



SPATIAL CONTRAST OF SOLID WASTE IN THE CITY OF NASIRIYAH

Manar Majid H¹, Hayder Chyad Mohammed², Huda Nadhim Mursal³

¹ The presidency of the University of Dhi Qar, Dhi Qar University, Iraq, Nasiriyah, E-mail m.manar.majid@utq.edu.iq, Mobile +9647825336491

² Ministry of Oil - Southern Refineries Company Dhi Qar Refinery – Email: Alwessiq@Yahoo.Com, Mobile +9647811145909

³ Dhi Qar University - Department of Geography - Iraq – Nasiriyah

Article history:	Abstract:
Received: 6 th July 2023 Accepted: 6 th August 2023 Published: 6 th September 2023	Waste has become a prominent phenomenon in most of the cities of the world, especially the cities of the third world, as it is accumulated and gathered inside the cities and near its inhabitants and is not treated or disposed of in any way, knowing that its quantity increases year after year, and this increase in the amount of waste is related to a set of factors, the most important of which is the population The city, the economic level, the cultural level, as well as the level of customs and traditions, the size and diversity of the industry, and waste in the city of Nasiriyah did not take one form, but it varied according to the source, and in this research the spread of solid waste was studied in the city of Nasiriyah, whose sources vary between (home, industrial and agricultural, Commercial, and medical) as well as the components of each of these sources and the process of distributing and spreading them inside the city of Nasiriyah at different levels that follow the type of activity inside the city. Improving it and preventing the spread of diseases and epidemics that accompany the spread of waste, eliminating unpleasant odors that accompany organic waste decomposition and eliminating the problem of bulk dogs wandering inside the .residential neighborhoods in the city of Nasiriyah
Keywords: Pollution - Environmental Pollution - Waste - Sanitary Landfill - Solid Waste - Nasiriyah City - Waste Treatment)	

INTRODUCTION:

Environmental studies are currently among the most important fields of research, given the risks posed to the environment and the negative impacts it has on people's daily lives. These changes have led to numerous conferences aimed at environmental conservation, as the dire consequences affect all nations. As a result, environmental studies have diversified across various fields, with waste management being one of the areas that has garnered significant attention.

The issue of waste has escalated due to the multitude of human activities, individuals' pursuit of a higher standard of living, population growth, increased industrialization, technological advancements, and variations in waste types and quantities from one place to another. It has become a prominent issue worldwide, affecting cities and human settlements due to the inherent environmental and natural resource hazards it leaves behind.

This phenomenon is not recent but has become more pronounced with the rise of megacities worldwide. Moreover, the problem is no longer limited to the Earth's surface; it extends deep into the ground and affects water bodies, negatively impacting aquatic life and contributing to spreading diseases, epidemics, and social problems.

Nasiriyah is one of the cities grappling with the waste problem. This is primarily due to rapid population growth resulting from high birth rates, internal migration, urban sprawl, the proliferation of informal settlements, increased consumption, and diverse daily activities. Consequently, pollution levels in the city have risen significantly, and the issue is now visible throughout the city, signaling impending dangers for living organisms if not addressed promptly.

RESEARCH PROBLEM:

The research problem revolves around the following questions: What is meant by pollution? What is the definition of waste? What are the sources of waste in Nasiriyah city? Is there spatial variation in waste distribution in Nasiriyah city? And does waste have an impact on Nasiriyah city?

RESEARCH HYPOTHESIS:

