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Original Research Article

Prediction the Effects of Tehran Air Pollutions on Increasing the Number of Pulmonary Diseases

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Abstract

Air pollution is one of the main environmental problems in Tehran capital of Iran. Every day, a huge volume of exotic and destroying gases and different kinds of dangerous pollutants are added to the city air by cars, heavy vehicles, motorcycles, small workshops activities and garbage burners of hospitals. A hazardous complex is made by different types of carbon and nitrogen monoxides, sulfurs and solid particles of lead create such a harmful complex which is able to expose civilian's lungs, eyes, skin to kill poisonous compounds made by the secondary and primary reactions. In fact, there is an exceeding number of those suffering from cancer, eyes, skin and pulmonary diseases. Carbon monoxide, nitrogen and sulfur oxides, ozone, and floating solar particles were studied as a monthly average within 12 months of a five- year statistical period. For each month the amount of the correlation the coefficient the hazardous pollutions with monthly average the number of pulmonary patients in Imam Hussein Hospital located in the east of Tehran has been determined in the same five- year- statistical period. Neural network models have been applied to predict the pollutants concentration for the next months. Since the correlation coefficients were in the best conditions, regressive relationships have been applied to predict the number of patients in Tehran and estimated the rate of the environmental destructive effects.
Keywords: Tehran air pollution, pulmonary patients, predicting pollutants.

INTRODUCTION

Tehran is known as the largest and the most populated city of Iran. The area of Tehran is 730 km² and scores 14 million populations. Geographically, Tehran located in the north of Iran and the south of Alborz chain mountain and is like a dent surrounded with range of mountains and polluted air is trapped inside it and holds no main aspiratory canals. In fact, the exceeding trafficking in Tehran produces different kinds of carbon oxides, sulfurs, nitrogen and other perilous gases, lead and floating particles all directing into increasing the pollution condense [1]. Considerably, the 90% of the whole pollutions are spread from vehicles and motorcycles, the rest 10% is exhausted by stable sources [2]. Based on present study 27 people daily die because of air pollution of Tehran. Moreover, it has been reported by the global bank, yearly 3 million of people lose their lives because of air pollutions and 90% of them scored in developing countries [3]. These deaths are particularly caused by asthma, bronchitis, respiratory difficulties, heart attacks and different respiratory allergies occurred as a result of breathing in the polluted air. Fig1 Tehran map [4].

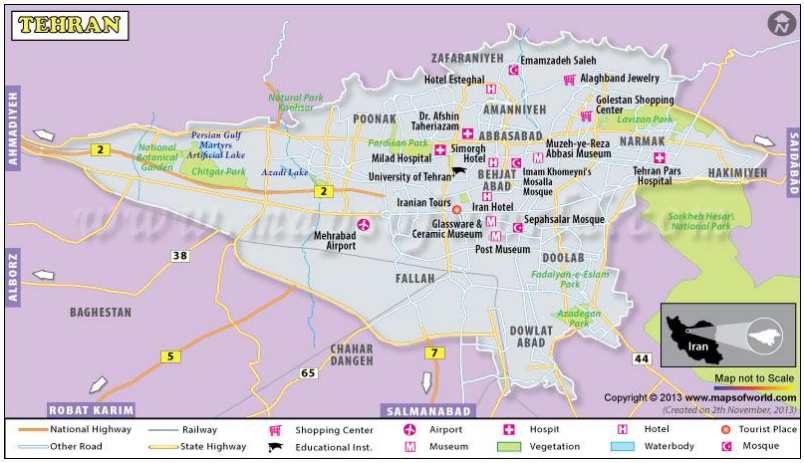


Fig-1: The scheme of Tehran map

State of the Problem

A Review on Authorities Plans to Reduce Air Pollution

Since the late of November 2005, the program of odd and even vehicles plate number has been held in Tehran in an extent of 74 km² expanded to 200 km² in 2011 [6]. This district embraces 120 entrance spots and by committing vessel thoroughfares as the limitation boarder and has caused many problems in parking at the sides of the streets, because lots of drivers after being stop from driving into those districts, tempt to park at the sides of the vessel throughways of the limitation boarder and the auxiliary ones [7]. Consequently, this plan prevents trafficking from the 700 to 800 cars and has decreased 20 to 30% of traffic and cutting down air pollution [8]. Figure-2 represents the traffic statistics of 7 crosses during rush hours in two phases of before and after applying the trafficking of odd and even cars' plates and implies the traffic declining. As a matter of fact, it has effectively dwindled air pollution.

