

The Ecological Repercussions of Solid Refuse on Earth Pollution and Microbial Dissemination in Al-Najaf City, Iraq: An Analytical Review

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Abstract: The accumulation of solid waste has become one of the most important environmental issues associated with rapid urban growth particularly in developing countries. The city residents are increasing, boundaries of cities are growing, and consumption is increasing, all which contribute to the increasing amount of waste generated in the cities of Iraq. One of the urban areas that is particularly overburdened environmentally is Al-Najaf city, which is a holy city, and has been a vital tourist hub since a large number of pilgrims visit it, and the number of houses and business establishments is still increasing. In this comprehensive review, the impact of solid waste accumulation on soil health is discussed and how it helps in the spread of microbes in metropolitan areas with a special focus on Al-Najaf City. This paper provides a synthesis of existing knowledge by analysing previous geographical and environmental investigations on refuse management, soil degradation, disease carrying microorganisms and ecological difficulties faced in the area. Results show that uncontrolled dumping of refuse results in immediate degradation of soil quality through contaminated runoff, decomposition of the organic material, and toxic pollutants. In addition, the waste piles provide an ideal cover for the growth of harmful bacteria and fungi, especially in over-crowded urban regions with poor local services. Overall, the study highlights the importance of strengthening waste management systems, increasing environmental monitoring, and promoting recycling programs to reduce environmental degradation and improve the health of urban communities.

Keywords: Solid Refuse; Earth Pollution; Disease-Causing Bacteria; Fungal Life, Metropolitan Contamination; Al-Najaf City; Ecological Geography; Local Garbage.

(Submitted: December 18, 2025; Revised: January 23, 2026; Accepted: February 28, 2026; Published: March 31, 2026)

1. Introduction

The contamination problem from solid refuse is now considered to be one of the biggest ecological challenges in modern metropolitan areas. Due to the fast growth of the cities and the resulting demographic growth in the amount of waste produced in domestic, business and service areas, the amount of refuse generated has increased to an unprecedented rate. Many developing nations (including Iraq) face multiple hazards due to waste accumulation and inadequate ecological infrastructure and waste management (Almudhafar et al., 2024).

Al-Najaf City is a religious and metropolitan hub in Iraq, experiencing continual population growth, and being served by a large, year-round tourist population, all of which contribute to increased solid waste generation. Other areas of the city have also been ravaged by such environmental stresses, as have been tightly built-up residential and commercial areas.

Solid waste has not only a detrimental effect on the environment in terms of being unattractive and smelly. There is direct pollution of soils from heaps of garbage that give off foul runoff and decaying organic material. In addition, these piles are a perfect breeding ground for various types of bacteria and fungi that pose a threat to the ecosystem that surrounds it, and to the health of the surrounding community (Almudhafar et al., 2024).

The ecological situation in the Iraqi municipalities is quite different from that of developed countries, mainly due to rapid urban expansion, lack of ecological awareness and the lack of adequate local government funds. Several ecological studies conducted in Iraq have been conducted to detect the sources of microbial contamination of city soil and neighboring water bodies, including the improperly managed

dump sites (Hoornweg & Bhada-Tata, 2012). As a result, the awareness of how the accumulation of solid wastes affect soil deterioration, and how the presence of microorganisms in the soil spreads has become an emergency ecological need in Iraqi cities.

The need to develop a program on solid waste and associated ecological problems in the metropolitan area.

2. Solid Waste and Associated Metropolitan Ecological Dilemmas

Solid waste means solid materials that are discarded from residential, commercial, industrial and institutional processes. The food wastes, plastic, paper, metals, glass, organic waste and medical waste are common examples of MSR. This trash is composed of a myriad of different materials and amounts depending on the population density, the economic activities of the community, consumer lifestyles and the prevailing metropolitan lifestyle (Tadena, 2025).

Population growth in cities has put a strain on the system of city waste management in many Iraqi cities. The city has poor refuse collection systems, weak recycling systems and lack of proper landfill facilities in many parts of the city. This causes the garbage to accumulate often in easily-accessed areas near residential developments, streets and vacant land, leading to major environmental and health problems.

The population growth and spread of urban residents in Al-Najaf City have led to an increase in domestic and business wastes. Based on projections for the local environment, the municipal solid waste is projected to be 964 tons per day at the city's current rate until the year 2025. This type of refuse production is geographically unevenly distributed throughout the city and is related to population density and land use (Farhan, 2026).

