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Relationship between Temperature, Humidity, Oxygen and Carbon Dioxide in the Air of Yadavaran Oil Field and Neighboring Cities (Ahvaz and Azadegan Plain)

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Abstract

Background: One of the most important problems in human life is air pollution and its effects on human health. The aim of this study was to investigate the amount of carbon dioxide in the air and its relationship with temperature and humidity and compare the allowable threshold of carbon dioxide concentration in Yadavaran oil field with neighboring cities including Ahvaz and Azadegan plain.

Methods: In order to measure temperature, humidity, oxygen and carbon dioxide in this Yadavaran oil field and the cities of Ahvaz and Azadegan plain, 15 stations were considered each. Parameters were measured using ALTAIR 4X and Trotec BZ30 devices. SPSS software version 18 was used for data between B and Pearson and Spearman coefficients were used for correlation analysis of the measured data.

Results: The results showed that the temperature and carbon dioxide in the air of Ahvaz was higher than Yadavaran oil field and Azadegan plain area ($P<0.05$). There was no statistically significant difference in oxygen and moisture levels in the study areas ($P>0.05$). Correlation analysis showed that there was no positive and significant relationship between the parameters ($P>0.05$), But there was a significant relationship (Pearson correlation= 0.990; Spearman's correlation= 0.885) between the correlation between carbon dioxide and temperature ($P<0.05$).

Conclusion: The results of this study showed that Yadavaran oil field is not affected by the air of neighboring cities and its temperature and carbon dioxide are lower than Ahvaz industrial city. Based on the results of Pearson and Spearman coefficient analysis, spatial changes studied in Yadavaran oil field, Ahvaz city and Azadegan plain region showed that meteorological parameters of temperature and carbon dioxide have no effect on humidity and oxygen.

Keywords: Air Pollution; Carbon dioxide; Health human; Yadavaran Oil Field; Khuzestan Province

Introduction

Many definitions have been proposed for air pollution. According to other definitions, "air pollution" is the presence of one or more pollutants or compounds in the open air or indoor air in amounts and for a period of time that may cause harm to human, plant or animal life or property. "Or unreasonably interfere with the comfortable enjoyment of life or property." According to the Environmental Protection Agency of Iran, air pollution is the presence and spread of one or more pollutants, including solid, liquid, gas, radioactive and non-radioactive radiation in the open air in the amount and duration of its quality that is harmful to humans and other living organisms. Or change plants or artifacts and buildings [1,2].

The harmful effects of air pollution on human, animal and plant health, as well as the destruction of cultural materials and artifacts have been the subject of many studies. In recent decades, the issue of acid rain in the ozone layer and global warming and its effects on ecosystems and ultimately humans have been studied and discussed by scientists [3,4].

Air pollutants such as carbon monoxide, sulfur dioxide, nitrogen oxides, volatile organic compounds, ozone, heavy metals and reparable particulate matter 2.5PM and 10 PM in terms of chemical composition, reactive properties, release and diffusion, degradability time and ability to expand in Far or near distances are different [5]. Air pollution affects human health both acutely and chronically, as well as a number of different organs and systems [6]. These effects include high or partial respiratory irritation, chronic heart and respiratory disease, lung cancer, acute respiratory infections in children and chronic bronchitis in adults, exacerbation of previous lung and heart disease, and asthma attacks [7].

Emissions of carbon dioxide as one of the greenhouse gases as one of the causes of air pollution are increasing with the development of industry [8]. Carbon dioxide in the air is a very stable and non-flammable compound. The compound is soluble in water in the form of carbonic acid (H_2CO_3) and is widely used in various industries, especially in the storage, freezing and canning of agricultural and medical products. Carbon dioxide is produced by the processes of combustion, fermentation and decay of organic matter [9]. At high concentrations, carbon dioxide has irritating effects on the central nervous system, while excessive levels cause depression [10]. NIOSH (1976) found in a study that exposure to 10% carbon dioxide for about 1.5 min caused neurological symptoms such as eye flicker, psychomotor stimulation, and uncontrolled muscle contraction. There

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was also an increase in muscle contraction, respiratory rate, euphoria, and impatience [11]. Exposure to 30% carbon dioxide within 5-10 min can cause loss of consciousness [12]. The effects of hypercapnaia on respiratory function occur immediately and at relatively low concentrations (1% carbon dioxide). After exposure to 5% carbon dioxide, an increase in respiration rate, an increase in respiratory volume, amplitude and respiratory rate, and a decrease in respiratory air transport appear [13,14].