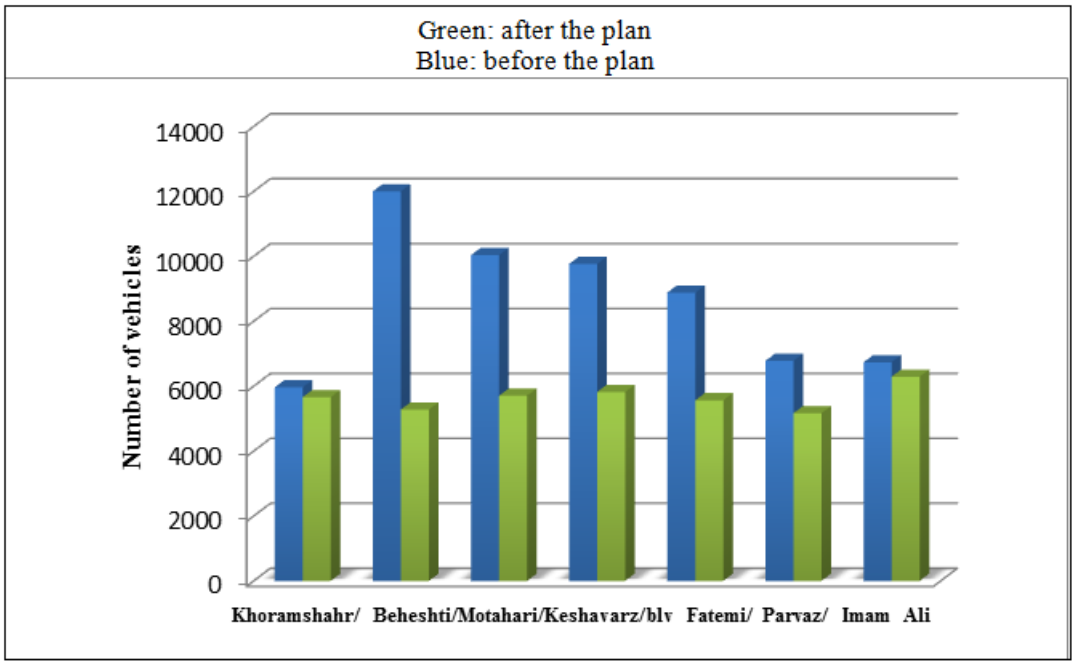


Fig-2: Graphically changes of daily traffic in main streets in Tehran before and after applying the plan

Exercising the Plan Limitation of BRT (Bus Rapid Transport) in Tehran

Since the middle of the August 2007, due to the high increases of air pollutions, the bus rapid transport (BRT) with the 50 km^2 extent was practiced. First, it was successfully handled in the direction of Tehran Pars to Azadi and then developed into 10directions with the extent of 370 km^2. In conclusion, one hundred people daily get on them. This plan stops trafficking of 20000 cars on the average and diminished a 30% of traffic and conducts in abating air pollutions.

Limiting Cars Fuel Consumption

Iranians are known as the most highly consumers of energy especially the petroleum worldwide and the authorities of the country always put the blame on the drivers. The shortage or the absence of some foundations is regarded as the main reasons of Iranians' making records in petroleum consumption. Although Iranians inevitably consume the petroleum the most, the car manufacturing directors are also responsible for supplying the fundamental grounds of slowing down the consumption. Within the last few years, the government have tried to lessen the cars yearly consumption of petroleum through a monthly share and rising up the price. This plan was successful to some extent. Although it was not a suitable solution to fall off its consumption. In the summer of 2007, petroleum was planned to be monthly distributed to the consumers through electronic cards and in the autumn of 2010, its price was considerably increased. Eventually, all these plans have not been worked to alter the position of Iran as the top consumer of petroleum. Totally, this plan stopped the trafficking of 5000 cars and reduced traffic up to 40% and diminished Tehran air pollutions.

A Review on critical Conditions of Tehran Air Pollutions

In 2003, Iran consumed only 20355 million liters of petroleum component in transportation system. Tehran uses a quarter of the whole country consumption among other cities and owns the first place. The main part of the issued pollutants from the interior combustion engines are made up of hydrocarbons, carbon monoxide, nitrogen oxides, sulfur dioxides and solid particles. 90% of these gases are produced by vehicles and the rest 10% rose from houses, small workshops and hospitals. In Tehran mini- buses are old and they can pollute the air three times more than new ones. Based on the studies on a number of active mini-buses, the sum of the produced pollution consists of carbon monoxide, floating inorganic methane free compounds, nitrogen oxides, sulfur dioxide and floating particles in Benz mini-buses aging more than five years scoring pollution as 23662mg per km and Fiat mini-buses older than five years produce 26662mg of pollution in every km and Iveco mini- buses aged more than five years pollute the air as much as 19308mg in each km. The production amount of the air pollutants in all municipal areas has been calculated from the yearly sum of the air pollution in each area. As it is shown in fig (3), the Tehran municipal areas 2, 6 and 4 hold the most part of air pollution from the moving sources, but considering the surface of areas, the rate of pollution in areas 6, 12, 11 is more than other ones and the habitants of them are highly exposed to air pollution and pulmonary diseases. Figure (4) shows the yearly changes of air pollutants in different areas of Tehran. As observed, areas 1 and 19 municipal areas produce the maximum yearly pollutions.

