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Concentration of some heavy metals resulting from the incineration of wind-borne medical waste in Al-Qasim General Hospital

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Abstract
This research included the environmental assessment of the heavy metals obtained from the work of the incinerator in Al-Qasim General Hospital. Through this study, heavy elements generated from internal and external medical wastes from the incinerator were examined by four observations in the morning and evening during the study period, where some elements were measured, their quantities were determined and compared with the permissible determinants, where the results obtained from the chemical and physical examinations showed that there is a large discrepancy from one sample to another, and it is almost non-existent in some samples. Al-Qasim General Hospital achieves some high efficiency rate in the burning process, according to the staff working in that hospital.
Keywords: Heavy metals, wind, medical, Hospital.

Introduction

Medical waste is one of the environmental risks that must be dealt with in an appropriate manner with the requirements of the environment. This waste includes two types of waste. The first is non-hazardous organic waste, which represents food waste and ordinary dirt that comes out of hospital halls and public facilities [(1)].

The other is dangerous chemical waste, which includes waste that comes out of operating theaters and laboratories of all kinds [(2)].

So, there are cases of transgression on the city's environment through the non-optimal use of the incinerator or a decrease in its efficiency ratio, and is it reflected as a result on air pollution and its increased spread due to the wind factor.

As the technology of incineration of medical waste is one of the most severe and dangerous technologies for the environment and human health, as global environmental organizations consider the establishment and operation of waste incinerators as a feature of underdevelopment in environmental management, which

results in the destruction of air and soil and turns them into landfills for hazardous waste, both gaseous and solid [(3)].

Through this, some cases of non-application of the instructions for isolating and burning medical waste and failure to deal with the necessary technical methods for burning and destroying it appear, which leads to exacerbation of the problem of air pollution, in addition to that, the wind increases its spread to the areas surrounding the hospital building.

Heavy metals are dangerous because they tend to bioaccumulate [(4)]. Bioaccumulation is the increase in the concentration of a chemical substance in a living organism over time, compared to the concentration of that substance in the environment. Those minerals in low concentrations or their natural concentrations are useful by stimulating some biological processes, but if those concentrations exceed the threshold limit Any natural concentration, it becomes toxic. Being non-biodegradable, these minerals accumulate at different nutritional levels through the food chain causing problems for human health.

In recent years, there has been an increasing interest in analyzing trace elements in human materials such as foods, water and potable air, in order to understand the relationship between these elements with living systems in the human body, especially the elements that have different toxic effects on the environment. Some chemical elements in various organic substances, whether animal or plant, are considered as essential macro elements such as: chlorine, phosphorus, nitrogen, calcium, magnesium, potassium, sodium, oxygen, hydrogen and carbon, while others are considered as essential micro elements such as: cobalt (Co) chromium (Cr), copper (Cu), iodine (I), manganese (Mn), molybdenum (Mo), vanadium (V), zinc (Zn), iron (Fe), flour (F) and nickel (Ni). These elements turn into a toxic substance if their concentrations exceed the permissible limits. The third type of elements are not essential but are originally toxic such as: cadmium (Cd), lead (Pb), mercury (Hg), beryllium (Be), thallium (Th), arsenic (As), barium (Ba) and antimony (Sb) [(5)].

Because of all the aforementioned matters, the study decided to analyze the concentration of heavy elements in the gases emitted from the incinerator of Al-Qasim City Hospital and compare them with international determinants to find out the extent of air pollution surrounding the hospital and its impact on human health.

The study site was located in the province of Babylon in the district of Al-Qasim, specifically in the Al-Qasim General Hospital.

Material and Method

Samples were collected from different places close to the pollution area, and samples were taken from different places and at different times (morning, evening) and at a height of (1) meter or less, because the final pollutant and high concentration is near the surface of the soil, and this is determined by two factors, the air temperature. And

the temperature of the pollutant itself resulting from the medical waste incineration process.

The samples were examined using a device X-ray fluorescence (XRF), then the device was calibrated using reference standard calibration materials approved by the German company that manufactured the device. After that, the samples are measured directly, as this device is distinguished by its high accuracy results and the speed of sample preparation (5-10) minutes and in a non-destructive manner. As for the speed of measurement, the examination takes (5-15) minutes only. It is considered one of the non-destructive tests, in addition to that it is distinguished by not using chemicals, acids or chemical reagents to treat the samples.

Results

It is clear from Table No. (1) the concentrations of the elements in the ppm unit of measurement that the results of the analysis and for all elements exceeded the internationally permissible limits as in Table No. (2)

This shows the size of imperceptible pollution mixed with particulate matter, which is the process of transporting these pollutants through the movement of wind and delivering them to the areas surrounding the hospital and populated areas.

Where the concentrations were close in the morning and evening observations, due to the continuity of random burning. As for the area of spread, it was in the evening less widespread and more effective. As for the morning observation, it is the opposite of the evening observation, due to the wind factor and the difference in temperature as well as atmospheric humidity.

Table (1): Shows analysis of air samples at four different times

Sample 4	Sample 3	Sample 2	Sample 1	Elements
0.23	0.24	0.23	0.25	Cd
3.33	3.46	3.19	3.27	Al
37.8	37.7	37.3	37.3	Si
0.18	0.24	0.31	0.22	S
0.25	0.28	0.2	0.28	Cl
5.1	5.19	5.24	5.24	K
2.74	2.65	2.97	2.8	Co
0.41	0.4	0.41	0.37	Mn
0.41	0.82	0.8	0.86	Fe
0.83	0.15	0.2	0.18	Cu
6.24	6.27	6.47	6.39	Zn
46.5	44.7	44	58.3	Sr
18.9	19.3	20.1	19.3	Ba
18.92	14.5	0.16	0.17	Pb

Table (2): Shows the normal emissions rate within four hours

Rate in four hours (mg/m3)	Emitted material
0.05	Mercury
0.05	Cadmium
0.05	Thallium
0.5	Lead
0.5	Chrome
0.5	Copper
0.5	Nickel
0.5	Arsenic
0.1	Dioxin
0.1	Furan

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