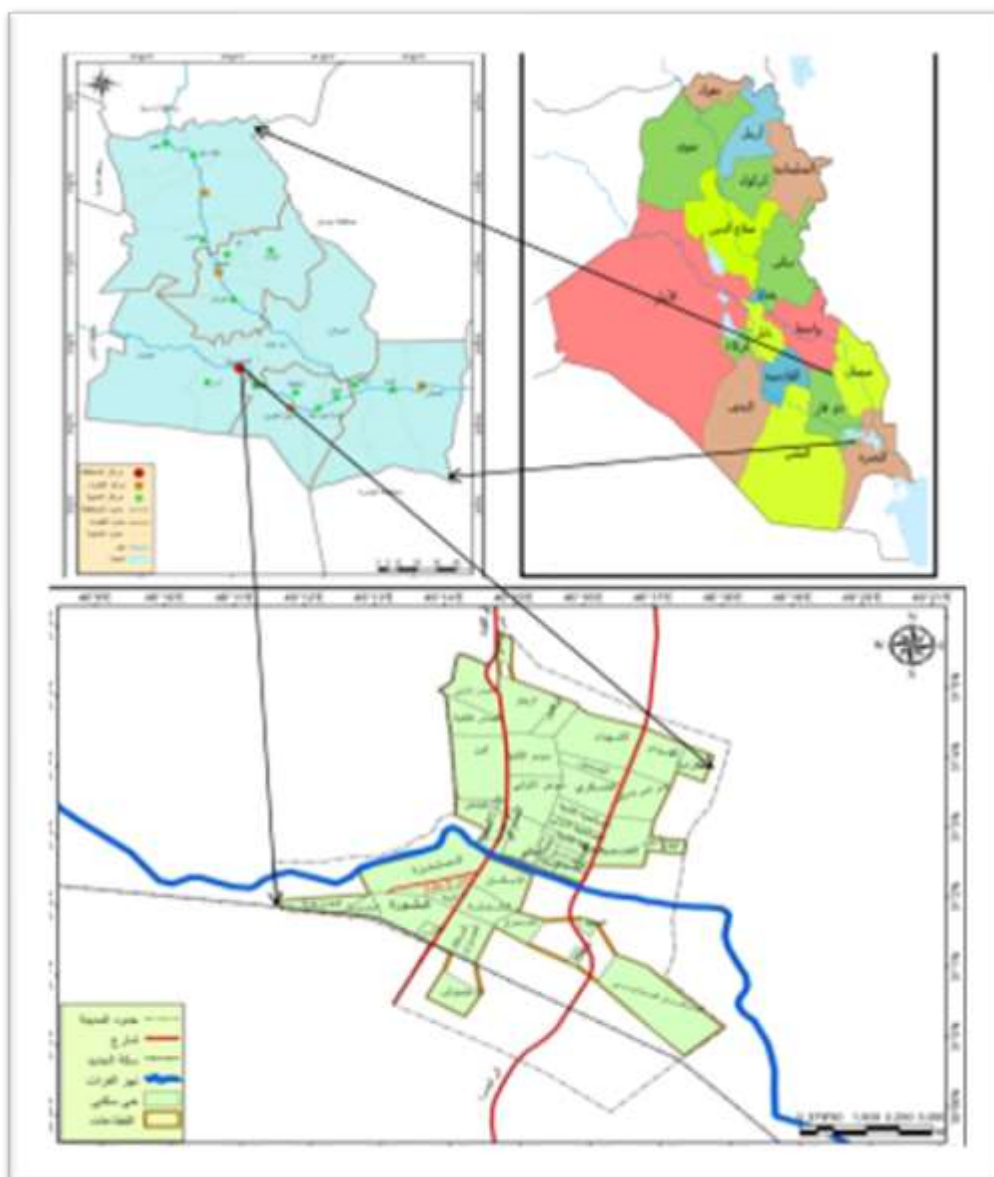
Everything that affects all living elements, including plants, animals, and humans, while waste pertains to everything related to materials that individuals no longer desire, whether usable or not. Its sources are diverse within the city due to the human activities and events present in the city. This, in turn, is related to the population size, types of housing, and the economic level of individuals in society. Consequently, it results in spatial variation in waste distribution within the city, leaving negative economic and social impacts.

RESEARCH OBJECTIVE:

The research aims to study waste, understand the reasons for its spread in Nasiriyah city, and then address the resulting impacts and the suitable measures to alleviate the problem using modern scientific methods.

SPATIAL AND TEMPORAL BOUNDARIES:

The study area is located in southern Iraq, extending into the alluvial plain region, representing the administrative center of Dhi Qar province. The city is approximately 346.4 kilometres from the capital, Baghdad, and is surrounded by a group of affiliated districts. The astronomical location of Nasiriyah city spans between the latitudinal circles (99°30' - 10°31' N) and the longitudinal arches (20°46' - 29°46' E) over an area of 2,891 hectares, consisting of 43 residential neighborhoods, as shown in maps (1) and (2). Temporally, the research period is defined from October 2022 to April 2023.



Map (1): Study Area Location in Dhi Qar Governorate, Iraq

The source: From the work of the researcher, relying on Ali Ajil Haib Al-Khaikani, 'Evaluating the Efficiency of Recreational Function in Nasiriyah City,' unpublished Master's thesis, College of Education, Maysan University, 2020, p. 5.

First: Environmental Pollution and Waste Concepts:

1. Linguistically: Pollution, in language, is derived from the word "luth," which means mixing something with what is foreign to it. It is said that something is polluted with something else, meaning that harmful foreign substances

have mixed with it (Al-Mu'jam Al-Wajeez, 1993, p. 567). Pollution, in both its material and moral aspects, signifies the corruption or alteration of the characteristics of something (Abdelkawi, 2002, p. 40).

