Original Article

Investigation of Household Hazardous Wastes Production in the Amirkola Township, Iran, in 2012-2013

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Abstract

Background and purpose: It is extremely important to recognize the qualitative and quantitative characteristics of this type of waste before any planning on them due to the lack of the prepared program in the field of household hazardous waste (HHW) management in the country. This research has been done in Babol, Iran, in order to achieve this important goal.

Materials and Methods: The cross-sectional study was carried out on the basis of cluster samplingamong150families of Amirkola, Iran, to determine the per capita and percentage of different types of HHW. Training items in the form of pamphlets and special disposal bags were given to the families for being familiar with the types of waste and collection the waste, respectively. Statistical analysis was performed with the use of SPSS version19 and to signify of mean data was used with one-way analysis of variance.

Results: Average production of HHW was 75.6 kg a day, which contained almost 0.3% of municipal waste. The most important types of hazardous waste, including cleaners (60%), drugs (15.5%), toxic materials and chemicals (9.5%), electronics (8%), cosmetics (6.5%), sharp objects (1%), and pesticides (0.5%).

Conclusion: This study showed that a high percentage of the amount of hazardous waste was allocated to the cleaners and medicines respectively. In this respect, the families were trained in order to reduce HHW in the source, to separate and recycle them. Moreover, it is also recommended to collect, transport and dispose of in accordance with health regulations.

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1. Introduction

Household hazardous wastes (HHW) are substances, which because of their chemical, physical, or biological natures, pose a potential risk to health of people and environment (1-3). Changes in lifestyles and consumption patterns of families in recent years caused the significant transformation in quality and quantity of HHW in urban areas, and the management of these materials have made it costly and complex problems (4, 5). Many of these chemicals are not "biodegradable" (that is, able to be broken down into their components by microorganisms); for such chemicals in particular, the potential for adverse health effects can continue for decades or even centuries (1, 6, 7). Hazardous wastes are which cause risks to humans and environment if their management was incorrect (8, 9). Hazards of household products are classified in many different ways. These hazardous materials include (10-12): (a) explosive compounds: substances that release pressure, gas and heat suddenly when they are subjected to shock, heat or high pressure. (b) flammable and combustible materials: substances that is easy to ignite. Paint thinners, charcoal lighter fluid, and silver polish are all highly flammable. Related hazards are posed by oxidizers, which will lend oxygen readily to support a fire, and reactive materials, which are unstable and may react violently if mishandled. (c) poisons (or toxic materials) can cause injury or death when they enter the bodies of living things. Such substances can be classified by chemical nature (for example, heavy metals and cyanides) or by toxic action (such as irritants, which inflame living tissue, and corrosives, which destroy or irreversibly change it). One special group of poisons includes etiological (biological) agents. These are live microorganisms, or toxins produced by these microorganisms, that are capable of producing a disease. (d) Radioactive materials are a category of hazardous materials that release harmful radiation. They are not addressed specifically in this course.

From the perspective of American Environmental Protection Agency hazardous wastes refer to materials that have the potential destruction or damage to the environment or human health (2, 13). Hazardous wastes in terms of their physical states can be liquid, solid or gas (14, 15). Mixed non-hazardous and hazardous wastes are classified as hazardous waste. One of the most important issues on a global environment is related to the generation of HHW. Some percentage of these wastes contains hazardous materials which must be purified and managed to remove the pollution of the environment (16-18). When these substances are released into the environment, they can be considered as a serious threat to living organisms. HHW can be almost anywhere in the house such as a hut, bathroom, backyard, kitchen and attic room. Some examples of HHW include disinfectants, waxes, detergents, cosmetics, pharmaceuticals, solvents, lead paint, pesticides, oil and lubricants, batteries, fluorescent lamps (1, 2, 19). The unethical waste management can be caused a potential hazard to people and environment (18, 20). The existence of this problem is due to uninformed and sometimes irresponsibility of families in disposal of HHW in combination with other household wastes. In general, these hazardous wastes with other wastes were dumped into the trashcan and delivered to the municipal staff. Besides many problems for families they cause irreparable injuries for the personnel of municipality and pollution for the environment (18). Each individual household creates hazardous waste which, when combined with that from other homes in the same community, presents local government with a potentially serious threat to the local environment and public health (1, 3, 7).

