Effect of asphalt emissions on the health of workers, Najaf City - Iraq A case study

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Abstract. Human activities have the greatest impact on environmental change and natural biological disruption, and there are many forms of this change, whether in the environmental climate, such as the rapid loss of biodiversity and lack of land suitability for agriculture, or the rise in temperature as a result of human changes or environmental health impacts. This research included detecting the effect of asphalt plant pollution on physiological blood parameters for workers in these plants by estimating certain blood markers in samples from 30 workers of different ages, and exposure periods included blood WBC, HGB, HCT, PLT and CO2. The findings showed that the WBC values showed that 93% of employees were above the usual limit, while 84.4% of employees had higher concentrations than control group values, 99% of workers had concentrations above usual HGB levels, while 43% had concentrations below control group values, 86.8% had concentrations below control group values, 33.4% exceeded the control group values, the results of laboratory CO2 analyzes show that 90% of the CO2 concentrations of this indicator are outside the natural limits and that 100% of the CO2 concentration of workers in their blood is higher than that of the control group.

1. Introduction

Urban economies have increased and the consequences of pollution have been complicated since the industrial revolution began. One plant affects the soil and surroundings; however, other pollutants, including ammonia, carbon dioxide, carbon monoxide, and methane, are at risk of emissions. It is not just urban areas that are contaminated, but that extends to heavily populated areas [1].

Today environmental pollution is a concern which, due to its direct relations and activities with the people, is followed by a wide interest among governments of many countries of the world, the religious importance of the field of study and the increase in the population has led to an increasing diversity of manufacturing, commercial and tourist industries. The asphalt workers are most exposed to pollution and thermal stress because air pollutants released during the production stage and the high heat emitted from the furnaces are concentrated abnormally into the work environment. The environmental impact of the asphalt industry has been extensively investigated, especially the effects of gasses and heavy metals, despite the significant impact of industrial asphalt dust, limited attention, and few studies on their workforce and the environment were conducted. So, first and foremost, even though the asphalt plant meets all air pollution standards, people in its immediate vicinity are still exposed to long-term carcinogenic agents [2].

Human beings are considered to be the most important vital reason for environmental change and biological natural disruption, and there are unlimited changes in the environmental climate, such as loss of biological diversity and lack of land suitability for agriculture, and rapid rises in temperature due to human-induced changes [3]. Asphalt is a black-colored carbohydrate composite adhesive consisting of hydrogen and carbon, becoming liquid when heated. Also known as bitumen. In asphalt operations,
bituminous materials are generally used either by spraying it on the desired asphalt surface or by mixing it with gravel and sand in special mixers and then dispersing it in layers where bitumen is used as an insulating layer to prevent water penetration and permeation. Asphalt materials are provided by evacuation distillation or from natural sources such as rock asphalt lakes [4]. Asphalt is also defined as a non-volatile black liquid with high viscosity or solid at normal temperature and shows the behavior of thermoplastics as it melts with heat and turns into a liquid state and then returns to a solid-state by cooling and dissolving in some organic solvents such as benzene and ethylene tetrachloride and carbon disulfide and resists oxidation and various weather conditions [5].

Manufacturing of asphalt and pavement must take place at elevated temperatures ranging from 135-150 degrees Celsius in some types, while the other types are between 145-150 degrees Celsius. As a result, large quantities of asphalt vapors are produced and emitted into the air [6]. Volatile chemicals and fumes affect the quality of the surrounding air and may harm the health of workers at the site, in particular asphalt vapors, which are complex mixtures of aerosols and volatile organic compounds, including complex cyclic hydrocarbons and aromatic hydrocarbons, which have an acute and chronic effect on human health through inhalation and skin pollution [7].

2. Methods and materials:
Blood samples were collected from asphalt plant workers in Najaf City, as 30 blood samples were collected from workers representing the test group exposed to polluted air and high temperatures. And five blood samples were collected from normal individuals with proven health and physiological status. The normal group was not exposed to high temperatures and polluted by air. 10 ml of venous blood has also been drawn. Then the blood is placed in a plastic container containing (EDTA) as an anticoagulant and in another container containing a silicone gel. After that, the blood picture will be taken and the CO2 measurement will be estimated.

The Analysis of Variance (ANOVA), T-test, mean±SD, was used to determine the significance between the variables tested using the SPSS statistical program software (version 17).

3. Result and Discussion
This study is part of a comprehensive study on the impact of pollutants emitted from asphalt plants on the health of workers in these plants. The CBC analysis was carried out to identify the health status of workers and to examine, diagnose or monitor one of the various diseases affecting the blood cells, such as anemia or infection or inflammation, as well as bleeding and cancer diseases [5]. Blood-related indicators (CO2, PLT, Hct, HGB, WBC) have been treated as shown in Table (1), the data of which represent the average of the above-mentioned indicators for certain physiological blood parameters for workers as well as their age and duration of work as well as age and blood indicators. For the control sample, note that the sampling was taken by 30 workers and five persons representing.

Table 1. shows the values of some important blood parameters in the samples of workers in asphalt plants.

| NO. | Age groups | WBC 10^9/L average | HGB g/dL average | HCT % average | PLT 10^9/L average | CO2 Mmol/l average |
|-----|------------|---------------------|------------------|---------------|-------------------|--------------------|
| 1   | 15-20      | 6.84                | 14.18            | 41.2          | 279.75            | 31.83              |
| 2   | 21-25      | 6.92                | 15.2             | 44.57         | 168               | 35.5               |
| 3   | 26-30      | 7.92                | 14.52            | 43            | 323               | 34.95              |
| 4   | 31-35      | 7.06                | 5                | 14.39         | 232.5             | 23.64              |
| 5   | 41-45      | 9.31                | 4.63             | 15.06         | 289.29            | 34.27              |
| 6   | 46-50      | 6.36                | 13.45            | 30.98         | 191               | 31.05              |
| 7   | 51-55      | 6.14                | 15.6             | 46.9          | 177               | 40.0               |
| 8   | 56-60      | 7.72                | 15.1             | 44.4          | 225               | 39.4               |
An adult body contains approximately 6-5 liters of blood, equivalent to 8 percent of the total body weight (9, 10). Blood functions as a food transport, gas exchange and metabolism removal product as well as a defensive function against pathogenic bacteria through its Cellular Elements components. (Erythrocytes, Leukocytes, Platelets) and Plasma.