2. Technically: It is defined as the negative change that occurs in one of the components of the environment, resulting from all or part of human, biological, or industrial activities, causing harm to human life and other living organisms (Al-Bayati, 2014, p. 11). It also refers to changes resulting from natural factors or human intervention in the natural environmental systems, causing harm to living organisms and environmental elements (air, soil, water, food) (Bouziane, 2011, p. 58). It encompasses everything that affects all elements of the environment, including plants, animals, humans, and the composition of non-living natural elements like air, soil, water, and more (Al-Rifai, 2009, p. 69).

We can categorize pollution based on its sources as follows:

1. Natural Pollution: This results from pollutants emanating from the environment itself, such as earthquakes, volcanoes, sandstorms, and heavy rainfall that washes away soil. However, with time, nature tends to balance itself in such types of pollution, by the will of God.

2. Non-Natural Pollution: This type is associated with human activities, including social, economic, or developmental activities conducted by countries. Examples include road construction, dam building, draining ponds, and urban encroachment on forests and green areas, creating opportunities for dozens of infectious diseases to spread and become epidemics. Many examples of such pollution exist, including malaria, AIDS, mad cow disease, yellow fever, cholera, influenza, and various hemorrhagic fevers. Regardless of the diversity of pollution forms due to human activity, they can be divided into two types:

- Material pollution, such as water, air, and soil pollution.
- Non-material (moral) pollution, including various types of radiation, electromagnetic pollution, cultural, media, ethical, intellectual pollution, and archaeological pollution.

Third: Classification of Waste

Waste is classified based on its composition and source, and this will be presented later.

1. Classification of Waste by Source:

1.1. Household Waste: Contains both organic and inorganic materials, with the organic materials accounting for up to 40% of the waste's quantity.

1.2. Commercial Waste: This waste category is quite similar to household waste but differs in terms of component percentages and the quantity of waste produced.

1.3. Industrial Waste: It, in turn, is classified into hazardous industrial waste and non-hazardous industrial waste.

1.4. Medical Waste.

1.5. Construction and Demolition Waste.

1.6. Agricultural Waste (Green Waste).

1.7. Electronic Waste (E-Waste).

2. Classification of Waste by Composition:

2.1. Organic Waste: Such as leaves, branches, and food waste in homes. These are waste materials that can decompose and ferment.

2.2. Inorganic Waste: Originating mainly from industrial processes, like plastics, synthetic fibers, and solid waste materials like construction debris.

2.3. Hazardous Waste: These are materials that can pose a potential hazard, such as medical waste and chemicals causing corrosion and posing risks in certain situations.

2.4. Corrosive Waste: These materials can corrode metals due to their acidic or alkaline properties.

2.5. Toxic Waste: Threatens the health of living organisms when inhaled, ingested, or touched. These chemical and radiation toxins may come from factories, bakeries, or household waste like medicine bottles and batteries.

2.6. Reactive Waste: Unstable materials that can cause explosions or produce toxic gases and vapors.

2.7. Flammable Waste: Materials such as volatile solvents and perfumes can transfer and burn easily and quickly (Nouichi, 2019, p. 31).

Fourth: Sources of Waste:

The sources that generate waste vary depending on urban activities and natural and social conditions represented by customs and traditions within communities. Waste sources in cities are linked to various factors, including:

- **Housing Type:** The type of residence and the standard of living of individuals in society affect the quantity of waste. The higher the standard of living, the more it contributes to increasing waste quantities due to increased individual requirements and consumption of various products.

- **Degree of Urbanization:** The level of urbanization affects the quantity and type of waste generated in the city.

- **Social Conditions (Customs and Traditions):** Social conditions, including customs, traditions, religious events, and special occasions, also affect waste generation. Different seasons, for example, can lead to increased demand for specific food and beverages related to temperature changes and the need for cooling.

- **Population Movement Throughout the Year:** Population movements within a city during the year, such as migrations or seasonal changes, impact waste generation.

- **Food and Product Storage Practices:** The method of storing food, products, and consumables can also affect waste generation (Al-Aga, 2013, p. 27).

Fifth: Causes of Waste Proliferation:

- **Biological causes:** Every life cycle produces what is known as metabolism. In other words, organic waste arises from the nature of organic waste and is associated with the presence of living organisms and their death.
- **Chemical Causes:** Chemical reactions are bound by material retention. Obtaining one can produce two materials, and wanting two can produce three.
- **Technological Causes:** Technological and industrial advancement results in waste generation (Boujemaa, 2017, p. 47).
- **Ecological Causes:** Environmental pollution removal processes and environmental preservation can produce a range of waste. Recycling waste materials, for instance, initially produces new waste.
- **Economic Causes:** Economic factors, particularly the economic level of a country, contribute to increased waste generation. As the economic level rises, individuals tend to seek higher levels of comfort and demand consumer goods that align with new updates, resulting in large quantities of waste.

