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Original Research Article

Study Plant Contamination Surrounding the Brick Factory in Al- Saniyah: Al- Diwaniyah Governorate, Iraq

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Abstract: This study examined how brick factories in Al-Saniyah, Al-Diwaniyah Governorate, affected the surrounding plants at 50, 500, and 1000-meter intervals in relation to the direction of the prevailing winds, as well as at 50, 500, and 1000-meter intervals in the opposite direction. Zinc concentrations were measured; the values ranged from 20.2 µg\g in the summer to 161.3 µg\g in the winter. Additionally, in winter, the content of cadmium was 0.39 at its lowest and 3.7µg\g at its maximum. The maximum concentration of cobalt was 41.55 µg/g in winter, while the lowest was 2.55 µg/g in summer. While the highest value in Pb was 96.4 µg/g in S2 in winter and the lowest value was 0.7 µg/g in S6. It's possible that the causes Seasonal variations in wind and precipitation that leave suspended metals in the atmosphere may be the cause of wintertime increases in element concentrations. Alternatively, better weather could be the reason for a rise in productivity.

Keywords: Cobalt, Opposite, Lead, Brick, Zink.

INTRODUCTION

Degradation of soil quality caused by several contaminants is increasingly recognised as a major environmental issue in many countries [1]. Several environmental conditions have a negative impact on plant growth and development. Heavy metal stress is one of the most essential abiotic elements that has received enormous attention in the last 30 years [2].

When non-biodegradable and toxic metal concentrations accumulate in agricultural soils, it has a substantial negative influence on crop health and yield [3].

How toxic metals are to crops depends on a variety of factors, including crop types, growth conditions, developmental stages, soil toxicity levels of specific elements, physical and chemical characteristics of the soil, the distribution and bioavailability of metal elements in the soil environment, and the chemistry of the soil zone surrounding a plant [4]. Metals are non-degradable and permanent in the environment, due to their high uptake by plants and crops, excessive concentrations of several elements (such as lead, chromium, arsenic, zinc, cadmium, copper, mercury, and nickel) in arable soils have the potential to contaminate the soil and have an effect on the quality and safety of food [5].

Certain metals, like zinc and copper, are considered micronutrients when present in small amounts; however, other metalloids, like lead and cadmium, are considered toxic since they are not necessary for the body's metabolic functions [6].

Aim of Study

Study the effect of brick factory pollutants on surrounding plants at different dimensions and in two directions, the first with the direction of the prevailing winds in the region and the second against the direction of the prevailing winds.

MATERIAL AND METHODS

Plant samples were collected in the summer and winter of 2023-2024. Samples were taken from 6 locations toward the wind and opposite the wind direction in relation to the factory They were placed in plastic bags until they reached the laboratory, then they were washed well and dried at 80°C. They are then digested and prepared using Method [7]. to obtain results measured in µg/g dry weight.

RESULTS AND DISCUSSION

Plant Content of Zinc:

In Figure 1, it was found that the levels of zinc in the plant were highest in winter at S2, which is about 500 m away from the factory towards the air, and its concentration was 161.3 µg\g dry weight, while its minimum or less value was 35.1 µg\g in S4 opposite the air direction. While in summer season the highest value in S3 was 61.1 µg\g and the lowest value was 20.2 µg\g in S4 opposite the wind direction. The reason for the increase in zinc concentration in winter is due to rain, which leads to the release of all pollutants into the air from particles that contain this element. Zinc is one of the essential elements in the production of plant proteins that help develop and strengthen the plant system and can be a reason for the vegetative growth of the plant [8]. Plants are often very or moderately sensitive to zinc deficiency and excess, with a small range separating toxic excess from deficiency that can stunt growth and lead to plant physiological problems and reduced productivity and quality [9].

