A study of Environmental Pollution of Gases Emitted in Goldsmithing Workshops in Al-Najaf Governorate, Iraq

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ABSTRACT
The goldsmithing industry is considered one of the basic craft industries in Iraq, and there are many goldsmithing workshops in the city of Najaf in the Great Market. It is known that this industry emits toxic and dangerous gases, for example (HN_3, NO_2, SO_2, SIH_4, H_2 and CO), which negatively affect indoor air quality and, consequently, the health of workers and the surrounding community. This study analyzed the results of gas emissions for ten workshops Gold formulation and knowing the extent of its impact on the health of workers, as this study included estimating the concentrations of some gases such as HN_3 0.09 ppm, NO_2 0.0965 ppm, SO_2 0.1 ppm, SIH_4 0.1305 ppm, H_2 2.95 ppm and CO 9.29 ppm, taking into account the examinations During six months, from October 2022 to April 2023, the results showed a clear discrepancy, as the workshops in which the gases were measured recorded high pollution compared to the recommended limits.

Key words: Environmental pollution, Goldsmithing workshops, Gases emitted, Indoor air quality

1- INTRODUCTION

Goldsmithing workshops are among the factories that emit many different gases that may pose a threat to the health of workers and the surrounding environment [1]. These workshops are located in the large market area in the city of Najaf, and have been in operation for many years [2]. Goldsmithing workshops are factories that emit many different gases that may pose a danger to the high concentrations of many gases emitted from these workshops, including nitrogen oxides NO_x, sulfur dioxide SO_2, carbon monoxide CO and SIH_4, HN_3, H_2 that can pose a significant health risk to workers [3]. Outdoor air pollution gets more attention than indoor air pollution Although indoor pollution levels are twice as high as outdoor pollution [4], people spend 80-90% of their lives living and settling in indoor buildings [5]. More than 5 million people die prematurely every year due to poor indoor air quality, which causes multi-million worker losses due to reduced worker productivity, physical and health damages [6]. Indoor air pollutants include more than 400 organic and inorganic chemical compounds, the concentrations of which are governed by several indoor factors [7]. Pollutant prevention is not always technically feasible, so cost-effective mitigation units need to be implemented [8]. To date, there is no physicochemical technology that is able to treat all indoor air pollutants in effective ways [9]. Emissions due to human activities and crafts were previously identified and classified according to potential harm [10]. Indoor environments experienced increased smoke concentration due to ventilation due to human activities [11]. High indoor concentrations of harmful gases were common from the burning of sulfur and fossil fuels for activities and workshops [12]. The external environment has suffered greatly from workshop activities and other uncontrolled hazardous emissions [13]. Gaseous pollutants (the state of gas produced from natural and human sources) which are harmful to humans [14]. This study aims to know the extent of environmental pollution occurring in goldsmithing workshops and what are the rates and rates of gases emitted during the work of the workshops and compare them with the permissible limits for the internal environments of some countries to find out the extent of the danger of emissions to the health of workers in goldsmithing workshops. Gases were measured from October 2022 to April 2023.

2. MATERIALS AND METHODS

This study was conducted from October 2022 to April 2023, and aimed to estimate the concentrations of several gases emitted from goldsmithing workshops. Ten sites were chosen to measure the selected gases to find out the current situation of indoor air quality for goldsmithing workshops in the Iraqi city of Najaf, and the results were obtained after taking repetitions in each workshop, and we obtained the average results as Table 1. Table (1) showed the gases (HN_3, NO_2, SO_2, SIH_4, H_2, CO). The gases were measured using the Meter 2012 - Gray wolf device, which contains two sensors specialized for measuring the aforementioned gases.

