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AN ENVIRONMENTAL ASSESSMENT OF THE CONCENTRATIONS OF HEAVY ELEMENTS AND NOISE LEVELS IN THE GRAIN MILLING PLANTS

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Abstract

The main aim of the research is to detect the concentrations of heavy elements contaminated in the internal environment dust of grain mills as well as to measure the noise levels and compare these concentrations with the environmental determinants in order to reach an environmental assessment of the impact of these pollutants on workers and make recommendations that will contribute to reducing levels environmental pollution in these mills. The important factors leading to high concentrations of the elements is due mainly to the availability of sources of pollution and the important sources of dust falling and accumulated as well as equipment within the mills.

Key words : Grain milling plants, heavy elements, noise levels, workers.

Introduction

World Health Organization (WHO) defines air pollution as a situation in which the atmosphere outside the workplace contains substances that are harmful to humans and the environment. When we talk about air pollution, we are talking about pollution of the surface layer of the Earth's atmosphere that extends above the Earth's surface to a distance of 15 to 18 kilometers, called the troposphere. This is the important layer of its living environment because it contains air components represented by oxygen, nitrogen, Argon, carbon dioxide and steam water and some other materials at different rates depending on the purity of the air. It is assumed that this layer of the atmosphere contains pure air, but this has not been achieved on the ground as a result of the diversity of human activity and the introduction of pollutants of different sources and composition of this layer. Therefore, pollution is different from one region to another and in all directions (Ennis, 1999; Salman *et al*., 2009). This makes it even more dangerous to contain microbial particles of microscopic size and at the same time contain different concentrations of heavy metals such as cadmium and lead,nickel, cobalt, copper, iron, and others.

Air pollution is considered an epidemic condition if it exceeds the standard rate of dust and solid particulate matter in the air, as defined by the World Health Organization (WHO) at about 75-80 μg/m^3 (Niosh, 1999; Ali, 2008). Most of the Arab cities and the surrounding region have exceeded these percentages. This view is confirmed by the fact that the percentage of diseases has increased by 80% in the developing countries and the Arab countries (Salman *et al*., 2009). Air pollution is one of the most dangerous types of environmental pollution. Air pollutants originate either from natural sources such as plant degradation, dust and sand storms, weathering and erosion of various lands (Butte, 2003) or from industrial sources such as accidental products of industrial and technical activity. Despite the manufacturing strategies that aim primarily at providing many of the needs of the community such as building materials, chemicals, transportation, clothing, cleaning materials and others. The rising gases and dust from the

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factories contribute to the increase in the percentage of the resulting dust with the smoke of these factories and their residues (Hara et.al 2006). Quantities and type of chemical pollutants (gaseous and suspended particles) in the air are constantly changing because the air is unstable environment exposed to climatic conditions such as winds that displace and change location and concentration of pollutants and rain that transport pollutants from the air environment to the aquatic environment and land. The chemical processes that take place on contaminants and the change in their concentration and composition change in the types of sources and their location and the type of pollutants that are thrown into the air, because there is a large variation in the levels of air pollutants from one country to another or from one location to another within the same city. It is difficult to give a general statistic to concentrations of pollutants that change with days, hours and minutes.

The effect of chemical air pollutants on humans is a general justification for the effect of chemical contaminants. It causes irritation of many organs and tissues of the body. The impact of pollutants is more severe in patients with the respiratory system, blood vessels and heart. Many statistics and health studies indicate that the pollutants accelerate the death of these patients. There are many studies that confirm that most of these elements have a negative impact on the human being is infected by many diseases such as allergies in the skin, eye, nose and respiratory system to asthma and various lung diseases besides their negative impact on the rest of the components of the environment. Blomberg (2012) showed the effect of chemical air pollutants on vegetation and food crops. The air particles carried by suspended materials accumulate on the surface of the leaves, thus preventing the arrival of sufficient sunlight to perform the photosynthesis process. The plant has a significant impact and mainly on the presence of contaminants in the atmosphere reduces the intensity of sunlight (Rashed Almusleh, 1999). The problem of the research is that dust particles suspended in the internal air of the mills range from 1.0 to 10 microns in diameter and remain suspended in the air for a long period because their deposition is slow, which leads to health damage to the workers and is considered the most dangerous dust particles contaminated to the air because it forms the bulk of the dust, which is found in the internal air of the mills because it contains fine particles containing the various metals that have effects on the respiratory system because it can penetrate the nostrils easily and reach the bronchial and alveoli in the lung. In addition to the noise pollution resulting from the various milling operations.