The aim of this study was to investigate the amount of carbon dioxide in the air and its relationship with temperature and humidity and compare the allowable threshold of carbon dioxide concentration in Yadavaran oil field with neighboring cities including Ahvaz and Azadegan plain.

Methods

This study was conducted in 2017 in Yadavaran oil field and cities of Ahvaz and Azadegan plain in Khuzestan province. Yadavaran oil field is one of the oil fields west of Karun in Iran, which is located in Khuzestan province, 70 km southwest of Ahvaz and north of Khorramshahr. In order to measure temperature, humidity, oxygen and carbon dioxide in this oil field, all existing neighborhoods such as operational and exploitation areas, residential camps, administrative, executive camps and exploitation units were considered. Regarding the cities of Ahvaz and Azadegan plain, 15 stations were considered each.

The research parameters were measured during the working and office hours of the day in spring and June. In this study, the temperature, speed and direction of the prevailing wind in the region, humidity, oxygen, buildings and obstacles, and the distance and proximity of emission sources and altitude from the ground were considered to measure the amount of carbon dioxide. Also, due to the fact that carbon dioxide is heavier than air, the gas was measured close to the ground at a height of 2 to 3 meters. In the case of ambient carbon dioxide measuring stations, having a minimum distance of 20 m from the green space, a minimum distance from obstacles twice the height of the barrier, no air flow restriction at 270 degrees around the station, being away from any source of pollution such as chimneys and the like. It was taken into account so that the location of the station was as representative of the surrounding areas as possible. In this study, wind speed on sampling days was very low and stable and uniform and the prevailing wind direction was northwest-southeast. The prevailing wind direction in the area was determined by a wind gauge installed at a height of 6 meters. ALTAIR 4X and Trotec BZ30 devices were used to measure carbon dioxide, carbon monoxide, oxygen, temperature and relative humidity. ALTAIR 4X was manufactured in the United States by which carbon monoxide, oxygen and hydrogen sulfide gases were measured in the range of 0-0.99 ppm, 0-30% and 0-200 ppm, respectively. The accuracy of this device was 1 ppm for carbon monoxide and hydrogen sulfide and 0.1% for oxygen. Temperature, relative humidity and carbon dioxide were recorded and measured by the Trotec BZ30. This device is made in Germany. The range of application of this device to measure temperature, relative humidity and carbon dioxide was -5 to +50°C, 0.99-1.9% and 0-999.9 ppm, respectively. Also, the measurement accuracy of Trotec model BZ30 for temperature was 0.1±0.5°C, relative humidity was 0.1% and carbon dioxide was 1 ppm. In order to increase the reliability of environmental factors, sampling was performed in each place with 3 replications.

SPSS software, version 18 and one-way ANOVA were used to correlate the obtained data and compare it with the threshold of international standards. Pearson and Spearman coefficients were used to analyze the correlation of the measured data. Calculations of carbon values, graphs and tables were also performed using Excel software.

Result and Discussion

Grounded on the magnitude of the public health impact, it's certain that different kinds of interventions should be taken into account. Success and effectiveness in controlling air pollution, specifically at the original position, have been reported. Acceptable technological means are applied considering the source and the nature of the emigration as well as its impact on health and the terrain. The significance of point sources and non-point sources of air pollution control is reported by Schwela and Köth- Jahr. Without mistrustfulness, a detailed emigration force must record all sources in a given area. Beyond considering the below sources and their nature, geomorphology and meteorology should also be considered, as stated preliminarily. Assessment of the control programs and styles is frequently decided from the original to the indigenous and also to the global scale. Air pollution may be dispersed and transported from one region to another area located far down. Air pollution operation means the reduction to respectable situations or possible elimination of air adulterants whose presence in the air affects our health or the environmental ecosystem. Private and governmental realities and authorities apply conduct to insure the air quality. Air quality norms and guidelines were espoused for the different adulterants by the WHO and EPA as a tool for the operation of air quality. These norms have to be compared to the emigrations force norms by unproductive analysis and dissipation modeling in order to reveal the problematic areas. Supplies are generally grounded on a combination of direct measures and emigrations modeling.