Sixth: Waste in Nasiriyah City:

Classification of Waste in Nasiriyah City:

Various types of waste exist in Nasiriyah City, spread throughout the city in areas such as the Central Business District (CBD) represented by the Habubi area, residential areas, educational service locations at various levels, and administrative service locations represented by government departments. Waste in Nasiriyah City takes various forms, including liquid, solid, and gaseous. These forms of waste will be discussed in detail.

First: Solid Waste.

Humans engage in various activities in their lives to ensure their survival. These activities differ from one place to another and from one country to another based on the nature of the prevailing systems in societies. This, in turn, has affected the type of solid waste left behind by humans after their use. Solid waste can be further classified into:

- Household Waste.
- Commercial Waste.
- Industrial Waste.
- Medical Waste.

Second: Liquid Waste.

Liquid waste is another type of waste generated in Nasiriyah City. This waste category includes various types of waste liquids, such as sewage water, industrial wastewater, and agricultural runoff.

Third: Gaseous Waste.

Gaseous waste is another category of waste found in Nasiriyah City. This waste includes emissions from vehicles, factories, and other sources that release gases into the atmosphere.

The study will focus on solid and liquid waste in Nasiriyah City, identifying their types and secondary classifications based on the human activities in the city.

Seventh: Household Waste:

Household waste consists of:

1. **Organic Materials:** These include food leftovers that undergo decomposition and decay within a short period. They can attract insects and their quantity varies depending on population density, the economic level of residents, and social factors like customs, traditions, religious events, and special occasions. In the summer season, for example, there is an increase in demand for vegetables and various types of summer fruits due to higher temperatures, which can lead to an increase in the consumption of these foods, especially after they have been cooled and turned into juice.



Captured by the researcher on 5/1/2023

Captured by the researcher on 4/10/2023

Figure 1: Organic Household Waste

2. **Non-organic Materials:** These include cardboard, wood, furniture residues, clothing, plastic, household utensils, and cleaning residues, among others, which are associated with human activities inside residential units.



Figure 3: Non-organic Household Waste
Source: Captured by the researcher on 5/1/2023.

EIGHTH: COMMERCIAL WASTE:

Commercial waste consists of the waste generated by commercial establishments in the city, primarily from transporting and using goods in bags, cartons, or boxes.



Figure 4: Commercial Waste in Nasiriyah City

Source: Captured by the researcher on 22/1/2023.

Ninth: Industrial Waste:

Industrial waste is produced by industrial processes, often associated with local industries. This includes waste from carpentry and blacksmithing workshops, as well as agricultural residues resulting from tree cleaning, cutting, and pruning.



Figure 5: Industrial Waste in Nasiriyah City

Source: Captured by the researcher on 22/1/2023.

Tenth: Medical Waste:

Medical waste consists of waste generated by hospitals, healthcare centers, and laboratories. It can be solid, liquid, or household medical waste. Examples include insulin syringes, pharmaceutical waste left in excess after a patient's improvement or expiration, as well as swabs, cotton, and bandages used for wounds. Liquid medical waste includes disinfectants and antiseptics like iodine and microchromium.

These waste materials can be hazardous if they are infectious waste used by individuals with communicable diseases, as well as needles and scalpels used for patients and blood sample collection. The quantity of medical and non-medical waste in hospitals varies depending on the number of patients, the length of stay, and there is an inverse relationship between the number of inpatients and the waste in hospitals.

Quantity of Solid Waste in Nasiriyah City:

The quantity of solid waste in Nasiriyah City is approximately 1,100 tons per day. The type and proportion of materials disposed of vary depending on the material and the volume of use, which, in turn, contributes to the quantity of waste.

Table 1: Quantity of Solid Waste in Nasiriyah City

Material	Percentage
Paper	12,0
Plastic	13,2
Glass	1,6
Metals	2,2
Organic Materials	65,8
Garden Waste	2,4
Electrical Appliances	0,0
Fabrics	2,8
Other Waste	0,0

Source: Republic of Iraq, Ministry of Construction, Municipalities, Public Works, Dhi Qar Municipality Directorate, Nasiriyah Municipality, Unpublished Data 2022.

Note: The percentage of solid waste that can be reclaimed, recycled, or converted into fertilizer is not provided.

Eleventh: Quantity of Waste Disposed of in Nasiriyah City:

The quantity of waste disposed of in Nasiriyah City is approximately 1,100 tons per day. The per capita waste generation rate within the city is around 1.7 kilograms per day. This high rate leads to significant waste quantities. It's worth noting that these quantities are subject to increase due to population growth.