4. White blood cell count (WBC count)
Estimating the average amount of blood white cells in workers' blood is highly significant as their primary function is to protect the body from immune system infections and infectious diseases and they are known to be part of the immune system. It is divided into 5 species (New) and lymphocytes (Lyme), monocytes (Mon) and Basophils (Eos). The WBCS shows that the highest value observed in the age group (45-41) is (9,31) within the standard limits (11-4) and is above the control value (6,09). Tables (1) and Figure (1) indicate that eight groups were within the standard range. The smallest amount registered in the age group (55-51) is (6.14). All age groups have recorded values higher than control values when comparing test samples.

5. Blood hemoglobin (HGB)
The concentration of hemoglobin in blood is represented by HGB. The data in Table (1) and Figure (2) show that the highest concentration of hemoglobin was in the age group (51-55) and the lowest concentration was in the age group (41-45). Compared to this concentration with the control sample, two age groups were recorded. Values are lower than the control values (31-35) and (41-45), while the rest of the groups recorded higher concentrations than the control sample concentrations, and when comparing the values of (HGB) with the natural limit, six categories within the natural limit are found. This clearly shows the effect of asphalt emissions on the concentration of hemoglobin in the plant.
6. Blood viscosity (HCT)
The highest percentage of viscosity reported in the blood of workers in the age group (51-55) was 46.9%. It is noted that four groups have the lowest proportions of the control sample, while three groups (46-50), (41-45) and (31-35) have registered lower than the normal values. By Table (1) and Figure (3), 56.6 percent of workers in asphalt plants in the town of Najaf are observed where the percentage of their HCT was much lower than the natural limit.

7. Platelets (PLT)
Platelets perform a well-known function, which is the formation of thrombus for the purpose of stopping and controlling bleeding because it has the advantage of grouping around the bleeding area (11). Table (1) and Figure (4) show that the values of this indicator ranged between (289-168) This means that all values are within the normal limit. However, when comparing these concentrations with the values recorded in the control sample, four categories appeared to be less than the control concentration. This shows a low concentration of PLT in the blood of most workers compared to the control sample.
8. Concentration of CO2 in the blood of workers
The results of the co2 estimate showed that the highest age groups of workers in the asphalt plant had high concentrations that exceeded the natural limit, except for those recorded in the age group (35-31) and the concentrations recorded in the blood of workers ranged between (23.6-40) which is a high percentage compared to the normal limit (29-23). Also, when comparing the CO2 concentration with the control sample, it became clear that 100% of workers mostly had higher concentrations than the control sample concentration value. This indicates an increase in the CO2 ratio in the working environment even though most plants are open.

Figure 4. shows the variation of PLT values in the blood samples of workers in the asphalt plant.

Figure 5. shows the variation of the CO2 values in the blood samples of workers in asphalt plants.
Conclusions
This study concluded that WBC values for workers were greater than control, HGB values for workers were lower than control, HCT values for workers were lower than control, PLT values for workers were lower than control, and CO2 levels were higher than control group concentrations.

References
[1] Aldehaidahwi, F., Almayahi, B. A., Albukaa, M., Aldeen, S. J., and Zyughir, L., Health Effect of Heavy Elements Produced by Solid Residues and Dust Accumulated Inside the Factories, La Prensa Argentina, Argentina, Volume 106; 2 pp 1-3
[2] Emilion M., Environmental Social Sciences Human-Environment Interaction and Sustainability, Published by Wiley – Blackwell, Published in Hoboken N1, USA, (2010), P. 1-4.
[3] Initiative, C. C. S., Formation and Release of POPs in the Cement Industry, 2nd ed., Geneva, 2006.
[4] J., S. G. a. G. W., Mush rush Petroleum Products: In Compatibility, Taylor Uncl, Francis, 1995.
[5] Gudimetta, J. M., Cooley, L. A. Jr., and Brown, E. R., Workability of hot mix asphalt, Auburn Univ., Auburn, AL NCAT Rep 2002, p3.
[6] Becking, G. C.; Nordberg, M.; Nordberg, G. F. (2007). Essential metals: Assessing risks from deficiency and toxicity. In: Nordberg GF; Fowler, BA; Friberg, LT (ed) Handbook on the Toxicology of Metals, Elsevier, 163-176.
[7] Pocock, G. and Richards, C. D. (1999). Human physiology, the basis of medicine. Oxford, University press, New York.
[8] Tortora, G. J. and Anagnostakos, N. P. (1984). Principals of anatomy and physiology. 4th ed., Harper and Row, publishers, New York.
[9] Al-Hakkak, Zaid Makki, Effect of industrial atmospheres and temperatures on some biochemical and physiological blood parameters and spirometric in workers of Kufa cement factory, Master Thesis.
[10] Al-Haidarey, M. J., Al-Hatami, A. O., Bahlol, R. (2012). The determination of total mercury in blood and urine samples collected from people worker in and living beside the Al-Furat Company for Industrial Chemistry- Saddat Al-Hindia/ Iraq. Al-Kufa University Journal of Biology, 4(1), http://journals.uokufa.edu.iq/index.php/ajb/article/view/760/676