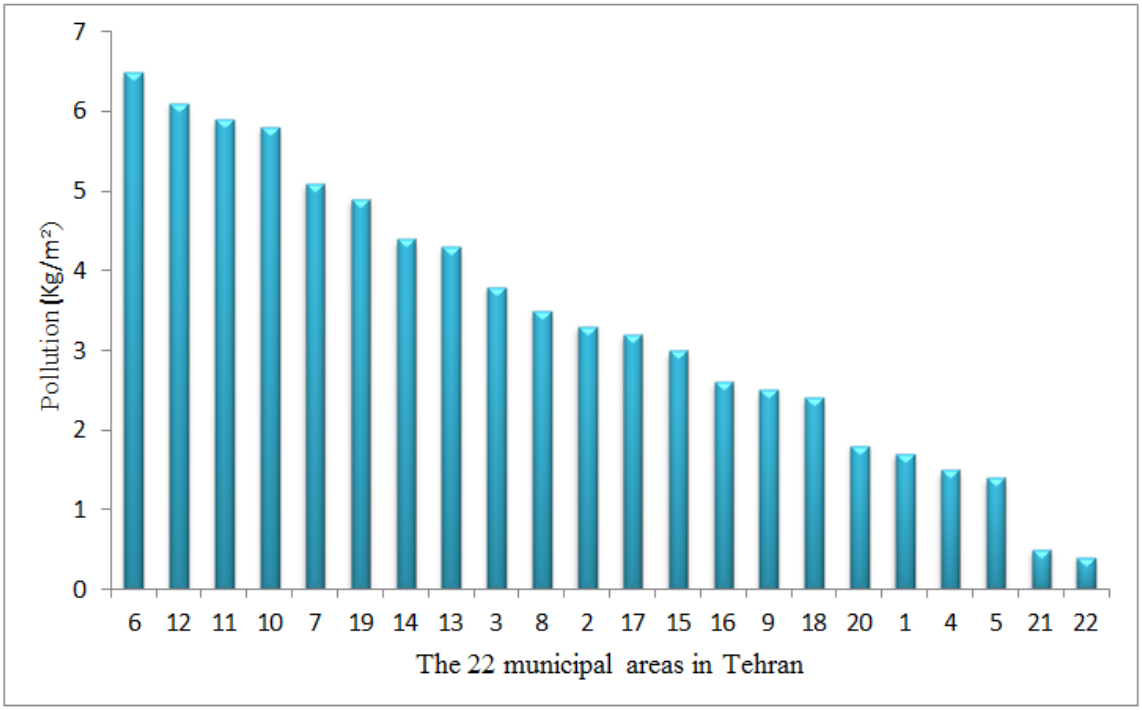


Fig-3: The amount of pollutions production from different sources in all municipal areas of Tehran

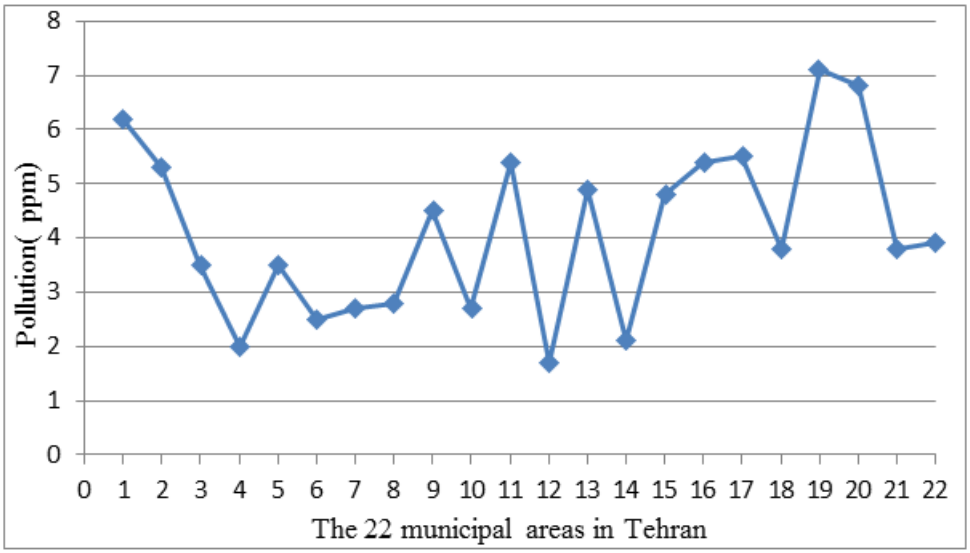


Fig-4: The sum of pollution from the different sources in each area in Tehran

Carbon monoxide is the most dangerous and killing output pollutant exiting from the cars' exhaust engines. This gas has no color and no smell and is untouchable and is quickly attracted to human lungs by breathing it in and combines with blood hemoglobin and produces COHb. The presence of this substance in blood is directed into less ability of carrying oxygen by hemoglobin to different textures of body. This destructive gas gradually starts affecting on the central nervous system and causes disorders in eye sights, heart and lung and continually ends to death. As researches shown in figure (4), cars are the most polluting factors producing carbon monoxide in Tehran and are mostly concentrated in the heavy traffics on the crosses in Tehran.