3. The Effect of Solid Waste on Soil Degradation

The contamination of land is one of the major ecological consequences of uncontrolled accumulation of solid waste. Lack of controls and irregular approaches to refuse disposal cause the contamination of city soils with harmful constituents. The polluted runoff from organic refuse is particularly rich in organic components, salts, foul chemicals and heavy metals as it decomposes. These toxins slowly leach into the ground, changing its chemical composition, physical structure and biological characteristics (Tudararo-Aherobo & Osaide, 2025).

This ecological burden is heightened in areas where there is no intentional design of landfills or ecological oversight programs. Dumping sites are commonly located near residential areas and unprotected ground in many Iraqi municipalities, including the City of Al-Najaf, where no runoff collection or treatment systems exist. Pollutants are thus likely to percolate into adjacent soil and underground water sources.

Ecological studies carried out in Al-Najaf showed higher levels of microbial pollution and soil degradation next to refuse accumulation and wastewater discharge sites (Tchobanoglous et al., 1993). The findings reinforce clearly the relationship between the accumulation of solid waste and the deterioration of the ecological situation of metropolitan sectors.

4. Bacterial and Fungal Proliferation Linked to Refuse Pile-Up

Dampness, organic matter, and higher temperatures create conditions that are conducive to microorganisms multiplying in the collection of solid refuse. Growing up of disease-causing microbes is highly possible in domestic garbage, leftover food and rotting organic material.

A wide variety of bacterial species have been commonly isolated from refuse polluted ecosystems, such as *Escherichia coli*, *Salmonella* spp., *Klebsiella pneumoniae* and *Enterobacter* spp. These tiny organisms can be spread by contaminated soils, polluted water, wind borne particles and insect vectors, thus increasing the risks to the environment and human health (Espey, 2025).

Fungi also tend to grow at waste pile sites, especially in areas where there is insufficient air movement and humidity. The opportunistic-as well as the infectious fungi can grow on decaying organic matter or on polluted soil. Earlier ecological studies done in Al-Najaf and Al-Munadhirah areas confirmed that the zones affected by garbage dumping and contaminated wastewater were the main sources of dissemination of causative fungi.

In the context of metropolitan environments, the spread of bacterial and fungal life is a profound ecological concern, as these micro-living forms could contribute to respiratory diseases, skin infections, gastrointestinal ailments and the overall environmental degradation.

5. Ecological and Governance Challenges at Local Level

This is because inadequate local government services are a key factor contributing to the problems of solid refuse contamination in Iraqi municipalities. Delay in collecting refuse, lack of transportation trucks and absence of efficient recycling systems contribute to the accumulation of waste in housing areas and communal spaces.

The fast expansion of the metropolitan area in Al-Najaf City has exacerbated the problems of dealing with the refuse efficiently. Every day, a tremendous amount of waste is generated that puts a huge strain on local facilities and ecological services. In addition, the random burning of garbage in some parts of the city contributes to air pollution, increasing the risk to the environment.

In addition, there are insufficient comprehensive plans or solutions for the management of waste, resulting in loss of materials that should be recycled, such as plastics, metals, paper products and glass. Despite their importance for reducing ecological pollution and enhancing the long-term sustainability of cities, few initiatives are dedicated to collecting and sorting refuse for re-use.

6. Analysis and Discussion

The ecological consequences of the accumulation of solid waste in Al-Najaf City are similar to the wider ecological issues facing rapidly-growing Iraqi cities. The daily production of area refuse has been significantly increased by surges in population, the spread of urban boundaries, and rising consumption patterns.

The previous ecological research has shown that if the refuse dump sites are not properly monitored, it results in the contamination of the ground and the multiplication of microorganisms in a very short time. Dissemination of disease-causing bacteria and fungi in polluted metropolitan environments is a major concern for the ecosystem and human health, especially in densely packed areas that receive poor ecological services.

The existing ecologic situation in Al-Najaf City highlights an urgent need to improve the local systems for waste management and environmentally thinking. Proper waste management, the development of sanitary landfills, recycling programs, and strong environmental management systems are essential to reduce soil pollution and the spread of microorganisms.

7. Final Thoughts

The accumulation of solid waste is among the main environmental problems in Al-Najaf City due to the city's rapid growth and high population density.

1. Poor waste disposal practices cause direct environmental degradation and destruction of the environment.
2. Garbage piles create conditions that promote the spread of bacterial and fungal organisms which may cause disease.

3. Local issues of waste management create weak systems that increase the ecological pollution level within city sectors.
4. Even though they have an important ecological role, they are lacking in recycling and modern systems for the treatment of refuse.
5. Al-Najaf City's ecological governance system requires upgrading, the process of which is crucial in protecting the local ecosystem and the people's well-being.

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