Generally, about 1% of all waste generated in the average American households is hazardous. The average household generates

about 30 pounds of HHW per year, for average annual national total of about 1.6 million tons (2, 3). In an average city of 100,000 residents, 23.5 tons of toilet bowl cleaner, 13.5 tons of liquid household cleaners, and 3.5 tons of motor oil are discharged into city drains each month, according to the environmental hazards management institute (6).

According to the investigations, few researches have been done to determine the quantitative and qualitative characteristics of HHW in our country so far. Therefore, it is necessary and inevitable to pay special attention to the management of HHW and to adopt management methods that reduce this type of waste production. We examined the qualitative and quantitative characteristics and HHW management among families in order to reduce risks and increase their health level in Amirkola, Iran.

2. Materials and Methods

In this study, Amirkola city of Babol, Iran, Towner ship was chosen as the study location due to the characteristics of the same social, cultural, and economic characteristics. The study was done on the basis of cluster sampling among 150 families of Amirkola to determine quality and quantity of generated HHW. Comprehensive information about HHW characteristics and their names was given to families through training brochures and pamphlets. Enough disposal bags were given to the families for collecting hazardous wastes after the families were sufficiently informed. HHW collection was done in the middle month of winter and summer months by families. At the end of each month, the encoded disposal bags from houses were taken to weighing and waste analysis laboratory of Department of Health and Para Medicine in Babol for weighing the various components of hazardous solid wastes. Weighing the waste was accurately measured by a digital scale 0.001 g to measure very small low-weight wastes and other digital scale with an accuracy of 10 g was used to measure larger and heavier residue. The components of wastes were separated and segregated into 7 categories to determine the percentage of HHW. These categories were cleaners and detergents, drugs and toxic materials and chemicals, electronics, cosmetics, sharp objects, insecticides (8, 12). After weighing the amount of hazardous wastes generated by families and dividing each of them on the population, per capita HHW was determined in grams to each person in per day. Statistical analysis of this survey was performed with SPSS for Windows (version 19; SPSS Inc., Chicago, IL, USA) and to signify of mean data was used with one-way analysis of variance.

3. Results

In this study, the amounts of HHW generated in summer and winter were 2.75 and 2.43 g for each person in per day, respectively. By considering the current population of Amirkola (28,000 inhabitants), The total production of HHW were determined 68 kg in per day, 2038.2 kg in per month of winter and 78 kg in per day, 2308 kg in each month of summer, respectively. And the average per capita waste generation in two mentioned seasons was 2.6 g for each person in per day. According to the municipal waste generated per capita rate and Amirkola population (800 g for each person in per day), 22,400 kg municipal solid wastes (MSW) were daily generated in the city. With considering to per capita of the hazardous household wastes (2.6 g/day) and per capita of the MSW of Amirkola (800 g/day), the percentage of hazardous household wastes were obtained 0.3%. More information on this subject has been presented in table 1.

Table 2 is based on the main components of HHW involving seven groups: cleaners and detergents, drugs and toxic materials and chemicals, electronics, cosmetics, sharp

objects, insecticides. As figure 1 shows, the amount of HHW in summer was more than in winter, and this difference is statistically significant (P = 0.004). The highest rate of HHW in two seasons belonged to detergents and cleaners, medicines and chemicals and toxic materials, respectively.

Table 1. Social characteristics and quantitative indexes of HHWs of Amirkola

Number of families	6200
Population	28,000 people
People number in any family	4.5
Waste generation by any person	800 g/day
The amount of MSW	22,400 kg/day
HHW generation by person	2.6 g/day
Average amount of HHW	75.6 kg/day
The HHW	2173 kg/month
The HHW	26,645 kg/year

HHW: Household hazardous waste, MSW: Municipal solid waste

According to figure 2, the greatest amount of HHW was allocated to cleaners and detergents, which included five components and the largest amount of them including the containers of dishwashing liquid and then of bleach.