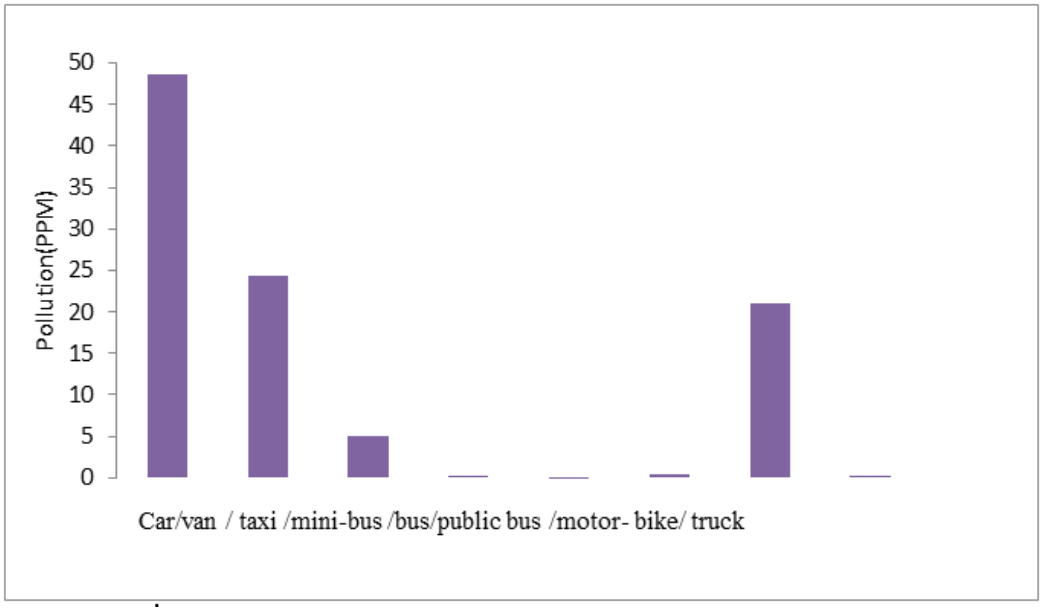


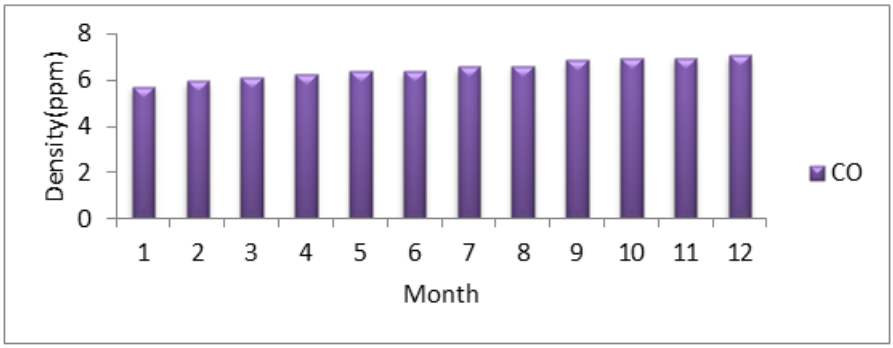
Fig-5: Percentage of various vehicles to exhaust carbon monoxide in Tehran

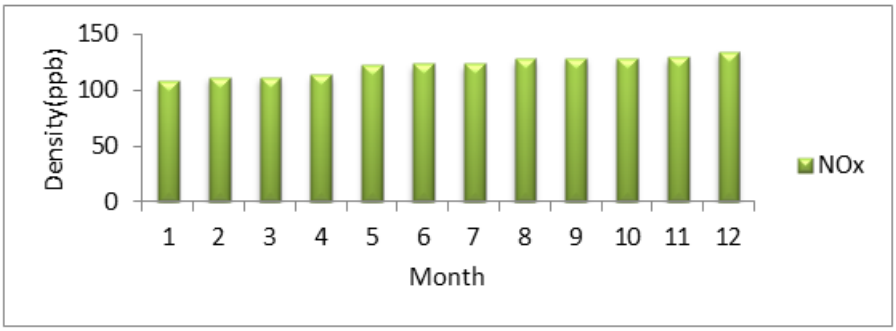
Beside carbon monoxide, other pollutants are observed in including: NO_x, So_x, Ozone and solid particles floating in Tehran polluted air. Each of them greatly have destructive consequences on bringing about pulmonary diseases and lung cancer.

