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Research Article

Investigating the Emissions amount of Gaseous CO and CO2 in Gas Pressure Regulating Stations in Razan City and Calculating the Emission Factor

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ABSTRACT

Today the world facing environmental pollution that is the most important problems. This study aimed to investigating emissions of gaseous pollutants dioxide and monoxide carbon through the chimney of gas pressure regulating stations and calculating the emission pollutants factor in 2014 and in summer and fall within the city of Razan located in Hamedan province was conducted. For this purpose, 10 gas pressure regulating station in the city of Razan was chosen as the population and gas sampling took from heater chimney in stations at three consecutive monthsand in twice a day by a gas meter.The results showed that the concentration of pollutants at all of gas pressure regulating stations is as Iran Environmental Protection Agency (EPA) standards.

Also the study emissions factor calculated and the results is less than the standard provided by the America Environmental Protection Agency. To test the hypothesis of relationship between carbon monoxide emissions into the atmosphere and the amount of oxygen consumed in the combustion process the t-test and linear regression was used and the results indicate the significant relationship between these two quantities.

Keywords: pollution, gaseous pollutants, Razan city, emission factor

INTRODUCTION

Emission of gaseous pollutants in the air is one of the major risks that threaten the environment and human health. The type and quality of fuel in the combustion process, the amount of air used in the combustion process and the type of technology used in making the combustion system is effective in rates of emissions. Therefore, any change in these factors contributes to the quality of the combustion process and as a result will also change emissions. (Nezhadpoor and Rafsanjani et al., 2013) Air pollution means a mixture of gases and particles of the air that reduce the quality of the air. Vehicles, aircraft and construction industries and factors are the air pollutants.

Air pollution is side effects of industrial activities. By focusing on the air pollutants caused from industrial activities that most important of them can diffuse in form of aerosols, evaporation of hydrocarbons, greenhouse gases and acid gases. The leaking hydrocarbons and evaporation of them, burning sulfur and acid gases, incinerators, blasting and excavation activities are the most important sources of air pollution in this section (Jafarzadeh, 2005). Urbanization and urban development are along with increasing population and development of industrial activities and uncontrolled use of fossil fuels has increased sharply pollution that the consequences of it primarily affects the residents of cities in form of diseases of respiratory, heart and lung diseases, and global problems such as acid rain, ozone destruction and global warming stressed.

The main pollutants include carbon monoxide, nitrogen oxides, hydrocarbons, sulfur oxides and aerosols are the cause of more than 90% of air pollution (Allali, 2012).

Over the past 15 years,the number of studies of health effects of air pollution have increased and is now well accepted that exposure to air pollution linked to a wide range of acute and chronic health effects from subtle physiological disordersto mortality due to respiratory and cardiovascular disease, in Iran emissions of air pollutants in many cities, including Tehran, Mashhad, Isfahan, Arak, Ahvaz, Shiraz and Tabrizreached a high degree of risk and the most important issue today has attracted many scientistsis global warming caused by greenhouse gases, as put the world to the brink of a major environmental and human disaster (Shamsuddini et al., 2012).

Goudarzi et al. in 2013presented a study entitled "Investigating distribution and pollutants emissions factor released from chimney of Raminthermal power plants".The results indicate that except the concentration of sulfur oxides, other pollutants are as the environmental standards (Goudarzi et al., 2013)

Almasi et al. published an article in 2013 entitled "Evaluation of emissions released from chimneys of Kermanshah Saman Cement factory. Based on the results of the study, the concentration of gaseous pollutants CO, CO2 is higher than the standard. (Almasi et al., 2013)

Karimiet al in 2007, an article entitled "Assessing monoxide and carbon dioxide emissions and aerosolsreleased". The results showed that based on the ambient air quality standards in Nigeria, the corresponding gas concentration was good.Velisoet al in a 2009 article entitled "predicting gaseous pollutants emissions of combustion in heating furnace from tube type.

8 furnaces in the project for a year and sampling was twice a month and the results indicate high concentrations dioxide gas emissions and carbon monoxide.

Air pollution in urban and industrial areas is the most important environmental problems that threaten human health. Among these pollutants, aerosols per every increase of 10 micrograms cubic meter, air mortality 1 to 3 percent increased and purpose of this study was to investigate the prevalence of industries annoying Shiraz city in terms of aerosols.

MATERIALS AND METHODS

The study of air pollution caused by the withdrawal of gaseous pollutants such as monoxide carbon and dioxide from chimney of heater in each station used to control gas temperature. Since the study area is mountainous and cold has a high potential inversion phenomenon, in the cold season investigating the amount and pollution control is necessary.