4. Discussion

This study aimed to assess the quantitative and qualitative characteristics of HHW in Amirkola city from Babol Township. Approximately 400 million tons of HHW were annually produced, which had dramatic effects on the health people and the environment (1). According to the findings of this study, the total amounts of HHW were 2038 kg and 2308 kg in winter and summer, respectively. The amount of HHW produced in summer was more than in winter, which is consistent with other studies. The most important reasons for increasing of HHW production in the summer, including increased use of detergents and cleaners (1, 19).

Table 2. Monthly production average (kg) of the main components of HHWs in different seasons

Solid waste materials	Winter	Summer	Mean
Group 1: cleaners and detergents	1224.2	1334.4	1279.3
Group 2: medicines	302.7	366.2	334.4
Group 3: chemicals and toxic materials	179.0	234.5	206.8
Group 4: electronics	174.0	153.8	164.0
Group 5: cosmetic	126.0	169.0	147.6
Group 6: sharp objects	19.7	18.4	19.0
Group 7: insecticides	12.4	31.5	21.9
Total	2038.0	2308.0	2173.0

HHW: Household hazardous waste

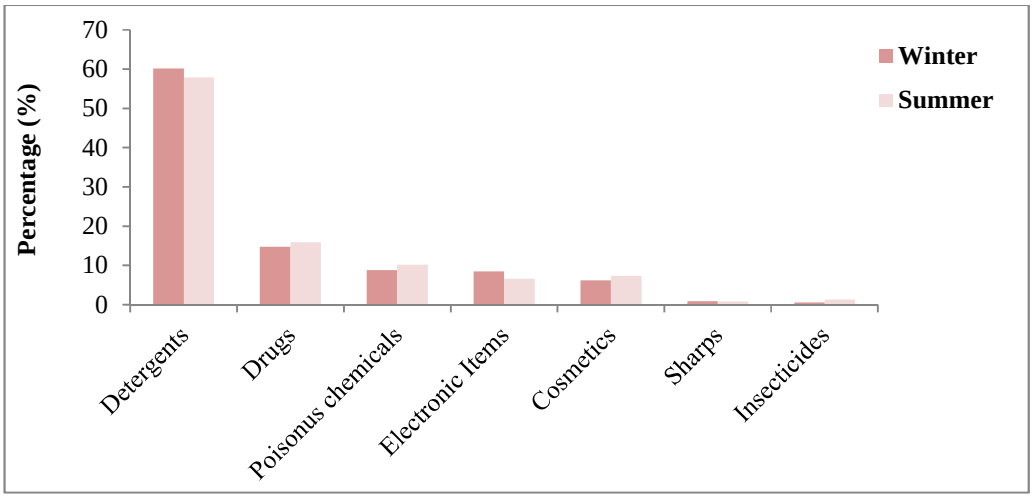

Figure 1. The physical components of household hazardous wastes in different seasons

