

A Comparative Study to the Amount of Dust Falling on Residential and Agricultural Areas in Karbala Governorate / Iraq

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Abstract:

The ecological effects of dust-induced air pollution in Karbala Iraq ,the main focus of our current research. In the Karbala Governorate, we are specifically examining the quantity of dust that falls on residential and agricultural areas. The comparison was carried out between January 2022 and January 2023 in order to examine the significant distinctions and relationships between residential and agricultural areas. Our study uses the SPSS software for statistical analysis ,we also saw the effect of vegetation on the amount of dust.

INTRODUCTION

Dust is mostly made up of small, loose particles that are released when things like roads, factories, volcanic events, and more wear away at the ground. Dust is made up of very small pieces of solid matter that are in the Earth's atmosphere, These particles come from aeolian processes (soil being blown around by the wind volcanic events, and pollution{1}. About 20% to 50% of the dust in homes is made up of dead skin cells, The remaining components found in workplaces and other constructed spaces consist of minimal quantities of plant pollen, human hairs, animal fur, textile fibers, paper fibers, minerals from outdoor soil, burned meteorite particles, and several other things that are commonly present in the surrounding environment {2}.

Dust is present in outer space and has also settled on Earth Cosmic dust particles typically range in size from a few molecules to 0.1 mm (100 μm), similar to micrometeoroids. Meteoroids are particles that are larger in size. Cosmic dust can be categorized based on its astronomical position, including intergalactic dust, interstellar dust, interplanetary dust (such as the zodiacal cloud), and circumplanetary dust (such as a planetary ring). Multiple techniques exist for acquiring measurements of space dust. Dust has various impacts on geochemical cycles, ecosystems, and the environment, while also detrimentally influencing public health {3}. Kerbala province is highly impacted by frequent dusty events throughout the year. This is mostly due to its close proximity to the Western Plateau and the significant growth in industrial operations, traffic, and urban expansion in the area {4}.

Study area: The Karbala Governorate is situated in the Middle Euphrates region of Iraq, bordering the western side. It is located at a latitude of 44 degrees and 40 minutes and a longitude of 33 degrees and 31 minutes (Figure 1). The governorate covers an area of 5034 square kilometers, which is 1.14% of Iraq's total area of 438,317 square km.



Figure 1: Karbala Governorate Map location in the Iraq

Climate: The temperatures fluctuate from 5°C in January to 45°C in July, with an average of 25°C. The governorate is located inside the arid region, where the average annual rainfall is less than 100 mm. The dominant wind direction is from the northwest, with the western wind being the second most common{5}.

Samples collection: A sample of dust fall was collected from two sites selected from residential and agricultural areas in Karbala Governorate the. The samples were collected monthly by three replicates from each site from January \ 2022 to 2023 {6}.

RESULTS AND DISCUSSION

It is crucial to examine the pace of dust-fall and its chemical components in order to understand the extent of dust pollution in a certain location, both in terms of quantity and quality. Residential regions have a significantly higher quantity of dust deposition compared to agricultural areas due to the presence of diverse plant cover in agricultural areas, which acts as a barrier to the dispersion of dust into the sky{7}.

Furthermore, there is a notable increase in the quantity of dust deposition throughout the month of May, surpassing 250 grams as depicted in figure no. 2, particularly in residential regions. The cause of this phenomenon may not be attributed just to the dry season, but rather to other unidentified factors that may be exclusive to this particular month compared to other months throughout the year {8}.

