing them with bags of paper or cloth, as decided by some governments prohibit the use of this type of bags in the future, to prevent environmental problems caused by the increasing volume of plastic garbage, as sought again to impose fine to use these bags.

But some of experts find it that the decision of the individuals in this area, a great role in reducing the problem of environmental pollution caused by the consumption of plastic materials [12], where it can be to him, and by doing some things, mitigation of damage resulting from it, for example; longer pick up the plastic bags, which won the individual from the process of shopping precedent, to carry their belongings and purchases of new, and without having to request bags additional shopkeepers, the exercise will reduce the quantities that arise per year.

Kmama plastic in the ruins of the waste, which reaches the amount in some states; like the United States of America to about 8 billion pounds per year, to include plastic bags of all sizes, and rolls nylon which is used to preserve food.

Also considered for asylum persons to carry paper bags, or other manufactured cloth, and claim shops supplied to customers, civilized behavior reflects conscious humanly trend of environmental issues, may encourage others to exercise, which will reduce the chances of loss of other organisms on this planet, and that may die because of a plastic bag, found his way to the combine as a result of the neglect of human beings.

Examples of countries that have to fight the plastic bags are Japan, France, set off warning signals of keeping food in the plastic bags, and even water, either with heat or in the usual situation is influenced saved in bottles and plastic containers, even became a dairy companies in France put the milk in cartons rather than plastic, while in Singapore, after noticing that the per capita consumption reached more than 625 bags per year initiated to launch a campaign entitled «bring your bag with you», involving more than 200 stores urging people to bring bags of their own while shopping instead of using those the plastic bags harmful to humans and the environment around him.

In this regard and under the auspices of the Yemeni Organization for Standards, Metrology and Quality Control has been expanded meeting on 13.04.2008 AD which was attended by representatives from the Ministry of Commerce, Industry and specialists from commercial and industrial companies, and some who are interested in this area, following the workshop, which was held on 10/12/2007 about to discuss the problem of the plastic bags in this regard has been the adoption of the standard Yemeni regarding the plastic bags where they were obliging manufacturers and traders of non-manufacturing or importing bags of less thickness of 40 microns were also prohibit the manufacture or import of bags .

Allaqi with black color and definitively because of the harm to health and the environment as shown specification adopted in this regard put explanatory statements on each pack of bags and sheeting Polyethylene used for general purposes, including the name of the manufacturer and its brand, product name, size bags and type of country of origin and date of production, as mandated specification that includes any data explanatory who endures such as weight of the bag, a fish, and the reference to the extent of environmental damage [19]. There are alternatives produced by the local environment such as the use of Yemen bags and wicker baskets made of local trees and palm fronds and other local industries environmentally friendly. It can use paper bags and cotton and textile as an alternative to plastic bags in grocery stores and shops and others, as was the case previously in Yemen and in some developed countries are required by law owners of shops and groceries to give an option to the buyer using paper bags or plastic to take the purposes. With the increasing and growing environmental awareness among citizens option is used bags paper instead of the plastic bags [19].

The solutions that we see is that do

- The implementation of a comprehensive information campaign equivalent of immunization campaigns in terms of the media handling of the material included the negative effects of plastic bags and the harm done and continue awareness media campaign through several periods of what would limit the spread of.
- Provide appropriate alternatives and parallel in terms of cost for users of the plastic bags.
- As he can send a message by mobile (mobile telephone) warns of the damage plastic bags and sacks, especially the black.

This issue should be placed with media programs in various ways visible and legible and audible must be spread the truth and should not be tolerated on the results of studies and recommendations and research, about these plastic materials and harm, we still see every day plastic bags are used in restaurants to transport food hot (Safari) and refills new encircling the necks of our foods.

The question remains when the day will come that we do not see the plastic materials harmful to humans, animals and the environment especially the plastic bags (bags Allaqi black) after we knew what harms and risks?

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