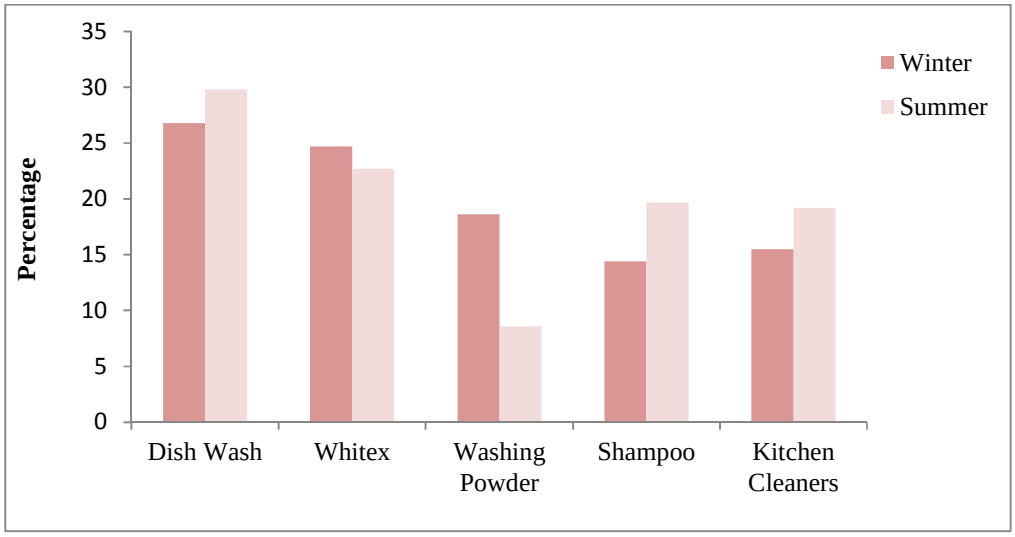

Figure 2. The percentage of detergents and cleaning components in different seasons

The mean generation of HHW and MSW was 2.6 and 800 g per person in a day respectively. Although amounts of HHW to MSW productions is much less, however the appropriate management of HHW should be noticed, due to special characteristics and potential hazards of this type of waste (1, 2). The present study, the Average production of HHW, was 75.6 kg a day that is 0.3% of MSW that consistent with the research of other researchers (2, 19). Studies in America showed that the amount of hazardous wastes in municipal wastes was variable from 0.01 to 1 weight percentage, and about 75-85% of urban hazardous wastes were concerned to inhabited areas (2, 4). A study in 2006 titled evaluating solid Wastes in Waltz City of Italy indicated that the city's wastes were composed of 36% recyclable materials, 61.5% bio-degradable materials and 2.8% hazardous wastes (12). 0.1% of 33.7 tons of commercial, industrial and inhabited wastes was belonged to HHW in England (13). In another study in Ohio of America, about 52 pounds (0.1% of total wastes) of 5320 pounds of municipal wastes in inhabited areas with low to moderate incomes were concerned to HHW (2). In the present study, the containers of cleaning agents and detergents were the maximum amount of HHW (60.1%). The other items of HHW including drugs, toxic chemicals, electronics, cosmetics, sharps and pesticides were 15.5%, 9.5%, 8%, 6.5%, 1% and 0.5%, respectively. In the study of HHW in Sari, Yousefi et al found that the largest amount of HHW generated by families included the containers of laundry and dishwashing liquid and the lowest amount of those belonged to batteries and electrical components (19). The maximum percentages of HHW in the United States of America were 36.6% and belonged to household maintenance items such as paints, thinners, and glues. Other HHW items in USA include: household batteries was 18.6%, personal care products (nail polish, nail remover, and hair spray) was 12.1%, cleaners was 11.5%, automotive maintenance products (grease, oil) was 10.5%, pesticides was 4.1%, hobbies chemicals was 3.4% and pharmaceuticals was 3.2% (2). In this study, the total weight of household batteries in summer and winter was 786 g. The batteries have been classified as hazardous wastes by U.S. environmental protection. More than 88% mercury of MSW was belonged to household batteries, in USA. in 1989 (1). The alkaline batteries (59%) had the greatest share to enter the mercury into the MSW (1, 3).

HHW are threatening resources, which can significantly damage the health of families, communities and environment if they do not properly manage. This study showed that a high percentage of the amount of these wastes was allocated to detergents, cleaners and after them to drugs. The prevention of adverse environmental effects of hazardous wastes is a priority, and this is achieved by applying good management practices. Therefore, the training of families is recommended to reduce, separate and recycle of HHW in the source and then to collect, transport and dispose of them according to hygiene standards. Ultimately such activities will lead to the adoption of healthy behaviors and consequently increase the level of family and community health, reduce injuries to the municipality staff as well as to decrease environmental pollution.

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