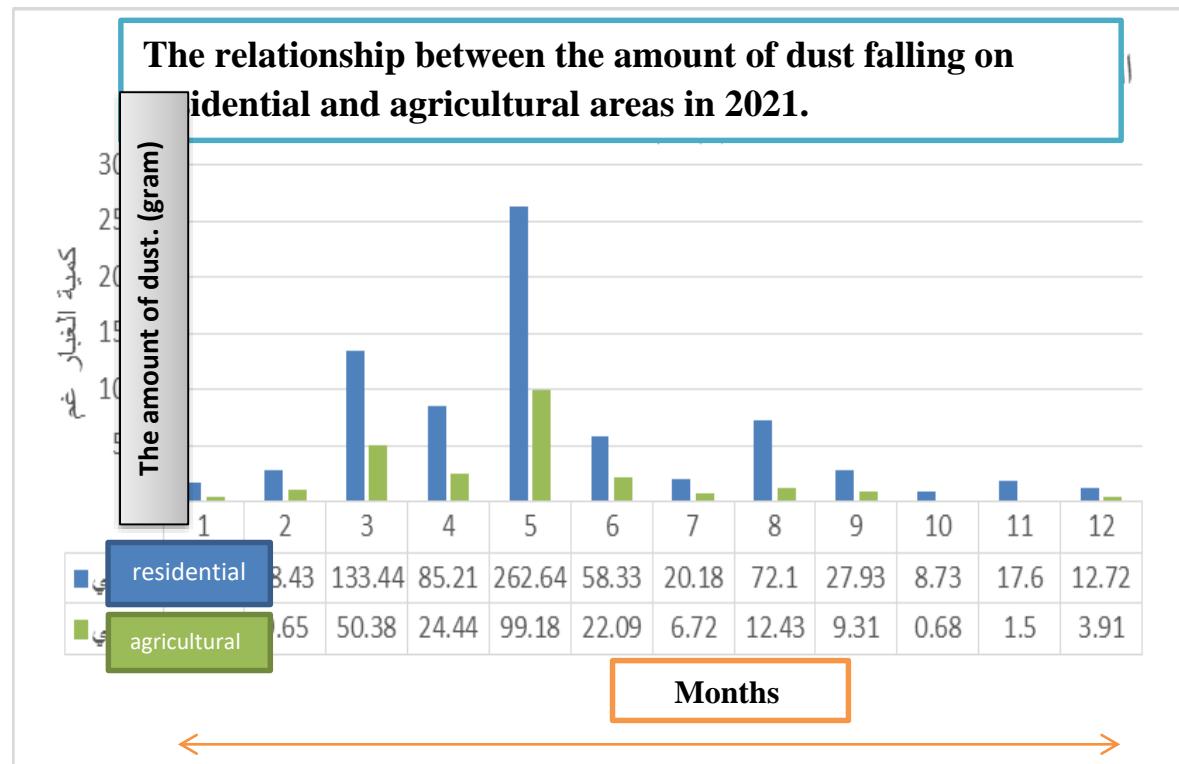


Figure 2: Shows the amount of dust falling in both residential and agricultural areas of every month during 2021.

If the percentage of dust falling on residential or agricultural areas exceeds the normal level, it can pose a risk due to potential radiation or transmission of deadly diseases to humans or animals. Additionally, excessive dust can negatively impact agricultural produce, leading to deterioration. This excessive dust is also a major contributor to environmental pollution, resulting in challenging environmental problems. Hence, it is imperative to conduct annual monitoring and measurement of dust levels to effectively manage any potential issues arising from the annual or monthly rise in dust deposition {9}. Dust is predominantly composed of loose particles that result from processes such as soil erosion, road transit, manufacturing, volcanic eruptions, and other similar activities. Dust that is falling may contain a variety of minerals. Mineral dust in the atmosphere significantly influences a range of meteorological phenomena, including cloud dynamics, precipitation, and atmospheric chemistry, Hence

it is vital to mitigate the occurrence of falling dust in order to prevent the aggravation of diverse environmental issues. An essential approach that must be adhered to is to prioritize agriculture and the expansion of green areas. By implementing this approach, the rate of airborne particulate matter will decrease, resulting in both a reduction of dust and an improvement in environmental cleanliness{10}.

The relationship between the amount of dust falling on agricultural areas (gm\m²\month).

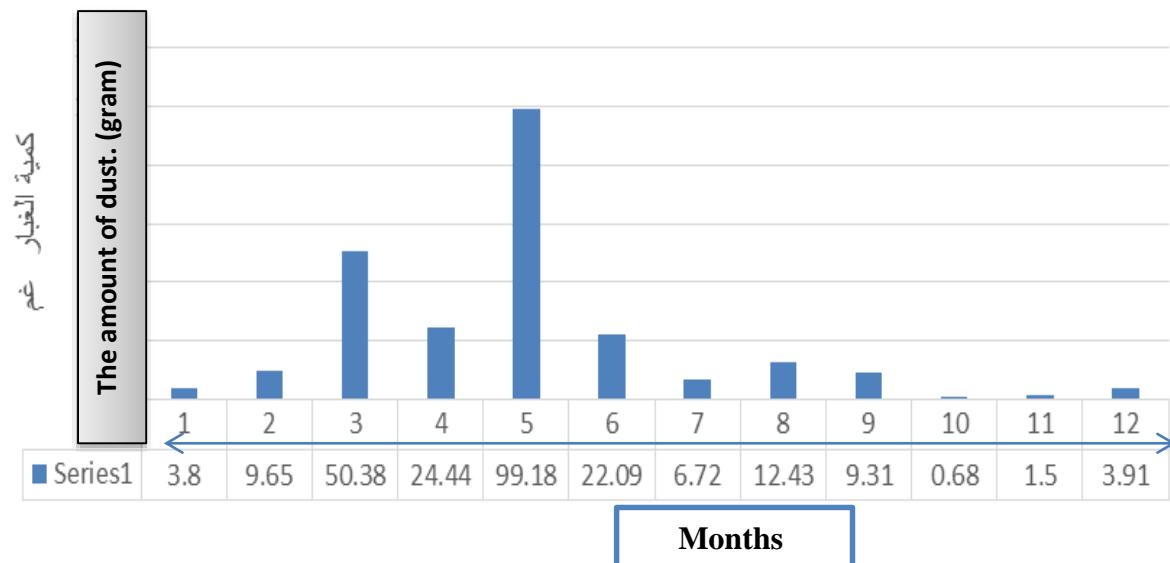


Figure 3: Shows the amount of dust falling in agricultural areas of every month during 2021.