Statistical analysis of minimum, maximum, mean, standard deviation, standard eror, variance, skewness and kurtosis of the studied parameters in the three regions are presented in Table 1. The results showed that the temperature and carbon dioxide in the air of Ahvaz was higher than Yadavaran oil field and Azadegan plain area ($P<0.05$). There was no statistically significant difference in oxygen and moisture levels in the study areas ($P>0.05$) (Table 2). The amount of carbon dioxide that is expelled from an environment is proportional to the volume of air that exits the environment, which in turn is replaced by fresh air that is replaced by the ventilation system. It fits. Also, the amount of ideal air flow and as a result, the required equipment and facilities in different conditions and under the influence of the activity level, are different and the more intense the activity, the higher the amount of carbon dioxide produced [15,16]. Changes in the amount of carbon dioxide are mainly related to the processes of photosynthesis and combustion. Other gases, such as sulfur dioxide, nitrogen dioxide, and ozone, are found in very small amounts in the atmosphere. Water vapor is also an important component of air, the amount of which varies from region to region [17]. The city of Ahvaz has special conditions due to the rich resources of oil and gas, large metallic and non-metallic industries, cellulose and electricity, as well as hot and humid weather conditions. Also, high consumption of fossil fuels in industry and automobiles, as well as miscellaneous sources such as seasonal dust, relatively high population density with urban traffic, lack of green space in the city and suburbs are the reasons for heavy metal pollution in the soil [18,19]. Large industrial factories such as South Oilfields Company, National Iranian Drilling Company, Steel Industries, Iran National Industrial Group, Auxin Steel, Kavian Rolling, Spanta factories, Shahid Modhaj and Ramin power plants are among the sources of soil pollution in They are the city of Ahvaz [20] (Tables 1 and 2).

Table 1: Statistical analysis of temperature, humidity, carbon dioxide and air oxygen parameters.

	N	Minimum	Maximum	Mean	Std. Error	Std. Deviation	Skewness	Kurtosis	Variance
Temperature	42	30.00	46.00	39.892	0.899	5.826	-0.459	-1.529	33.949
Humidity	42	12.80	27.50	19.854	0.581	3.771	-0.469	-0.678	14.225
Oxygen	42	19.00	20.30	19.885	0.059	0.382	-1.169	0.470	0.147
Carbon dioxide	42	481.00	618.00	533.881	5.485	35.548	0.759	-0.305	1263.717

Table 2: Comparison of temperature, humidity, oxygen and carbon dioxide in the air of Yadavaran oil field with the cities of Ahvaz and Azadegan plain.

Location	Temperature (°C)	Carbon dioxide (ppm)	Oxygen (ppm	Humidity (%)
Yadavaran oil field	33.35±2.45^{a}	495.28±29.55^{a}	19.90±1.06^{a}	22.41±1.05^{a}
Ahvaz	39.76±3.12^{b}	543.34±42.18^{b}	19.56±1.39^{a}	21.56±1.25^{a}
Azadegan plain	37.16±2.77^{c}	470.42±28.95^{c}	20.23±1.45^{a}	19.85±2.77^{a}
* Non-identical letters next to the mean numbers in each column show a significant difference (P <0.05).				

Table 3: Analysis of variance (ANOVA) for temperature, humidity, oxygen and carbon dioxide in the air of Yadavaran oil field with the cities of Ahvaz and Azadegan plain.

Variable	Location	Sum of squares	Degree of freedom	Mean of squares	F Value	P Value
Temperature	Yadavaran oil field	2.250	41	2.011	5.152	0.012*
	Ahvaz	2.324	41	2.221	5.432	0.002*
	Azadegan plain	2.678	41	2.387	6.987	0.043*
Carbon dioxide	Yadavaran oil field	1.665	41	1.254	4.654	0.024*
	Ahvaz	1.743	41	1.324	5.476	0.004*
	Azadegan plain	2.986	41	2.567	5.098	0.012*
Oxygen	Yadavaran oil field	3.453	41	2.965	6.765	0.444^{ns}
	Ahvaz	2.760	41	2.632	7.345	0.139^{ns}
	Azadegan plain	2.955	41	2.654	7.340	0.287^{ns}
Humidity	Yadavaran oil field	1.435	41	1.250	6.122	0.965^{ns}
	Ahvaz	1.345	41	1.120	6.937	0.776^{ns}
	Azadegan plain	2.555	41	2.432	5.946	0.789^{ns}
P Value: *P<0.05; ns: not significant, a: results obtained from one-way ANOVA analysis						