Table 2: Quantity of Waste Disposed of per Capita in Nasiriyah City

Population	Waste Collected (kg/day)	Per Capita Waste (kg/day)
618,861	1100000	1.7618

Source: Compiled by the researcher based on:

1. Republic of Iraq, Ministry of Construction, Municipalities, and Public Works, Dhi Qar Municipality Directorate, Nasiriyah Municipality, Unpublished Data 2022.
2. Republic of Iraq, Ministry of Planning, Central Statistical Organization, Dhi Qar Statistics Directorate, Nasiriyah Statistics Directorate, 2022 Census and Enumeration Results, Unpublished Data, 2022.

Twelfth: Spatial Variation of Waste in Nasiriyah City:

The distribution of waste in Nasiriyah City varies due to the city's diversity of activities and events, the distribution of services, the economic level, and the nature of residential neighbourhoods. These variations range from high to moderate to low levels, and the proliferation of informal settlements has significantly contributed to the random spread of waste in the city.

1. Spatial Variation of Waste in Landfills:

One of the primary landfills in Nasiriyah City is the largest and only one. It is located in the southern part of the city, approximately 5 kilometers from the city center and about 10 meters from the main road leading to Basra Governorate. Waste is dumped at this location daily (Field Study on 5/12/2022).



Figure 6: Waste Dumping in the Sanitary Landfill

Source: Captured by the researcher on 1/1/2023.

The waste at the landfill site is subjected to burning, carried out by two groups.

The first group consists of municipal workers who incinerate the waste within the site to reduce the accumulated waste and create space for disposing of additional garbage.

The second group involves personal burning conducted by a set of residents for personal purposes or individual interests, commonly referred to as "scavenging" and typically associated with the working class. (Field study, personal interview on 12/24/2022)



Figure 7: Waste Burning at the Sanitary Landfill

Source: Captured by the researcher on 1/1/2023

Waste at this site is found in its raw form, consisting of a heterogeneous mixture of household, industrial, and commercial waste, in addition to medical waste, which is considered one of the most hazardous types of waste. It is intermixed with other city waste. Solid medical waste is collected from residential neighborhoods, hospitals, and commercial establishments. As for damaged or expired medical materials, they are collected by a special committee in collaboration with Dhi Qar Municipality. These materials are often found in large quantities and occupy a significant area of the landfill (Field Study, Personal Interview on 13/3/2023).

It's worth noting that waste collection by responsible authorities is carried out using compactors, dump trucks, and bulldozers. The compactor trucks have a capacity of 10 tons each, with 95 trucks making daily rounds, and 30 trucks with a 5-ton capacity. In addition, there are various sizes of dump trucks, including 5-ton MAN dump trucks (20 trucks/day) and 25-ton Tuk dump trucks (25 trucks/day). Often, it is challenging to distinguish between different types of waste at the site due to its accumulation and degradation.



Figure 8: Waste during Burning at the Sanitary Landfill



Figure 9: Waste Transportation to the Sanitary Landfill by Municipality
Source: Captured by the researcher on 1/1/2023



Figure 10: Waste Transportation to the Sanitary Landfill by Municipality



Figure 11: Waste Dumping at the Sanitary Landfill

Source: Captured by the researcher on 13/1/2023.

Spatial Variation of Household Waste in Residential Neighborhoods:

Household waste accumulates due to various human activities carried out by members of the community within residential neighborhoods. This type of waste causes significant annoyance and concern among city residents due to its accumulation in the streets for days. This issue was confirmed by residents of the neighborhoods in the city who suffer from the piling up of waste until it is collected by the municipality. This is attributed to the lack of commitment from municipal personnel on one hand and the shortage of staff on the other hand to collect it on time, leading to soil contamination by the waste.

From the field study, it was revealed that there is only one main landfill in the city. Meanwhile, all other dumpsites are temporary, used by residents to dispose of their waste. These temporary dumpsites consist of piles of waste scattered randomly wherever empty spaces or vacant plots (unbuilt) are available in the streets and residential neighborhoods. Sometimes, waste is thrown on sidewalks and along the sides of roads for disposal.

One can easily observe the scene of scattered household waste in front of homes, primarily due to the overflowing garbage collection containers that belong to the households. Neglecting to collect them from the relevant authorities contributes to their accumulation, which leads to them being placed in bags in front of houses. This not only tarnishes the overall appearance of the street but also results in the spread of foul odors, attracting insects and mosquitoes, which can potentially spread diseases easily. Moreover, it serves as a source of food for animals that roam the city's neighborhoods and alleys.

Residents may also mishandle these waste materials by collecting and burning them in an improper manner for disposal. Improper burning can lead to the release of gases and foul odors, and sometimes, explosions can be heard during burning operations due to the presence of materials that cannot be burned, such as glass bottles or perfume bottles.

It is worth noting that the quantity of household waste varies from one place to another and temporally (daily, weekly, monthly).



Figure 12: Household waste in residential neighborhoods in the city of Nasiriyah.
Source: Captured by the researcher on 1/13/2023.