Tabl1 (1) shows the results of the gases that were measured in the goldsmitth's

Sample	Group	Month 10	Month 11	Month 12	Month 1	Month 2	Month 3	Mean	Std	P(value)>F
SIH_4	w	0.13	0.13	0.12	0.14	0.13	0.11	0.131	0.0083	
	c	0.12	0.12	0.13	0.14	0.11	0.12	0.1245	0.00686	0.01688
NH_3	w	0	0.1	0.2	0.2	0.1	0	0.09	0.07182	
	c	0	0	0	0.1	0	0	0.015	0.03663	1.75E-04
CO	w	9.3	10.3	8	8.5	11.6	8	9.29	1.66509	
	c	3.3	5.9	6.1	6.2	4.3	7.3	5.38	0.78579	1.40E-11
H_2	w	4	3	3	4	2	1	2.95	5.78996	
	c	1	2	3	1	2	2	1.75	0.55012	0.36198
NO_2	w	0.09	0.09	0.09	0.1	0.11	0.11	0.0965	0.00745	
	c	0.09	0.09	0.09	0.11	0.09	0.09	0.0945	0.00826	0.42626
SO_4	w	0.1	0.1	0	0.1	0.2	0.1	0.1	0.07947	
	c	0	0	0	0	0	0	0	0	1.85E-06

RESULTS AND DISCUSSION

The table shows (1) As for SIH_4, its average concentration was 0.1305 ppm, higher than the concentration of the control chambers, 0.1245 ppm, as in Figure A, and higher than the permissible limit of 0.05 ppm in the Electronics and technology industry (OSHA). And the concentration of NH_3 is 0.09 ppm, and higher than the concentration of the control rooms, whose concentration is 0.015 ppm, as shown in Figure B, and higher than the permissible limit of ppm 0.003 in various industrial and chemical sources. The highest concentration of CO gas as an average of 9.29 ppm is due to the high concentration of gas due to the incomplete combustion of fuel resulting from fossil fuels used in the workshops and higher than the limit measured in the control rooms, which was 5.38 ppm, and as in Figure D, it shows the result of a comparison between the workshops and the control rooms and that the concentration of CO was greater than the recommended limit of 9 ppm [15]. The rate of H_2 was 2.95 ppm, higher than the concentration of 1.75 ppm in control rooms, and higher than the permissible limit (0.05) in Multiple sources including internal combustion engine exhaust and manufacturing processes (OSHA). It was found that the average concentration of (0.0965) of NO_2 was higher than the concentration of the control chambers, which was 0.0945 ppm and higher than the recommended limit of 0.053 PPM in the (EPA). The burning fuel that contains a high amount of SO_2 is a source for supplying this gas, but the concentration limits of this gas in these workshops were 0.01 ppm higher than the result of the control rooms, which was equal to 0 and within the recommended limits in Table 2 and according to the specifications and specifications in (EPA).