The relationship between the amount of dust falling on residential areas (gm\m²\month).

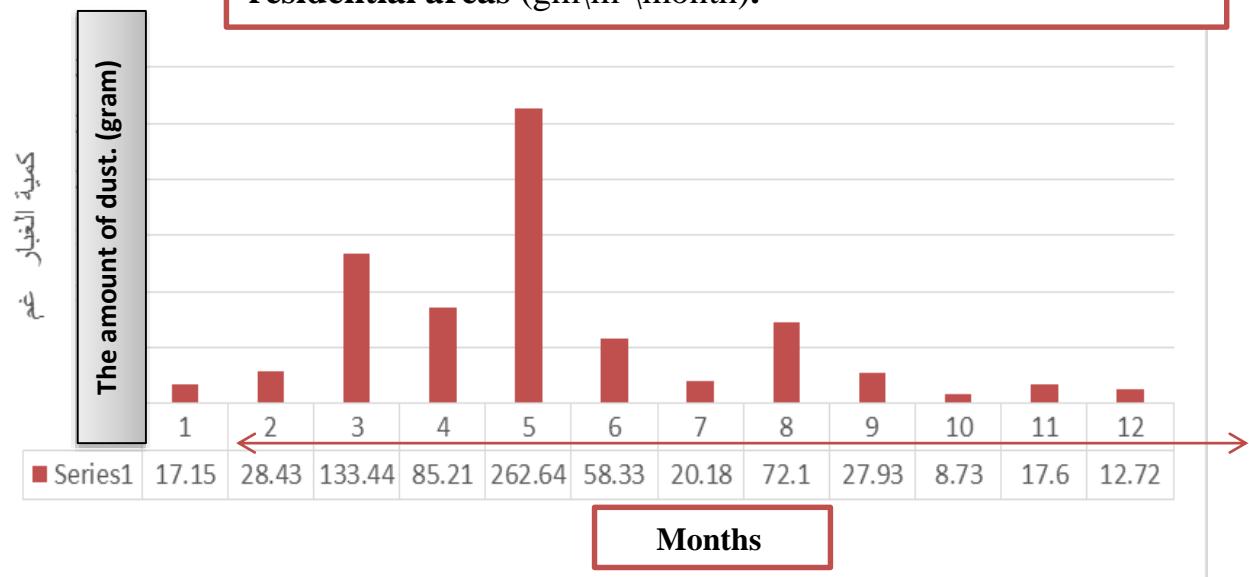


Figure 4: Shows the amount of dust falling in both residential areas of every month during 2021.

An escalation in the proportion of airborne particulate matter, whether in urban or natural environments, results in the susceptibility of individuals to respiratory ailments caused by pulmonary damage. Pneumoconiosis is a prevalent lung condition caused by the inhalation of tiny dust particles. The prolonged exposure to dust and radiation during work affects a significant number of miners and builders. Over time, the accumulation of tiny particles in the lungs leads to breathing difficulties and a reduced ability to acquire adequate oxygen. Based on this analysis, the month of May is identified as the period when the percentage of airborne dust particles increases. Consequently, this month is also characterized by a decrease in the percentage of oxygen in the atmosphere{11}. As a result, a significant portion of the population is likely to experience the negative effects of this issue. On the other hand, October is the month when the percentage of airborne dust particles decreases. This makes it the least polluted season, as depicted in figures 3 and 4. With a high percentage of humidity and a very low percentage of drought, dust is falling, making it clear that the air is clean. This makes it easier for the lungs to take in oxygen, and there are fewer cases of lung infections like pneumoconiosis and allergic diseases. The erosion of the earth's crust is caused by the strong winds that occur at high temperatures and low relative humidity during the summer months. This leads to a rise in the levels of coarse particles, which then settle owing to gravity. The particles' spherical form induces secondary reactions and atmospheric movement , so augmenting the rate of dust deposition in residential and agricultural regions {12}.

CONCLUSION:

The study was carried out in different residential and agricultural areas of Karbala Governorate. The summer season, particularly in May, experienced the highest level of dust precipitation in both regions due to heavy traffic. Conversely, the lowest level of dust precipitation occurred in the winter season, specifically in October. During the summer, the atmospheric dust precipitation levels are higher because the wind speeds are increased, leading to more wind dispersion. Reduced rates were noted throughout the winter. This phenomenon can be attributed to the occurrence of seasonal precipitation and elevated levels of relative humidity.

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