

Assessing Public Awareness and Promoting Safe Management of Household Hazardous Waste Through Community-Based Awareness Initiatives

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Abstract - Household Hazardous Waste (HHW) has emerged as a significant environmental and public health concern due to the widespread use of chemical-based products in daily household activities. Common items such as batteries, paints, pesticides, cleaning agents, fluorescent lamps, and expired medicines contain hazardous substances that can adversely affect human health and the environment when disposed of improperly. Despite constituting only a small fraction of municipal solid waste, HHW can lead to soil contamination, groundwater pollution, air quality degradation, and serious health hazards.

This study aims to assess the level of public awareness regarding HHW, analyze existing disposal and segregation practices, and promote responsible waste management among households. A descriptive survey methodology was adopted, wherein structured questionnaires were administered to residents through direct household visits. Additional insights were obtained through interactions with waste management officials. The collected data were analyzed using percentage-based statistical methods and graphical representations.

The survey findings revealed that only 36% of respondents were fully aware of HHW, while 24% were partially aware and 40% lacked awareness entirely. Furthermore, 60% of households disposed of hazardous waste along with regular garbage, and only 30% practiced waste segregation. These results indicate a substantial gap in public knowledge and proper disposal practices. However, the majority of respondents expressed a willingness to adopt safer waste management methods when provided with appropriate guidance.

Based on these findings, an awareness campaign was conducted to educate residents about HHW identification, segregation, safe disposal methods, and environmental protection. The study highlights the critical need for continuous public education, community participation, and effective waste management policies to ensure sustainable environmental protection and improved public health.

Key Words: Household Hazardous Waste (HHW), Waste Segregation, Environmental Awareness, Hazardous Waste Management, Public Health, Municipal Solid Waste, Awareness Campaign, Sustainable Waste Management, Environmental Protection, Community Participation.

1.INTRODUCTION

Household Hazardous Wastes (HHWs) constitute only about 1% of the total municipal solid waste generated. Despite their relatively small proportion, they can pose significant risks to both environmental quality and public health [1–4]. In this context, the present study focuses on assessing public awareness and attitudes regarding the potential risks associated with HHWs.

Only a limited number of studies have addressed this important issue. Therefore, the findings of the present study can provide a valuable foundation for future research. Furthermore, owing to the scarcity of earlier investigations in this area, the data obtained will contribute significantly to understanding the current level of public awareness and attitudes toward HHWs.

The management practices adopted for HHWs at their primary source, namely households, can substantially influence the treatment of domestic wastewater and the final disposal of municipal solid waste [5–12]. Consequently, assessing and enhancing public awareness and attitudes toward HHWs is essential for effective waste management.

The findings of this study can also serve as a reference for future research on HHWs in India, particularly in the selected study area. To identify the key factors influencing effective household hazardous waste management, a descriptive research approach was employed. Data were collected through a structured questionnaire administered to residents, along with interviews conducted with waste management officials, to obtain comprehensive insights into existing practices, challenges, and levels of public awareness.

The data from the present study can serve as a basis for future studies about HHWs in Iran, especially in the area under study, i.e., Kermanshah. To identify key factors for optimizing household hazardous waste management, a descriptive research approach was adopted using a structured questionnaire administered to residents, supplemented by interviews with waste management officials to gain comprehensive insights into current practices, challenges, and public awareness levels.

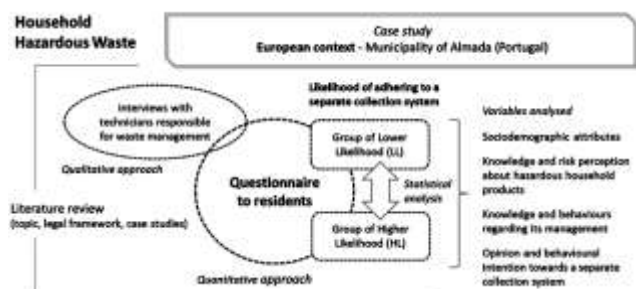


Fig 1 : Research approach of a researcher [13]

2. Household Hazardous Waste Generation

Household Hazardous Waste (HHW) is generated from everyday household activities that involve the use of chemical-based products. In modern homes, items such as cleaning agents, pesticides, paints, batteries, electronic devices, and expired medicines are commonly used. After their usage, these products often become hazardous waste due to the presence of toxic, corrosive, or flammable substances. As urbanization and lifestyle changes increase, the quantity of such waste generated at the household level is also rising significantly.

The generation of HHW mainly occurs through a simple process that begins with daily household usage. When chemical products are used for cleaning, maintenance, or personal care, they eventually reach the end of their life cycle. At this stage, they are discarded and become waste. If these materials are not properly segregated, they get mixed with regular municipal solid waste, leading to improper disposal and environmental risks.