Figure 13: Animals gathering around household waste in residential neighborhoods in the city of Nasiriyah.
Source: Captured by the researcher on 4/28/2023.



Figure 14: Household waste in residential neighborhoods in the city of Nasiriyah.

Source: The Figure was captured on 1/1/2023.

3. SPATIAL VARIATION OF COMMERCIAL WASTE IN NASIRIYAH CITY:

1. Commercial Establishments: Commercial establishments are spread along the main commercial streets in the study area, including Nile Street, Ibrahim Al-Khalil Street, Twenty Street, Sayed Saad Street, Habubi Street, Jihad Street, Republic Street, as well as the main Martyrs Street and Salehiya Street on the island side of the city. These main streets host numerous commercial establishments, which, in turn, generate solid waste. Sayed Saad Market and the adjacent area are known for their diverse businesses, crafts, and various activities. This area's historic streets and winding alleys are filled with commercial and consumption-oriented shops, including street vendors and stalls. Waste is often disposed of on the streets or near these commercial establishments. Cardboard boxes and plastic bags constitute a significant portion of the waste generated in this part of the city.





Image 15: Spread of waste in the commercial district of Nasiriyah City.

Source: Captured by the researcher on 4/18/2023.

2. Vegetable and Fruit Markets: In Nasiriyah City, vegetable and fruit markets can be categorized into:

A. Main Markets include the Herj Market, the Sacrifice Market (locally known as Alwat Alkhadra or the Vegetable Market), and Sayed Saad Market.

B. Small Popular Markets: These include Sumer Market, Aridu Market, Al-Shula Market, Al-Thawra Market, and Al-Askan alsunaay Market.

The largest vegetable and fruit market in terms of area is the Herj Market, which serves as a popular market located on Nile Street near Ibrahim Al-Khalil Street in the commercial center of Nasiriyah City. Waste in this commercial area varies between non-organic and organic waste due to the diversity of activities in the market. Moreover, it serves as a significant center for selling used materials (bales) of various types, which contributes to the diversity of activities in its vicinity. It's worth noting that some government offices are also located nearby.



Image 16: Organic waste in the main markets of Nasiriyah City.

Source: Captured by the researcher on 2/18/2023.



Image 17: Organic and non-organic waste in the Herj Market in the heart of Nasiriyah City.

Source: Captured by the researcher on 3/25/2023.

4. Spatial Variation of Industrial Waste in Nasiriyah City:

1. The Industrial District: The industrial district stands out as one of the city's most significant industrial areas, generating large quantities of industrial waste. The types of waste in this part of the city vary between solid and liquid waste. Due to the concentration of waste and pollution in this area, businesses (i.e., shop owners) pay municipal taxes amounting to nearly two million dinars monthly.

Solid medical waste, it is collected and disposed of in the city's sanitary landfill. It poses a real hazard, and proper treatment is necessary before disposal.

Thirteenth. Effects of Waste Accumulation in Nasiriyah City and Its Treatment:

1. Environmental Effects of Waste Accumulation in Residential Areas:

The accumulation of solid waste in front of homes or next to containers is an unsightly and detrimental sight. Accumulated solid waste, especially organic waste, poses a significant problem, as in high temperatures and humidity, waste ferments, producing gases like methane, carbon dioxide, and ammonia, along with foul odors. These issues inconvenience residents and can cause various diseases and harm to their health. Many diseases, such as bacterial and viral infections, can be transmitted through flies and cockroaches. Additionally, rodents can transmit various diseases, including plague and many others.

2. Effects of Waste Accumulation on Air Pollution:

Air is one of humanity's essential needs, but in recent years, it has been heavily polluted from both natural and human sources. Human sources, characterized by rapid and continuous development, have become a more significant and more substantial threat to humans. Air consists of various gases, including oxygen, nitrogen, carbon dioxide, and argon, with oxygen making up about 20.94%, nitrogen about 78%, and carbon dioxide about 0.03%. Pollutants such as solid waste impact the air, serving as carriers of pollutants and diseases from one place to another. Solid and liquid waste contributes to approximately 3% of global air pollution, making it crucial to find solutions. The degree of waste's air pollution varies based on physical and chemical composition. Higher organic content significantly increases pollution levels. Hazardous industrial waste has a more substantial impact than regular waste. Organic waste decomposition and accumulation generate gases like methane, carbon dioxide, nitrogen oxide, and sulfur dioxide.

3. Spread of Diseases:

Improperly managed solid waste poses a severe health risk, leading to various diseases such as dysentery, typhoid fever, and cholera. The variation in disease prevalence from one area to another is often due to waste accumulation, compounded by ignorance and a lack of environmental awareness. Some residents burn waste near their homes, further contributing to the problem.