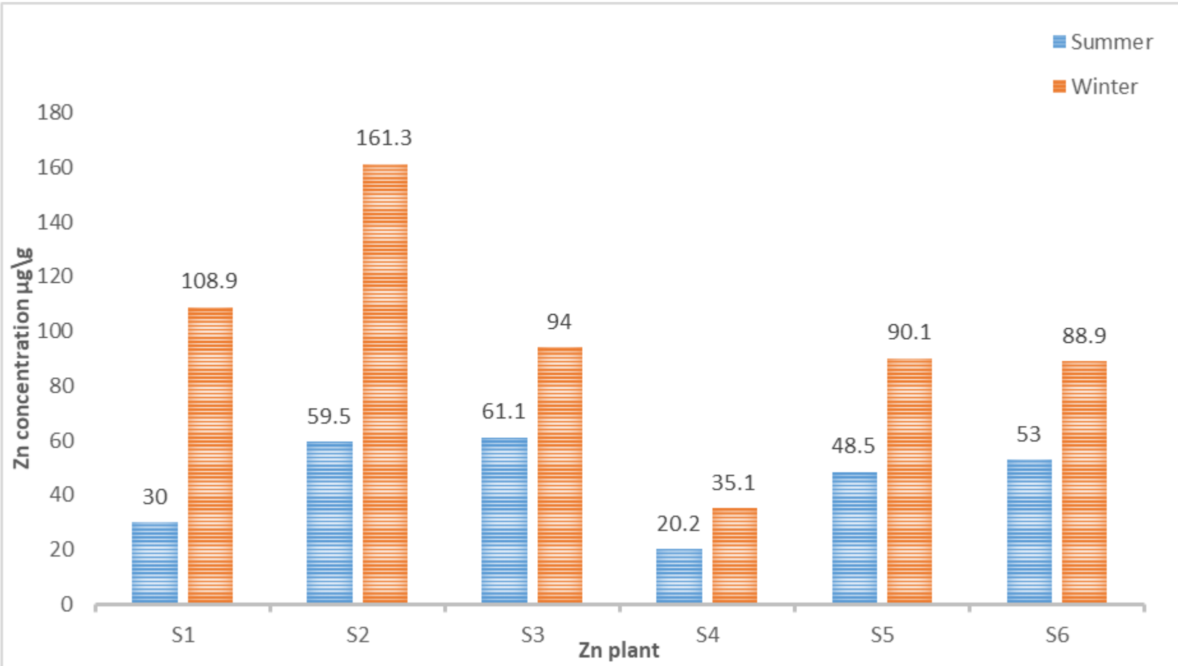

Fig. 1: Zn concentrations in study stations

Plant Content of Cadmium

In Figure 2, the level of cadmium in the plant was the highest in the winter. The highest value of cadmium was (3.7 and 3.18) µg\g in S3 ans S2 a distance of 1000 and 500 meters from the factory towards the wind direction, while the lowest value was 0.39 µg\g in S4, opposite the wind. In Summer the highest and lowest value was (2.76 ,1) µg\g in S2 and S4. Through these results, it was observed that there was an increase in the percentage of cadmium in all the stations studied and during the two seasons, which indicates the production of this element among the factory pollutants that reach the plant. The increase in winter can be attributed to rain and humidity that precipitate elements from the air. Plants that accumulate heavy metals undergo physiological and biochemical changes. Toxic metals, such as cadmium (Cd), are released into the environment in quantities that endanger human health and plant life [10]. Cadmium has a wide range of negative effects on plants, affecting vital activities such as photosynthesis, enzyme function, elements intake, and water transport [11].