Fig 2: Generation Process

Household hazardous waste can be broadly classified into different categories based on its source and composition. Chemical waste includes cleaning agents, pesticides, and paints. Electronic waste consists of batteries and discarded electronic devices. Medical waste includes expired medicines and used syringes. Each category requires specific handling and disposal methods to minimize harm.



Fig 3: Classification of HHW

Improper handling and disposal of HHW can lead to serious environmental and health impacts. When hazardous waste is mixed with regular garbage, toxic substances can seep into the soil and contaminate groundwater. Burning such waste releases harmful gases into the air, contributing to air pollution. Direct exposure to these materials can also cause health issues such as skin irritation, respiratory problems, and other chronic diseases.

Household hazardous waste consists of various materials commonly found in homes. These materials contain chemicals that can be harmful when released into the environment. According to the **United Nations Environment Programme (2019)**, improper disposal of hazardous waste can contaminate landfills and water sources.

Common household hazardous waste includes:

- Expired medicines and pharmaceutical products
- Cleaning chemicals and disinfectants
- Pesticides and insecticides
- Paints, varnishes, and solvents
- Batteries and electronic waste
- Fluorescent lamps and bulbs

When these materials are disposed of along with regular garbage, they may leak toxic substances into soil and water systems. Such contamination can affect ecosystems and pose health risks to humans and animals.

3. Environmental and Health Impacts of Household Hazardous Waste (HHW)

Household Hazardous Waste (HHW) can cause serious damage to the environment and human health when it is not disposed of properly. The major impacts include soil pollution, water contamination, air pollution, and health hazards. Each of these effects is explained below:

i) Soil Pollution

When hazardous waste such as batteries, paints, pesticides, and cleaning chemicals are dumped on land or mixed with regular waste, toxic substances seep into the soil. These chemicals reduce soil fertility and destroy beneficial microorganisms present in the soil. Over time, the contaminated soil becomes unsuitable for agriculture and plant growth. Heavy metals like lead and mercury from batteries can remain in the soil for a long time, causing long-term environmental damage.

ii) Water Contamination

Improper disposal of HHW can lead to the leakage of harmful chemicals into water sources. When hazardous waste is dumped in open areas or landfills, toxic substances can penetrate the ground and reach groundwater. These pollutants may also flow into rivers, lakes, and other surface water bodies. Contaminated water is unsafe for drinking and can harm aquatic life. Consumption of polluted water can lead to serious health problems in humans and animals.

iii) Air Pollution

Burning household hazardous waste or allowing it to decompose improperly can release toxic gases into the atmosphere. Materials like plastics, paints, and chemicals emit harmful fumes such as carbon monoxide, dioxins, and other volatile organic compounds (VOCs). These gases contribute to air pollution and can affect the quality of the air we breathe. Long-term exposure to such polluted air can lead to

respiratory issues and environmental problems like climate change.

iv) Health Hazards

Direct or indirect exposure to hazardous waste poses significant risks to human health. People handling such waste without protection may suffer from skin irritation, burns, or allergic reactions. Inhaling toxic fumes can cause respiratory diseases such as asthma or bronchitis. Long-term exposure to certain chemicals may even lead to serious conditions like cancer, nervous system disorders, or organ damage. Children and elderly people are more vulnerable to these health risks.



Fig 4: Overview of HHW Impacts on Environment and Health

4. Objectives of the Study

The present study aims to evaluate the level of awareness among residents regarding household hazardous waste and its impact on the environment and human health. It focuses on identifying the common hazardous materials present in households, such as cleaning chemicals, batteries, pesticides, paints, and expired medicines. The study also seeks to analyze the waste disposal practices followed by households, particularly whether hazardous waste is properly segregated or mixed with regular waste. In addition, it examines the environmental and health risks associated with improper disposal of such waste. Another important aspect of the study is to assess the willingness of residents to adopt proper waste management practices, including segregation and safe disposal methods. Finally, the study aims to organize an awareness campaign to educate residents and promote responsible environmental behavior for effective household hazardous waste management.

The objectives of this study are:

1. To evaluate awareness levels regarding hazardous household waste among residents.
2. To identify common hazardous materials present in households.
3. To analyze waste disposal practices followed by households.
4. To study environmental and health risks associated with improper waste disposal.
5. To assess willingness among residents to adopt proper waste management practices.
6. To organize an awareness campaign to promote environmental awareness.

5. Methodology

The methodology of the present study is based on understanding the existing flow of municipal solid waste management and identifying the role of household hazardous waste (HHW) within this system. As shown in the diagram, waste is generated from multiple sources such as households, commercial establishments, parks, and street cleaning activities. Among these, households contribute significantly to hazardous waste generation due to the use of chemical-based products in daily life.