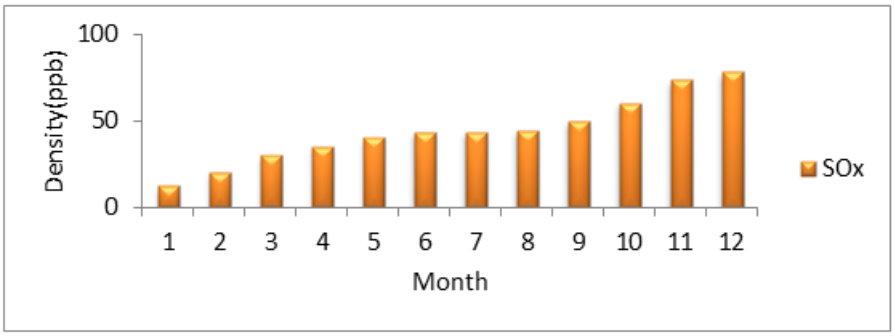
RESULTS AND DISCUSSIONS

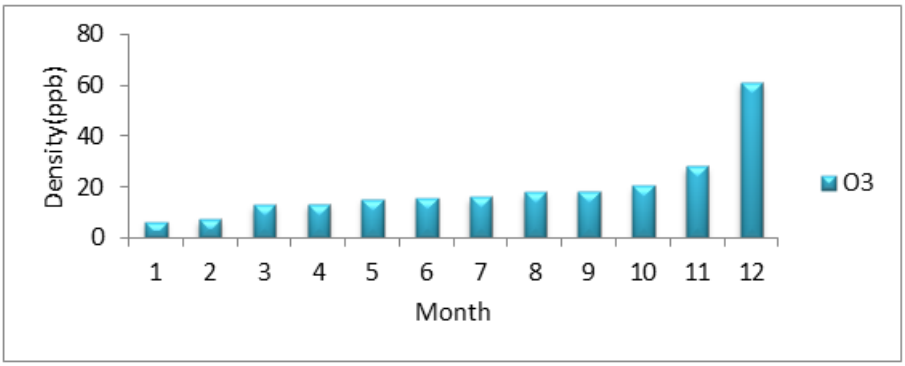
Tehran is one the most populated cities in the world and is severely influenced by air pollutions. Transportation system especially cars mainly are counted as the most polluting factors that besides imposing high financial environmental losses, it causes lots of deaths and diseases. One of the fundamental consequences of air pollution is the growing number of those suffering from pulmonary diseases like lung cancer and skin illnesses. The statistics of pulmonary patients of Imam Hussein hospital, located in east of Tehran, within the past five years have been studied.

Depending on patient ages, their physical resistance, and way of affecting by pollutants might differ. The monthly statistics of pulmonary patients refer to the hospital analyzed to hold a more comprehensive research. The pollution recording centers in east part of Tehran, the monthly statistics of the influential harmful pollutants within the last five years was measured.









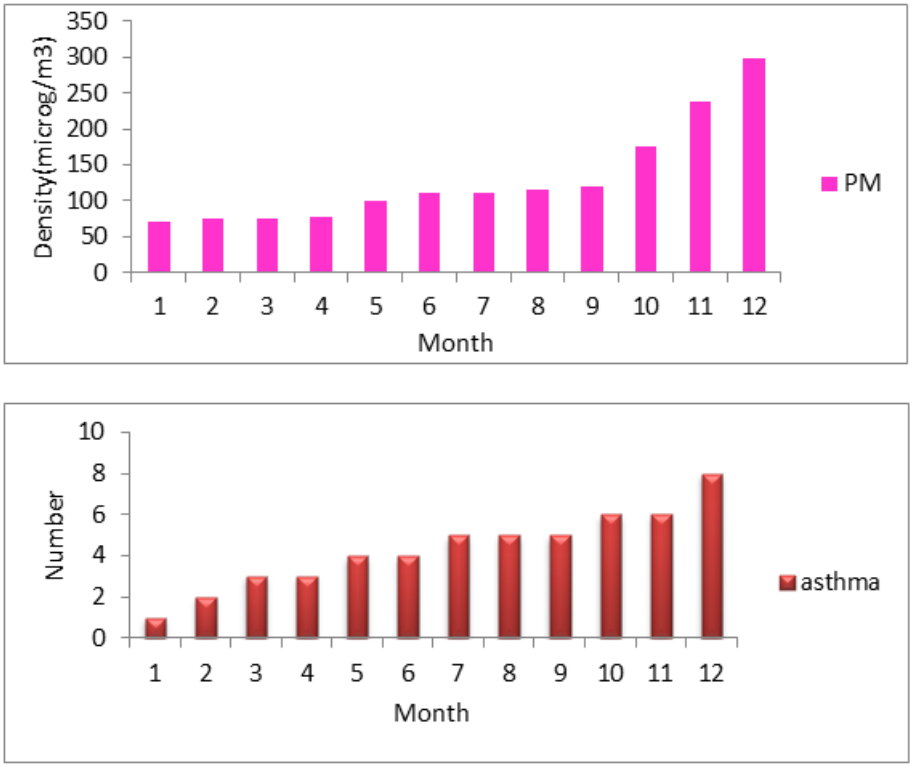
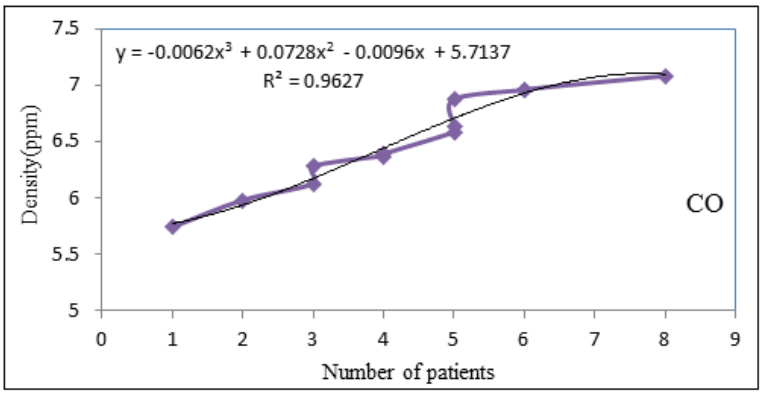