4. Social and Psychological Effects:

The accumulation of waste on open streets, valleys, and forests degrades the aesthetic quality of these places, affecting the psychological well-being of residents. It breeds annoyance and discomfort and fosters the emergence of social and psychological diseases such as depression, anger, and boredom. It can lead to declining residents' enthusiasm and participation in public sanitation efforts.

5. Economic Impacts:

Household waste negatively affects a country's economy due to the high costs of disposal, making waste management one of the costliest civic services. Failure to address this issue can disrupt essential environmental resources required for economic growth. It's worth noting that waste accumulation also negatively affects citizens' activities and productivity, with research showing that people living in clean environments have productivity rates 20% to 38% higher than those in unclean environments.

6- Touristic Effects:

Cleanliness is one of the key attractions for tourists in any country. Tourists prefer environmentally clean places. Waste, in all its forms, tarnishes the urban landscape, diminishes its aesthetic and artistic value, and becomes a focal point for various stray animals. This negatively impacts tourism. Therefore, tourist authorities are keen to promote environmental awareness, especially in tourist areas. The study area has numerous tourist and archaeological sites, and the presence of waste near these areas tarnishes their image.

Fourteenth: Waste Management:

1. Sorting Household Waste: This involves dividing the household waste bin into multiple sections, with each section containing a designated bag for easy and flexible collection. Additionally, the collection vehicle should be compartmentalized similarly to the household bin.

- Organic waste (food remnants and plant waste)
- Cardboard, paper, and wood
- Metallic items

It is worth noting that if this process is carried out correctly, waste collection and sorting can become an important economic resource, benefiting Nasiriyah city and the province.

The plastic percentage in Nasiriyah city's waste is approximately 13.2% of the total solid waste. If we consider that one ton of plastic can be sold for 250,000 Iraqi dinars, using the formula (percentage of material × total quantity of waste × price), this generates approximately 35,300,000 dinars daily and 13,000,000,000 billion dinars annually.

2. Centralized Waste Collection based on waste type, either organic or non-organic.

3. Separation of industrial waste, separating iron from wood, and utilizing them for recycling iron and producing other items from wood residue (wood chips).

4. Attention to tree planting campaigns as they act as natural filters by absorbing carbon dioxide and releasing oxygen.

5. Establishing covered waste collection yards to prevent waste from scattering due to weather conditions and to prevent the release of gases from decomposing organic materials. This also provides protection from vandals.

6. Increasing awareness campaigns for citizens directly by government departments concerned with waste management and utilizing civil society organizations and activists to raise awareness, from schools and kindergartens to local communities, markets, and more.

SUGGESTIONS:

1. Contribute to continuous awareness and guidance campaigns for the population to encourage them to respect the schedules and locations for disposing of household waste and to inform them about the dangers of waste and its negative effects on people's health and the environment.

2. Environmental awareness through the media, emphasizing the damages caused by the spread of waste within the city and its negative repercussions.

3. Imposing financial fines for indiscriminate waste disposal in markets or in front of commercial shops, as well as for not collecting waste in residential neighborhoods or for accumulating it in undeveloped plots in residential areas.

4. Implementing and enforcing Environmental Protection Law No. 27 of 2009.

5. Encouraging the establishment of green belts around the city and promoting urban agriculture to increase oxygen levels and reduce the emissions of gases resulting from waste decomposition.

6. Immediately find effective methods for disposing of household waste based on modern scientific and engineering approaches and develop waste management by relying on modern technologies.

7. Providing qualified and specialized labor, necessary machinery, and financial resources for waste collection in residential areas lacking these essential services.

8. Eliminating random dumping sites within the city as they contribute to the spread of diseases, epidemics, and foul odors, in addition to the proliferation of stray dogs in the city center.

REFERENCES

First: Books:

1. Arnaut, Mohamed El Sayed, "Methods of Utilizing Garbage and Solid and Liquid Waste," Dar Al-Arabiya Library, Cairo, 2003.
2. Municipality of Baghdad, "Comprehensive Development Design for the City of Baghdad until the Year 2000," Municipality Printing Press, 1973.
3. Bou Djema, Khalf Allah, "Introduction to Urban Waste Management (Ain M'lila, Algeria)," 2nd Edition, Diwan Al-Matba'at Al-Jami'iya, 2017.
4. Bouzen, Abdelaziz, "The Impact of Environmental Deterioration on Human Health in Cities: Activities of the Environment and Society Symposium," Social Communication Research and Translation Laboratory, Mentouri University, Constantine, 2011.
5. Khateeb, Sayed Ahmed, "Soil Pollution," Al-Shanhoubi Printing and Publishing, Cairo, 2001.
6. Al-Rafai, Sultan, "Environmental Pollution," 1st Edition, Dar Osama for Publishing, 2009.
7. Al-Saadani, Abdel Rahman, and Thanaa Al-Sayed Awad, "Environmental Problems," Dar Al-Kotob Al-Haditha, Cairo, 2007.
8. Shahtah, Hassan, "Environmental Pollution: Wrong Behaviors and How to Confront Them," Dar Al-Dara Al-Arabiya for Publishing, Cairo, 2002.
9. Shahab, Fadel, and Fareed Eid, "Soil Pollution," Dar Al-Yazouri Scientific Publishing and Distribution, Oman, 2008.
10. Al-Safadi, Essam, and Al-Dhahir Naeem, "Environmental Health and Safety," Dar Al-Yazouri Scientific Publishing and Distribution, Oman, 2001.
11. Zaher, Gamal Amin, "Environmental Pollution - Waste Management and Treatment," Assiut Journal of Environmental Studies, Issue 2009.