The results of one-way analysis of variance showed that the temperature and carbon dioxide were statistically different under the influence of the studied areas and were slightly different by changing the location of these two parameters (P<0.05), but the humidity and oxygen were not affected by Ahvaz and Azadegan plains. At the time of sampling, there was no significant difference with Yadavaran oil field (P>0.05) (Table 3). The positive effect of carbon dioxide emissions on the average increase of earth temperature has been reported. According to the two-way logarithmic model, with increasing carbon dioxide emissions by one percent, the earth temperature increases by an average of 1.02 percent. According to the linear model, by increasing carbon dioxide emissions by one unit (trillion tons), an average of 0.93°C increases the earth temperature [21]. The use of fossil fuels such as coal increases the amount of atmospheric carbon dioxide. Herding and agriculture are among the activities involved in methane production. The use of fluorocarbons in refrigerators intensifies the greenhouse effect. These days, humans produce greenhouse gases while watching TV, playing computer games, using air conditioners, fan coils, and stereo recorders, turning on lights to wash or iron clothes, heating food in the microwave, and using gas or oil heaters. Because doing this requires electricity and fuel, and the production of these energies it requires fossil fuels. In addition to threatening human health, greenhouse gases can endanger national security in various countries. The rising problem of carbon dioxide in the air is one of the major problems in the world [22,23].

In this study, Pearson and Spearman correlation methods were used to ensure the relationship between the parameters. The results of correlation analysis showed that there was no positive and significant relationship between the parameters (P>0.05), But there

Table 4: Determination of Pearson correlation between temperature, humidity, carbon dioxide and air oxygen parameters in Yadavaran oil field with neighboring cities.

	Temperature	Carbon dioxide	Oxygen	Humidity
Temperature	1	0.990**	0.354	-0.578**
Carbon dioxide	0.990**	1	-0.055	0.111
Oxygen	0.354	-0.055	1	-0.539**
Humidity	-0.578**	0.111	-0.539**	1
**. Correlation is significant at the 0.01 level (2-tailed).				

Table 5: Determination of Spearman's correlation between temperatures, humidity, carbon dioxide and air oxygen parameters in Yadavaran oil field with neighboring cities.

	Temperature	Carbon dioxide	Oxygen	Humidity
Temperature	1.000	0.885**	0.537**	-0.346*
Carbon dioxide	0.885**	1.000	-0.057	-0.022
Oxygen	0.537**	-0.057	1.000	-0.643**
Humidity	-0.346*	-0.022	-0.643**	1.000
*. Correlation is significant at the 0.05 level (2-tailed) **. Correlation is significant at the 0.01 level (2-tailed)				

was a significant relationship (Pearson correlation= 0.990; Spearman's correlation= 0.885) between the correlation between carbon dioxide and temperature (P<0.05) (Tables 4 and 5). Spatial changes studied in Yadavaran oil field, Ahvaz city and Azadegan plain region showed that meteorological parameters of temperature and carbon dioxide have no effect on humidity and oxygen. Of course, this may be due to the lack of data measurement in summer, autumn and winter. Many researchers have confirmed the association between meteorological data such

as temperature, wind speed, and relative humidity with increasing concentrations of air pollutants including sulfur dioxide, carbon monoxide, nitrogen dioxide, and particulate matter [24-27]. In other study, due to the significant relationship between some meteorological parameters of Tehran metropolis and pollutants, it was found that meteorological variables (air temperature, relative humidity, wind speed, precipitation and dew point) can increase the level of pollution [27].

Conclusion

The results of this study showed that Yadavaran oil field is not affected by the air of neighboring cities and its temperature and carbon dioxide are lower than Ahvaz industrial city. Based on the results of Pearson and Spearman coefficient analysis, spatial changes studied in Yadavaran oil field, Ahvaz city and Azadegan plain region showed that meteorological parameters of temperature and carbon dioxide have no effect on humidity and oxygen. According to the obtained results, the concentration of carbon dioxide in different areas of Yadavaran oil field was acceptable. Due to the fact that carbon dioxide is considered as one of the risk factors in the workplace, it is recommended that the concentration of carbon dioxide in the workplace in various industries and small and large jobs be studied.

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Competing interests

The authors declare that there are no competing interests.

Ethical considerations

Ethical issues have been completely observed by the authors.

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