Fig-6: The trend of the monthly average of dangerous pollutants of Tehran air within the last five duration years

As it is shown in the graphs of Figure-6, in the second half of the year (autumn and winter). The temperature decreases and inversion appeared and an exceeding number of all pollutants throughout Tehran atmosphere. In fact, the temperature reduction makes the air become heavier and prevent its rising up to the heights and hasten the concentration. Moreover, due to Iranian tradition the beginning of spring is crossed with the New Year, and there is always a record in trafficking. And summer is when the schools and many educational centers are closed and the hazardous pollutants score the least. Furthermore; it gets hot and the air becomes lighter and the pollutants move up. Besides as it is shown in Figure-6, the viscosity of all pollutants in the second half of the year is more than that of the first half of the year. The rate of the correlation coefficient for each of the perilous and effective pollutants in pulmonary patients was compared and calculated with the number of pulmonary patients within the 12 months of the year in order to identify the level of the affectivity of Tehran air pollutants in the outbreak of pulmonary diseases and the number of people refer to the hospital. As it is shown in the Figure-7, all pollutants feature a high correlation with the number of pulmonary patients during the 12 months of the year. Thus, the decrease and increase of all pollutants have a key role to get all kinds of illnesses and pulmonary diseases. As it shown in Figure-7 a high correlation coefficient exists between the density of air pollution and increasing the number of patients. Therefore regressive models presented for the number of patients with the respect to predicted populations.