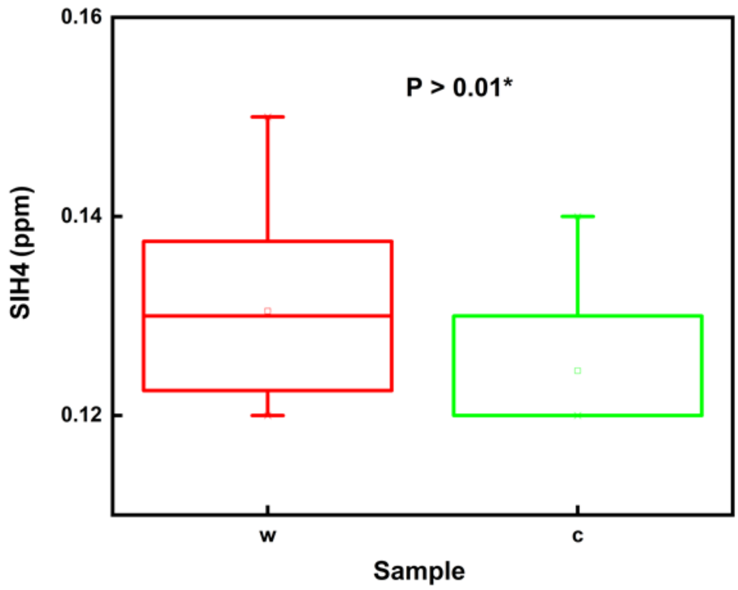

Figure A shows the difference between W workshops and C controls

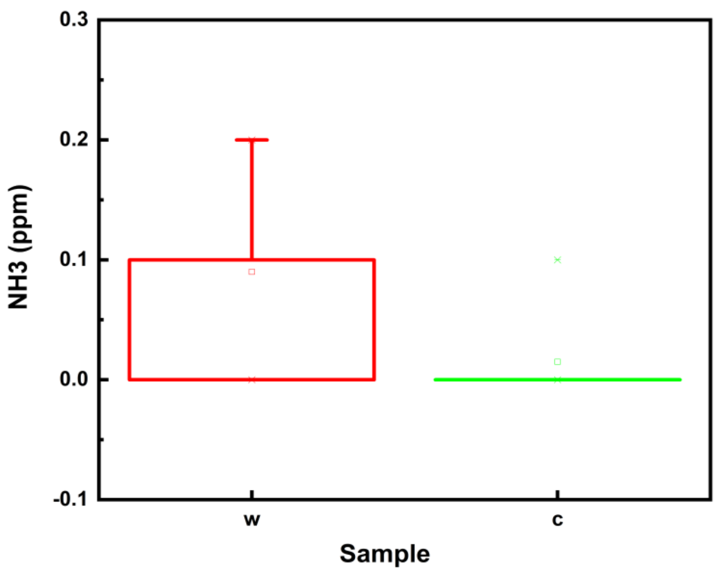

Figure B shows the difference between W workshops and C controls

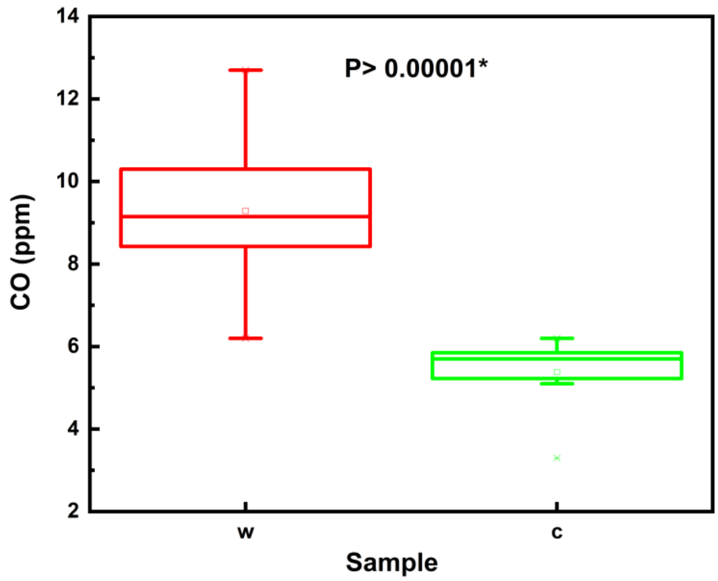

Figure D shows the difference between W workshops and C controls

Gas	***Maximum Allowable Indoor Concentration (ppm)***	***USA*** [16]	***UK***[17]	***Canada***[17]	***Afghanistan***[17]	***Haiti***[17]	***workshops***	***control***
SiH_4	0.05 [18]	0.05	0.05	0.05	0.05	0.05	0.1305	0.1245
HN_3	0.003 [17]	0.003	0.003	0.003	0.003	0.003	0.09	0.015
CO	9 [16]	9	10	25	25	25	9.29	5.38
H_2	0.5[18]	0.5	0.5	0.5	0.5	0.5	2.95	1.75
NO_2	0.053 [16]	0.053	0.2	0.05	0.15	0.15	0.0965	0.0945
SO_2	0.02 [16]	0.5	0.2	0.13	0.5	0.5	0.1	0