Introduction of the study area

This study in 10 gas pressure regulating station in the city of Razan and its functions were performed.Razan city on the main road Hamedan to Tehran is located. From the north and northwest to Qazvin province fromthe south to Famenin city from the east to Markazi province, and fromthe west to city Kabudrahang is limited. In addition to Razan city, two city of Qorveh Darjazin and Damagh in the Razan city located.To control the temperature of the gas at the station, the heaters used for heating and increase the gas temperature to about 40 degrees Celsius andprotecting against frost and the formation of hydrates in the cold or sudden pressure drops.

Its heating fuel are of natural gas type and is mostly methane, as a result of incomplete combustion in chamber heater substantial amounts of various pollutants gases such as dioxide and monoxide carbon that sampling from the exhaust flue of the heaters in three consecutive months (September-October-November) was performed. Sampling by kane-455 gas meterwas done.The device has ability to online measure the concentration of the desired pollutants, efficiency of heater and the percentage of oxygen with high accuracy.

The device to measure the concentration of pollutants gases CO-CO2 designed by England Kane Company and the ability to measure the O2 temperature and pressure in gas emissions from

heater chimney as onlineand straight.After the sampling, the calculation of the emission factor and potential of pollutants global warming and to analyze and
evaluate the results Excel & SPSS statistical software was used.

Calculations of the pollutants emissions factor

The quantity of **pollutants** emissions based on mass of released gas to the consumed fuel energy.

$$\text{EF Emission factor} = \frac{\text{Mg Pollutants}}{\text{Gr Consumed fuel}}$$

RESULTS

The results shown in (Table 1) indicate that quarterly average of concentration of CO in whole gas pressure regulating stations for research is as Iran Environmental Protection Agency's standard. The above charts show that the highest concentration of carbon monoxide in Oman pressure regulating stations and Razan industrial town and about dioxide carbon in Razan station.

Table 1 Average concentration of carbon monoxide and carbon dioxide in the research process for statistical analysis and comparison shows environmental standards. The results of measuring study pollutants have been shown in Table 1. Average concentrations of CO and CO2 had shown in Tables 2 and 3.

Graph 1 - Diagram of distribution
Quarterly average concentration of CO

Graph 2 - Percentage distribution of quarterly average concentration of CO2

Table 1. The results of the study measured pollutants

Sampling site	Quarterly average concentration of CO2	Quarterly average concentration of co	Standard Grade 1	Standard Grade 2
	PPM	PPM	CO	CO
Khorondeh	23052	43	304	435
Damagh	14404	51		
Oman	9608	60		
Qorveh Darjazin	23137	39		
Razan	144922	40		
Ekbatan Cement	40192	52		
Saravak	20333	57		
Asphalt Factory	7997	60		
Razan Industrial Township	27096	58		
Ahak Razan	28051	53		

Table 2. Average seasonal concentrations of CO and 2CO

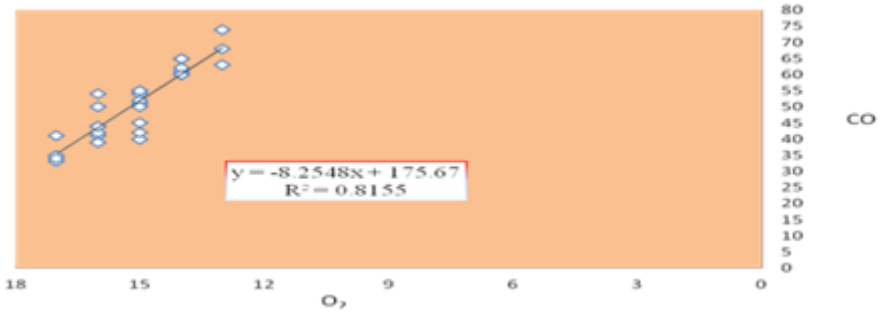
Sampling site	Average concentration of CO in the cold season PPM	Average concentration of CO in warm season PPM	Average concentration of CO2 in the cold season PPM	Average concentration of CO2 in the warm season PPM
	55	37	108878	43433
Khorondeh	54	50	128770	25745
Damagh	63	54	148970	11943
Oman	41	35	99229	19681
Qorveh Darjazin	44	35	100553	80755
Razan	56	52	129354	51815
Ekbatan Cement	60	55	144165	7170
Saravak	74	53	148241	6621
Asphalt Factory	63	56	13270	5785
Razan Industrial Township	60	50	132213	53090
Ahak Razan				

The above table reflects the high concentration of pollutants investigated in cold season compared to the warm season due to fluctuations in gas flowand disruptions in the stoichiometric ratio and the incomplete combustion of fuels.The average concentration of CO 2 and CO in the cold season compared to the warm season in all gas pressure regulating stations has been further investigated.