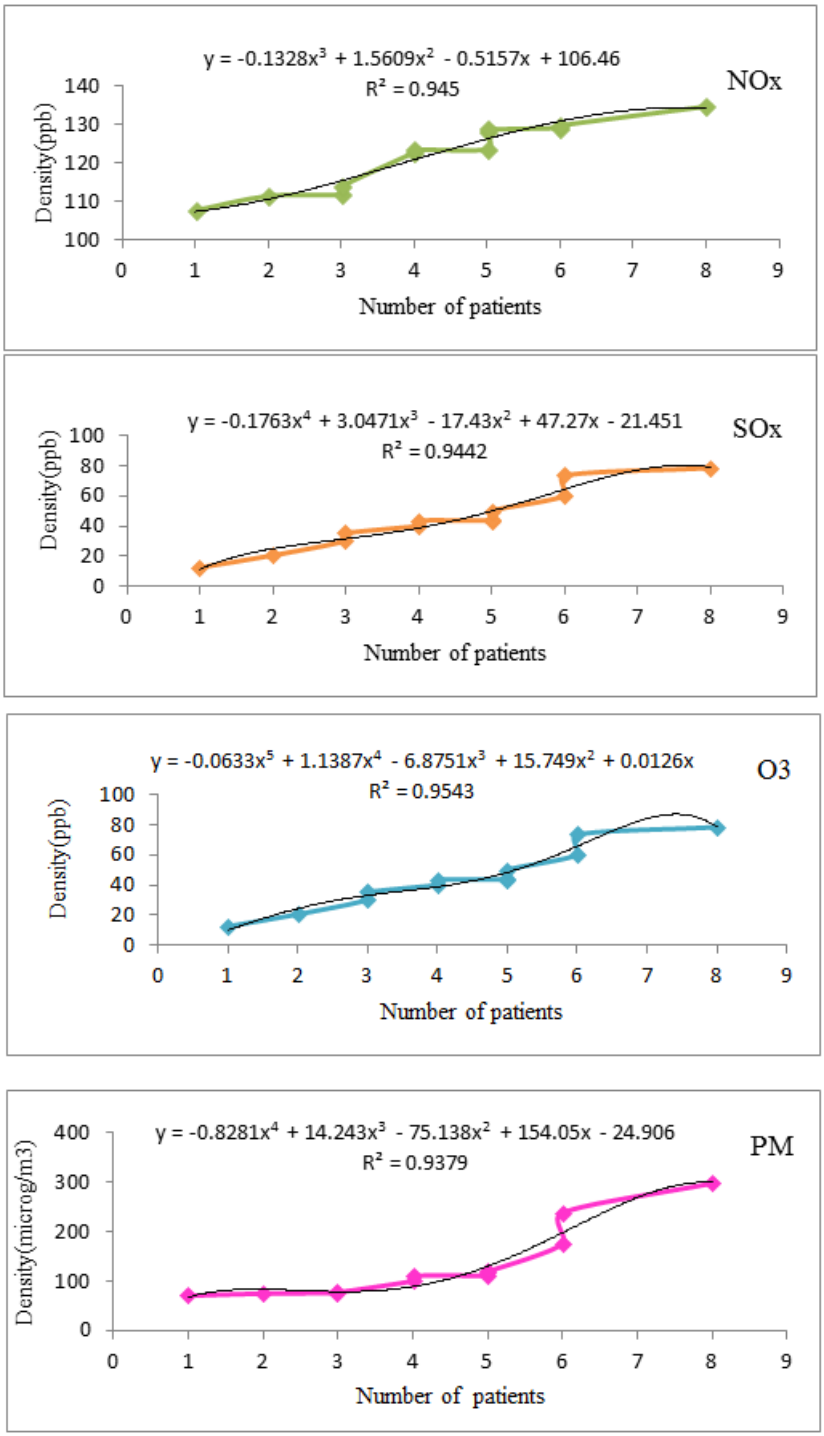


Fig-7: The graphs of the monthly correlation coefficient of the amount of Pollutants and patients

The outbreak of pulmonary diseases is directly related to the raise of hazardous pollutants. One of the methods to deal with this environmental problem is to predict the occurrence of aerial pollutions. the artificial neural network can be used to carry out such valuable and valid predictions. generally, the statistics basis of prediction is founded on the neural network resulted from the stations evaluating air pollutions of Tehran located in the city center within 1996 till the early of 2016 which was employed to foresee as the input statistics into the back neural propagation. The calculations started from the entrance layers of 4 neurons by the dimensions of the months of year to process the statistical information of 2002 to 2004 and the bias hired and the network trained through the statistical data of 2005 as the suitable one in the output layer. The considered Sigmund output function of the network and training the neural network for predicting the maximum amount of the harmful gases and pollutions ended up the task after 10000 educational sessions with the deviation percent of 0/01444434 and to forecast the sum of the amounts of the dangerous

gases and pollutants after 6726 educational sessions with the deviation standard of 0/00999644. Since the neural system from the February series uses the simulation of the functions and the final graphs have sinus shapes, more convenient responses are expected than those of statistical methods. Figure-8 exactly presents the results of the neural network model for predicting the total amount of the NO_x during 2006 and 2007.

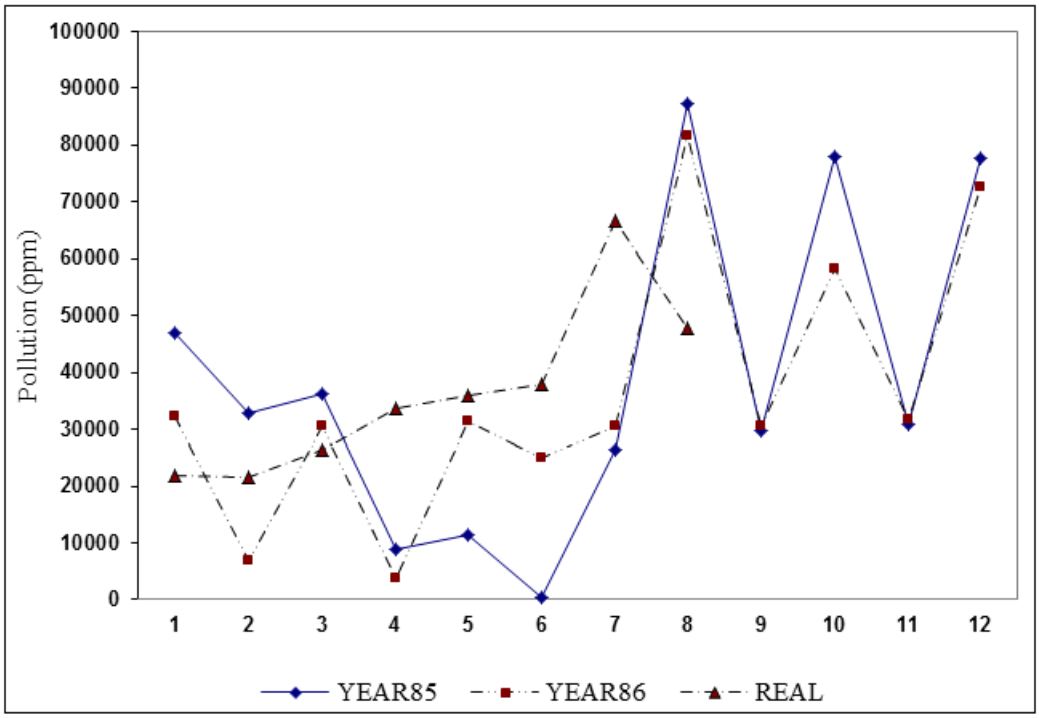


Fig-8: The monthly changing trend of NOx during 2006 and 2007 based on the neural network model

Figure-9 illustrate a comparison of the obtained amounts with those of real ones from the first three months of 2006 to evaluate the amounts predicted from the neural network. The NO_x total amount of the neural network precisely predict % 23.