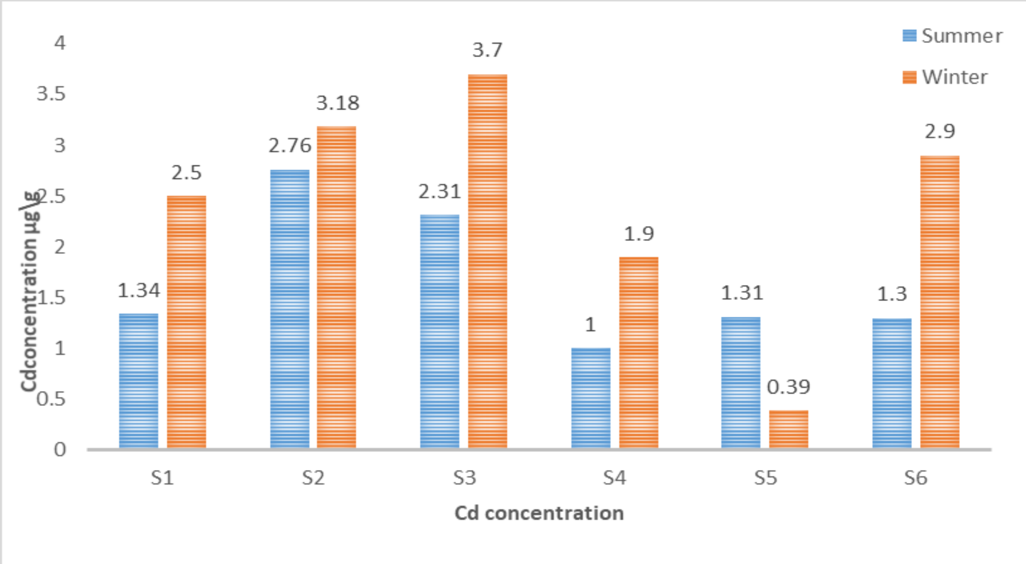

Fig. 2: Cd concentrations in study stations

Plant Cobalt Content:

In summer season in Figure 3 show the largest percentage of cobalt in the plant 7.01 µg \ g, S3 was 1000 m from the facility in the toward the wind, The lowest value was 2.55 µg\ g in opposite the direction of the wind, while in the winter the highest value was 41.55 µg\ g in S3 toward the wind and lowest value was 5.3 µg\ g and 5.8 µg\ g in S4 and S6 opposite the wind direction. It is noted from the results that the significant increase in cobalt concentration is within the permissible limits locally and globally at all study stations. The increase in cobalt concentration in winter is due to rainfall and the deposition of airborne suspended particles. Other factors that contribute to the increase in cobalt concentration in winter are pollutants resulting from factory operation. Cobalt (Co) has a beneficial effect because it is an essential component of many enzymes involved in N2 fixation, Plant development and metabolism. Increase and accumulation of this element leads to decreased production and decreased quality [12, 13].