12. Abdelkawi, Mohamed Hassan, "Criminal Protection of the Atmospheric Environment," 1st Edition, Al-Nasr Al-Dhahabi Printing, Cairo, 2002.
13. Abdelwahab, Ahmed, "Principles of Waste Recycling," 1st Edition, Dar Al-Arabiya for Distribution, Cairo, 1997.
14. Arabic-Arabic Dictionary, 6th Edition, Dar Al-Shorouk, Lebanon, 1988.
15. Al-Mu'jam Al-Wajeez, Arabic Language Dictionary, Cairo, 1993.

Second: Theses and Dissertations:

1. Al-Agha, Reem Khalid, "Assessment of Solid Waste Management in Khan Younis Governorate (A Study in Environmental Geography)," Master's Thesis, Faculty of Arts, Islamic University, Palestine, 2013.
2. Bediar, Adel, "Valuation of Urban Waste and Its Management: A Case Study of M'Sila," Master's Thesis, Institute of Management and Urban Techniques, University of M'Sila, Algeria, 2008.
3. Al-Bayati, Ikhlas Mahmoud Sultan, "Social Problems of Environmental Pollution in the Urban Society (Field Study in Diwaniyah City)," Master's Thesis, University of Qadisiyah, College of Arts, 2014.
4. Al-Khaikani, Ali Ajil Waheeb, "Assessment of the Functioning of the Recreational Function in Nasiriyah City," Unpublished Master's Thesis, College of Education, Maysan University, 2020.
5. Ramadan, Ramadan Mohammed, "Pollution in Household Waste in Geryan (Geographic Analysis)," Master's Thesis, Faculty of Arts, Seventh of April University, Libya, 2003.
6. Nwaihi, Warda, "Causes of the Spread of Household Waste in the Urban Environment: A Field Study in Biskra City," Unpublished Master's Thesis, Mohamed Khider University - Biskra, Faculty of Humanities and Social Sciences, Sociology Department, 2019.

Third: Scientific Journals:

1. Hasan, Mushri, and Msaltah Sufian, "Valuation of the Process of Recycling Household Solid Waste and Similar Wastes in Light of the Requirements of Sustainable Development: A Case Study of EcoSet Institution, Setif," The Strategy and Development Journal, Volume 11, Issue 4, 2021.
2. Qassem, Sayed Ahmed, "Household Solid Waste in Asyut City," The Arab Geographical Journal, Issue 44.
3. Al-Qahtani, Marai Bin Hussein, "Evaluation of Medical Household Waste in the Urban Abha Region in the Asir Region of the Kingdom of Saudi Arabia," Saudi Geographical Association, Issue 87, King Saud University, Riyadh, 2009.
4. Nasr, Amer Rajeh, and Ali Hamza Al-Jawdhari, "The Problem of Solid Waste in Al-Talai'a City and Its Environmental Effects," Al-Ameed Journal, Year 6, Volume 6, Issue 22.

Fourth: Government Sources:

1. Republic of Iraq, Ministry of Reconstruction and Housing and Municipalities and Public Works Directorate, Dhi Qar Municipality, Unpublished Data, 2022.
2. Republic of Iraq, Ministry of Planning, Central Statistical Organization, Dhi Qar Statistics Directorate, Census and Enumeration Results, Estimates for 2022, Unpublished Data, 2022.

Fifth: Field Study:

1. Field Study conducted on December 5, 2022.
2. Field Study, Personal interview with an employee at the Nasiriyah Municipality on December 5, 2022.
3. Field Study, Personal interview with an employee at the Nasiriyah Municipality on December 24, 2022.
4. Field Study, Personal interview with an employee at the Ministry of Health, Dhi Qar Health Directorate, on March 13, 2023.
5. Field Study, Personal interview with an employee at the Ministry of Health, Dhi Qar Health Directorate, on March 13, 2023.