The main aim of the research is to detect the concentrations of heavy elements contaminated in the internal environment dust of grain mills as well as to measure the noise levels and compare these concentrations with the environmental determinants in order to reach an environmental assessment of the impact of these pollutants on workers and make recommendations that will contribute to reducing levels environmental pollution resulting from these mills.Mills can be classified in Iraq according to the old two types of mills are the old mills that established the beginning of the eighties and another established after 1990, which came according to the United Nations (modern mills), according to ownership there are two types of mills, government and civil. Two types of mills were selected, with the old criteria and the type of property, which are characterized by the fact that the internal environment is very similar to the environment of all the mills in Iraq. Therefore, two sites were selected for each of the old mill (A) and the modern mill (B). The environmental conditions due to the proximity of place near the road of Karbala - Najaf. As for the temporal boundary, samples of the research were taken from 8 am to 2 pm of March 2018. The local boundary is the detection of concentrations of heavy elements in the dust of the internal mill and the detection of the characteristics of these elements and their impact on workers within the mill.

Materials and Methods

The suspended dust samples were collected using the Sniffer device where the device was placed at a height of 1.5 meters in an indoor environment for a full hour. Environmental conditions were measured within measurement sites by measuring temperature, humidity and atmospheric pressure. Measurements of the noise level in the work environment were carried out by means of a noise meter in decibels for the study sites for the purpose of providing clear information about the working environment. The filter paper is placed inside the oven for 15 minutes at a temperature of 105 to remove the moisture. After drying, the filter is weighed with a sensitive balance that is free from contaminants (W_1). The filter is placed in a Petry Dish and is kept until it is placed in the air intake device. The size of the drawn air shall be recorded in units (m) at the start of the machine (V_1) and after 60 minutes (V_2). After extinguishing the filter, transfer to Petry Dish and weigh (W_2).

Methods of calculating the suspended physical particles SPM and heavy elements:

For the purpose of calculating the mass concentration of the total suspended minutes in the air, the following relationship is used:

$$Sp = \frac{W2 - W1}{V_T} \times 10^6 \quad (1)$$

Mass concentration of suspended particles ($m^3/\mu g$) = SP

The final weight of the filter (g) = W_2

The primary weight of the filter (g) = W_1

The total size of the air drawn (m_3) = V_T

The method of calculating the volume of lost air according to the following equation:

$$V_T = Q \times t \quad (2)$$

The size of the drawn air in units of m^3/min

$$Sp = \frac{(V_1 - V_2)}{2} \times 1000$$

Time to Sniff (Minute) = t

Total volume of air drawn = Vt

Concentrate the elements in the liquid model (µg/ml) = C

The size of the liquid containing the model (ml) = V1

Filters containing contaminants are dissolved in a 1: 4 mixtures of $HClO_4$ and HNO_3. The mixture is placed in the glass in a water bath vibrating for an hour at a temperature of 45°C until the solution is clear. Transfer the mixture to a detergent flask with nitric acid and then with distilled water and then with ionic water. The volume is supplemented to 25 ml with the water of the ion (Perry and Young). The solution is ready to detect heavy elements by means of the Atomic Absorption Spectrometer.

Results and Discussion

The study concerned the detection of the mass concentration of the total suspended particles as well as the detection of the heavy elements in the internal environment dust of the study sites (Najaf Governmental Grinder and Rehab National Mill), which consisted of (lead, cadmium, cobalt, zinc).The highest total concentration of suspended grains was recorded at site1 with a value of (13506 µg/m^3), while the lowest mass concentration at site2 was recorded (11929 µg/m^3 as shown in table 1), as it exceeded the national and global determinants in both sites.