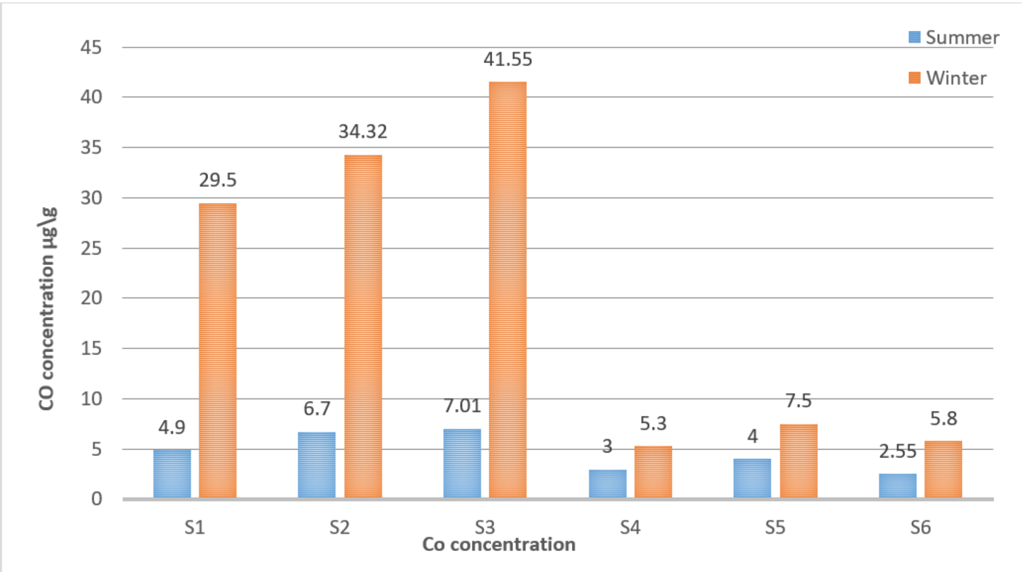

Fig. 3: Co concentrations in study stations

Plant Lead Content

The concentrations of high value in winter was 96.4 µg\g, in S2 500 m from the factory towards the wind while in the opposite wind direction recorded the lowest value 14.4 µg\g in S6. In the summer the highest value was 8.1 µg\g in S1 and lowest value was o.7 µg\ g. Because of the severe toxicity of lead, which is one of the heavy metals, is classified as a major pollutant and the second most dangerous pollutant, It is one of the chemicals that raises great global concern [14], and the values rise significantly in the winter because the brick factory produces this element through the fuel used and the materials it produces. Lead is released into the atmosphere without treatment and as a result of rainfall. Lead falls with the rain and is absorbed by plants directly or through the soil. Lead negatively affects plant physiology, including changes in enzyme activity, metabolic function, leaf discoloration, and decreased photosynthesis [15].

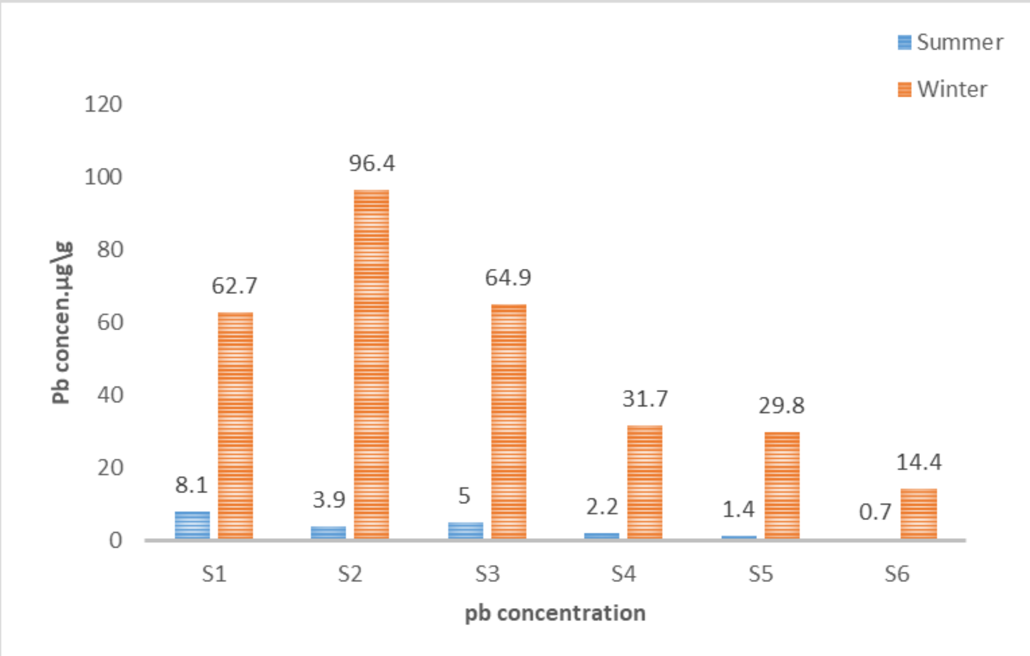

Fig. 4: Pb concentrations in study stations

CONCLUSION

1. The elements zinc, cadmium, cobalt, and lead that were measured in some plants in the areas surrounding the brick factory were high.
2. The concentrations of the studied elements in the winter were higher than in the summer due to rain, which dissolves the elements, leading to them falling directly on the plants or on the soil, where the plants absorb them.
3. The highest values were at 500 and 1000 m, in the direction of the prevailing winds in the region, and the lowest values were at the study stations, opposite the wind direction.

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