In this paper we will discuss the limits of indoor combustible toxic gases, which are emitted from various sources, such as internal combustion engines, systems and other industrial processes. The gases that will be discussed in this paper include nitrogen dioxide sulfide, hydrogen sulfide, carbon monoxide, silicon hydride, and hydrogen nitride. The maximum allowable amount of each indoor gas has been defined in many countries including the United States, United Kingdom, Australia, Canada, Afghanistan and Haiti. Legal limits for these gases are carefully assessed and updated periodically based on recent scientific evidence. The sources of these gases vary greatly and are emitted from various industrial and domestic sources. These gases are considered toxic and flammable in high concentrations and can lead to serious health damage and damage to building infrastructure. It is important to understand these legal limits and the sources from which these gases are emitted, and to provide safe working conditions inside buildings to protect public health and safety. Therefore, governments, institutions and individuals must take all necessary measures to achieve this. The table contains information about toxic gases that can accumulate in closed places and the maximum permissible concentrations in indoor air. The table includes six different types of toxic gases, namely HN3, NO2, SO2, SiH4, and CO. This information has been compiled from various sources such as the US Environmental Protection Administration, Occupational Health and Safety, World Health Organization, and others. The information in the table shows the maximum toxic concentrations of each gas in indoor air in parts per million (ppm), and the sources from which these gases can be emitted. The table also shows the legal limits for the concentrations of these gases in some major countries such as the United States, the United Kingdom, Australia, Canada, Afghanistan and Haiti. In general, this information can be used to determine the potential health risks of exposure to toxic gases inside buildings and to assess the current state of indoor air in homes, offices, industrial facilities and laboratories and others. This information can also be used to set regulations and laws to reduce exposure to toxic gases in the indoor air and to maintain the safety of workers in industrial facilities and laboratories. It can be noted that the table contains information on permissible levels of exposure to a specific group of toxic gases in the indoor air in a number of countries. The table includes information on the following gases:

For SiH4 gas, it can occur in the electronics and nanotechnology industries, and the maximum allowable limit in indoor air is set at 0.05 ppm according to OSHA. It is important to note that this gas can be very dangerous when exposed in large quantities, and can cause serious poisoning.

1- Ammonia (NH3): The table shows that the highest allowable level for the concentration of ammonia in indoor air is 0.003 parts per million (ppm) in the United States and approved by the Occupational Safety and Health Administration (OSHA). No permissible level of ammonia concentration in indoor air is specified in the other countries mentioned in the table.

2- Carbon monoxide(CO) gas is classified as one of the most dangerous and toxic gases present in indoor air, and it can result from the exhausts of internal combustion engines, heating and ventilation equipment, and incomplete combustion. And the maximum allowable level in indoor air is set at 9 parts per million according to the EPA.

3- Nitrogen dioxide (NO2): The data in the table indicate that the highest permissible level of nitrogen dioxide concentration in indoor air is 0.053 parts per million (ppm) in the United States and approved by the Environmental Protection Agency (EPA) and 0.053 parts per million (ppm). 2 ppm in the UK and validated by HSE, 0.04 ppm in Australia, 0.05 ppm in Canada, 0.15 ppm in Afghanistan, Haiti, Bangladesh and Ethiopia and validated by the World Health Organization (WHO)

4- Sulfur Dioxide (SO2): The data in the table show that the highest allowable level of sulfur dioxide concentration in indoor air is 0.02 parts per million (ppm) in the United States approved by the Environmental Protection Agency (EPA) and 0.2 ppm in the UK

5- Hydrogen gas H2: It is one of the flammable gases that is present in nature and in specific proportions. An increase in the percentage poses a great danger to the environment in which it exists. The percentage of permissible limits in internal environments is 0.05 PPM, as in developing countries in Table 2.

Common toxic gases in indoor air have been studied and the maximum allowable limits for each of them have been determined in different countries. In this context, this research paper aims to discuss the toxic gases SiH4 and CO, and to clarify the results that have been reached in the previous table. It is possible to notice the differences and inter-differences in the results in Table 2 between workshops and controls and compare them with the results of developing countries for the internal environment.

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