Table 3. The quarterly average pollutants emissions factor

Quarterly average pollutants emissions factor (Fuel Mg / other pollutants)					
No	Station	Emission factorCO	Emission factor2 CO	StandardCO / EPA	Standard$_2$CO /EPA
1	Khorondeh	1.3	2200	2.44	34.91
2	Damagh	1.1	2650		
3	Oman	0.73	1990		
4	Qorveh Darjazin	0.83	1875		
5	Razan	1.8	2300		
6	Ekbatan Cement	0.66	1685		
7	Saravak	0.79	2700		
8	Asphalt Factory	1.3	2350		
9	Razan Industrial Township	0.73	1700		
10	Ahak Razan	0.91	1900		

According to the above tables dioxide and monoxide carbon emissions factor in the statistical society is less than the standard. Diagram of linear regression show an inverse relationship between excess airs changes with the monoxide carbon produced in the combustion process that actually monoxide carbon is reduced by increasing the percentage of excess air (Graph 3).



Graph 3- changes CO, O2

Pearson correlation coefficient is a quantity to measure the intensity of the relationship between the two variables. Whatever the number is closer to 1 and there is more relationship between the variables. Minus sign indicates an inverse relationship between the variables. The results of this study show a significant inverse relationship with high intensity in the study.

DISCUSSION AND CONCLUSIONS

One of the major sources of environmental pollution, particularly air pollution related to industrial sources, especially oil and gas industry and also industries that lead to a variety of environmental problems, including respiratory diseases, contamination of rivers and seas. Certainly one of the most effective methods to identify the sources and prevent the spread of themis at outbreak level. According to a survey conducted in this study, following results were obtained. Concentration of CO in the gas pressure regulating stations is as standard of Iran Environmental Protection Agency. The average concentration of CO2 and CO in the cold season compared to the warm season in all gas pressure regulating stations has been further investigated. Due to increased emissions of research pollutants in cold seasons, pressure and flow fluctuations in natural gas and changes in the ratio of stoichiometric composition of the air-fuel and reaction progress towards the combustion is incomplete. The emission factor based on the mass of pollutants in relation to fuel consumption mass is defined and CO2 and CO emissions in this research through emission factor are explained and are less than the EPA standard. Optimum area shown is the most ideal conditions for combustion of natural gas in the heater, in the area complete combustion takes place with the highest efficiency and the lowest amount of monoxide carbon. Lambda quantity represents ratio of air - fuel mixed in real conditions to stoichiometric conditions and takes place in the case of complete combustion,there is minimum monoxide carbon and maximum efficiency in heather and its valueis equal to 1. In this mode, the combustion reaction does not require additional air. If you increase the excess air lambda rate increased and reactionfrom the optimum exist heater output dropped is not economically and in the case a reaction proceed to incomplete combustion and increased levels of monoxide carbon and reduce the lambda due to increased combustion chamber pressure caused by the accumulation of oxygen molecules that have not participated in combustion reaction heater explosion is possible.Of course,in the industry to avoid a sudden increase in pressure the safety valves are used. In this study, by adjusting the air vents, excess amount of optimum air in the heater of Razan pressure regulating stations for exposure in optimum area, 15% has been estimated. Emissions of monoxide carbon in the study by Mr. Keshavarz et al in 2011 in Ilam gas pressure regulating stations and also Moradi in 2013 in Darkhoein oil and gas operation unit heaters located in Khuzestan province, according to resultsit were compared with the average concentration of monoxide carbon, 10 and 15 PPM estimated, that with respect to this research has lower amount, but is an environmental standards. While Almasi and colleagues et al in 2011in Kermanshah cement plant chimney showed that the average

concentration of carbon monoxide 95PPM was estimated, that is higher value than the researchbut is as environmental standards. Nazari et al in 2009carried a study entitled “determining the emission factor of gases emitted from external combustion of fossil fuel power plants in Iran and compared with the North American countries. Annual estimates dioxide carbon emissions factor about 600 grams per kWh that compared with the investigation (300 g kWh) is much higher. Goudarzi et al in 2013 published a research on “distribution and emission coefficient of pollutants emitted from chimney of Ramin thermal power plants and annual estimationofemission factor of dioxide carbon gas about 100 grams per kilowatt hour estimated that in compared to the study (300 grams per kWh) has less amount and regarding to the monoxide carbon gas rate of 1.0 kWh is estimated that in ompared with the study (0.25 grams per kWh) has less value.

Suggestion

1. one way to reduce the amount of monoxide carbon adding additional air to the fuel in the combustion chamber. Hence it is recommended to reduce the release of monoxide carbon from heaters; gas pressure regulating stations used at least 15% excess air.

2. The use of filters for the adsorption of carbon monoxide of activated charcoal kind or membrane filters with Nano technology by installing at the mouth of the chimney recommended a high ability in separating the emissions from natural gas.

3. It is recommended to supply heating gas in pressure regulating stations instead of using fossil fuel heaters used in catalytic heaters because flameless catalytic reaction with the platinum through temperature about 900 F produces and pollutants such as monoxide carbon gas produced by incomplete combustion, is not produced.

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