The generated waste is collected through a structured collection system, which includes door-to-door collection and street sweeping by municipal workers. However, due to lack of awareness among residents, hazardous household waste is generally not segregated at the source and is mixed with regular waste during collection.

After collection, the waste is deposited in community dustbins or junkyards, where informal waste handlers such as ragpickers may separate recyclable materials. However, hazardous components often remain unsegregated and continue along the waste stream, posing risks to both workers and the environment.

The collected waste is then transported by municipal vehicles to processing or disposal facilities. In some cases, waste undergoes processing for material recovery or energy generation. However, due to improper segregation, hazardous waste is rarely treated separately and may enter general processing streams.

Finally, the remaining waste is disposed of through landfilling in low-lying areas. The presence of hazardous materials in landfills can lead to soil and groundwater contamination, as well as long-term environmental and health impacts.

Based on this methodology, a survey was conducted to assess awareness levels among households regarding hazardous waste management. The findings highlighted the lack of segregation practices and the need for improved awareness. Consequently, an awareness campaign was organized to educate residents on proper waste segregation, safe disposal methods, and environmental protection. This approach helped in linking the practical waste management flow with the study objectives and in identifying areas for improvement through community participation.

Survey Process

The study used a **survey-based research methodology** to collect information about hazardous household waste management practices.

6. Data Collection

Data was collected through a **structured questionnaire** distributed among households. The questionnaire included questions related to:

- Awareness of hazardous household waste
- Knowledge of hazardous items
- Waste disposal practices
- Environmental awareness
- Willingness to learn proper waste management methods

Survey Area

Households in the selected locality were visited, and responses were collected through direct interaction with residents.

Data Analysis

The collected data was analyzed using simple statistical methods such as percentage analysis and graphical representation.

7. Survey Results

The survey results provide important insights into the level of awareness and disposal practices related to household hazardous waste (HHW) among residents.

Awareness Level:

The analysis of awareness levels indicates that only 36% of the respondents are fully aware of hazardous household waste and its impacts on the environment and human health. About

24% of the respondents are partially aware, meaning they have limited knowledge but are not fully informed about proper handling and disposal methods. A significant portion, 40% of the respondents, are not aware of hazardous household waste at all. These findings clearly show that a large segment of the population lacks adequate knowledge regarding HHW, highlighting the need for effective awareness and educational programs.

Disposal Practices:

The survey also examined the waste disposal practices followed by households. It was observed that a majority of respondents, 60%, dispose of hazardous household waste along with regular garbage without any segregation. Only 25% of the households follow separate disposal practices, indicating some level of awareness and responsibility. Meanwhile, 15% of the respondents are not aware of how to dispose of hazardous waste properly. These results reveal that improper disposal practices are widely prevalent, which can lead to serious environmental pollution and health risks. Overall, the survey findings emphasize the urgent need to improve public awareness and encourage proper waste segregation practices to ensure safe and sustainable management of household hazardous waste.

8. Awareness Level

Following tables shows our results.

Table1: Distribution of Awareness Levels on Household Hazardous Waste Among Respondents

Awareness Category	Percentage
Aware	36%
Partially aware	24%
Not aware	40%

The results show that a considerable portion of the population lacks adequate knowledge about hazardous household waste.

Disposal Practices

Table2: Distribution of Household Hazardous Waste Disposal Practices Among Respondents

Disposal Method	Percentage
Mixed with regular garbage	60%
Separate disposal	25%
Do not know	15%

Most households dispose of hazardous waste together with regular garbage, which increases environmental risks.

Waste Segregation

Table3: Distribution of Waste Segregation Practices Among Households

Practice	Percentage
Segregation practiced	30%
No segregation	70%

These results indicate that waste segregation practices are still limited among households.

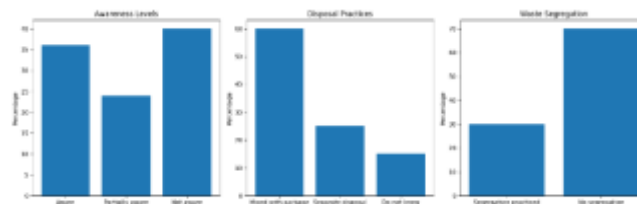


Fig 5: Awareness, Disposal Practices, and Waste Segregation Analysis

The survey results indicate a significant gap in both awareness and proper management of household hazardous waste among respondents. A large proportion of individuals (40%) are not aware of hazardous waste, while only 36% are fully aware and 24% have partial knowledge. This lack of awareness is reflected in disposal behaviors, where 60% of households mix hazardous waste with regular garbage, increasing environmental and health risks. Only 25% follow proper disposal methods, and 15% are uncertain about correct practices. Furthermore, waste segregation is not widely adopted, with only 30% of households practicing segregation, compared to 70% who do not. These findings highlight the urgent need for awareness programs and improved waste management practices.

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