The concentration of heavy elements in the dust of the internal environment of the study sites was also revealed. The highest concentration of the lead element is 1.8641 µg/m^3 is found at site 2. While the first site recorded a concentration of 1.6622µ g/m^3. Where, lead is a toxic element and has resulted in a high proportion to the pollution of the internal environment of the sites of the study (mills) and widely. Where lead is a substance accumulation toxic affects many organs of the human body and damage and that many diseases caused by exposure to high concentrations of lead as it inhibits many of the enzymes in the human body and resulting in inhibition of the production of hemoglobin and negatively affects the tissues of the kidneys and red blood cells. Cobalt has a lower value than other measured elements. Where, its value was the least value which reached (0.6504µg/m^3) at site 1. Its value was 7,7563µg/m^3 at site 2. Cobalt is a gray metallic metal, a metallic mineral used in the paint industry, which leads to heart damage, sensitive dermatitis, hyperthyroidism, and high red blood cells. Cadmium was also detected at site 1, which recorded the lowest value of 1.0261µg/m^3, while the highest value was recorded at site 2 (0.9603µg/m^3). Zinc was detected at both sites (4.4181µg/m^3) at site1 while it was (4.3358µg/m^3) at site 2. By comparing the general average of concentrations with environmental determinants, there is a slight increase in some concentrations of elements and some within the permissible limits. The study revealed that the dust in the internal environment of the sites indicates that there is a great danger to the health of workers and residents in the neighboring areas and close to the mills and also impact on the vital system by comparing the general rate of concentrations of elements with environmental determinants shows a clear deviation of the values of some elements.

The permissible range of the component is 5.1 quarterly and 0.5 0 per year. Results have been shown to exceed the permissible limits, especially at site 2 (1.6641 µg/m^3). This value is considered high and very dangerous, but the other elements were within the permissible limits. The reason for the increase in the percentage of lead element in the site2 can be attributed to the age of the mill, its size and its high production capacity (250) tons/day, 1984, its continuous work and its addition to the transport means that produce polluting gases. Where lead is considered the most dangerous. There are many studies that confirm that most of these elements have a negative impact on the human being is affected by many diseases such as allergies in the skin, eye, nose and respiratory system to asthma and various lung diseases besides their negative impact on the components of the environment (Blomberg, 2012). Noise level was also detected. Where the noise levels exceeded

Table 1 : Concentrations of air (ppm) and noise pollutants (db) in grain mills and general air conditions inside and outside the work environment.

Location	TSPµg/m³	Pb	Cd	Zn	Co	Noise Level			Atmospheric pressure (millibars)		Temperature C°		Humidity
						High	Low	Mean	Inside Plant	Outside Plant	Inside Plant	Outside Plant	
1	13506	6225.1	1.0261	3.4603	0.6504	104	90.5	97.5	1020	1021	20	17	35
2	11929	1.8641	0.9603	3.4181	1.7563	113	91	102	1017	1020	16	15	33

Table 2 : Time of exposure to permissible noise (Ministry of Labor and Social Affairs, 2017).

No.	Time	Noise level (db)
1	8h	85
2	6 h	87
3	4 h	90
4	3 h	92
5	2 h	95
6	1.5h	97
7	1 h	100
8	1-2h	105
9	lm	115

Table 3 : Shows the permissible noise rates (Ministry of Labor and Social Affairs, 2017).

No.	Location	Permissible Limits (db)
1	Workshops within the factory	50-60
2	Industrial zones	60-70
3	Work Labs	30-35
4	Indoor engineering workshops	45-50
5	Administrative office rooms	35-40
6	Corridors and restrooms	45-50
7	Offices within the factory	45-50
8	Power generation and power plants	85-90

the permissible limits as in tables 2 and 3 and reached a maximum value of 113 db in the site 2.

While the level was relatively less than 104 db at site 1. The high level of noise over the permissible range leads to environmental damage and damage to the health of workers, which may lead to hearing loss of workers over time and also a defect in concentration. Some climatic elements were measured in the internal environment of the study sites as shown in table 1.

Conclusion

It has been revealed that the studied area is heavily contaminated by the element of dangerous lead. Lead was found to be highly corrosive and had a significant effect because it was considered to be one of the three major elements with mercury and cadmium. The least recorded concentrations should be treated with caution because of the length of exposure of the workers in the study (mills), with a duration of exposure for each period of 8 hours. The most important factors leading to high concentrations of the studied elements is due mainly to the availability of sources of pollution and the most important sources of dust falling and accumulated as well as equipment within the mills.

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