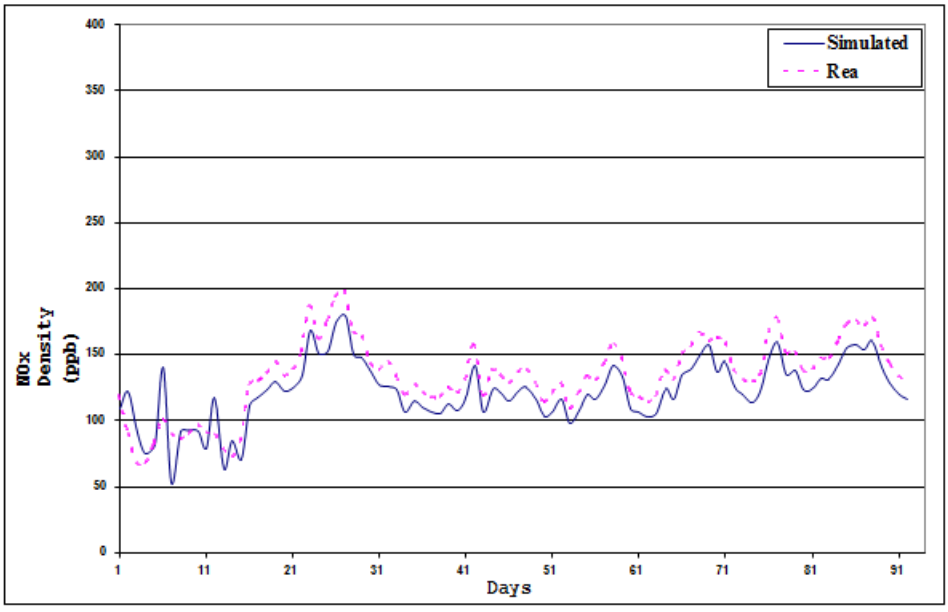


Fig-9: Comparing the observed No_x concentration with the simulated amounts.

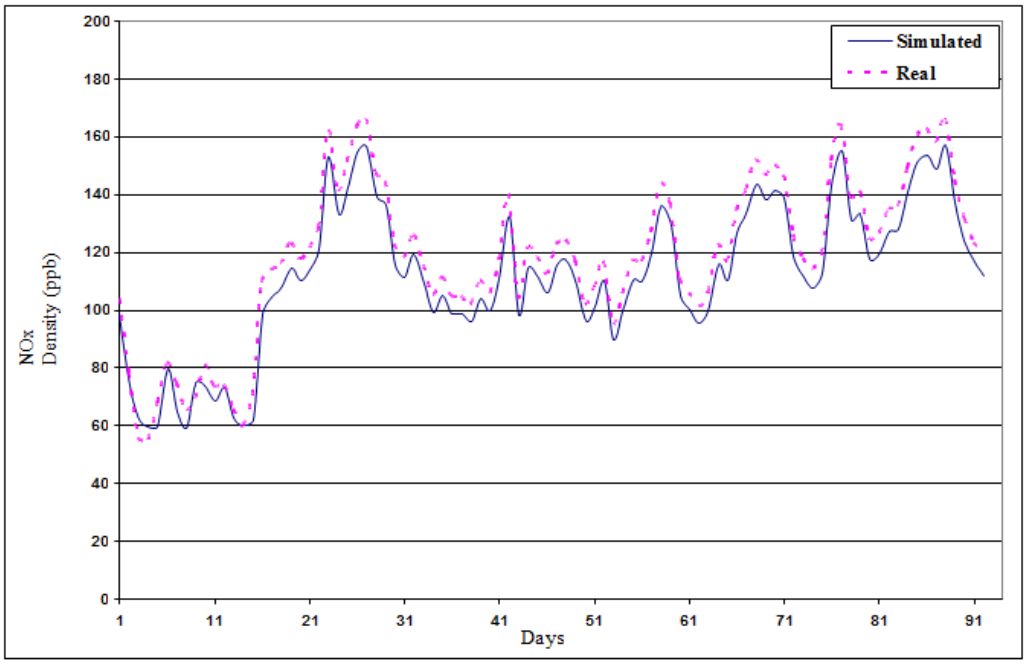


Fig-10: Comparing the observed NO concentration with the simulated amounts

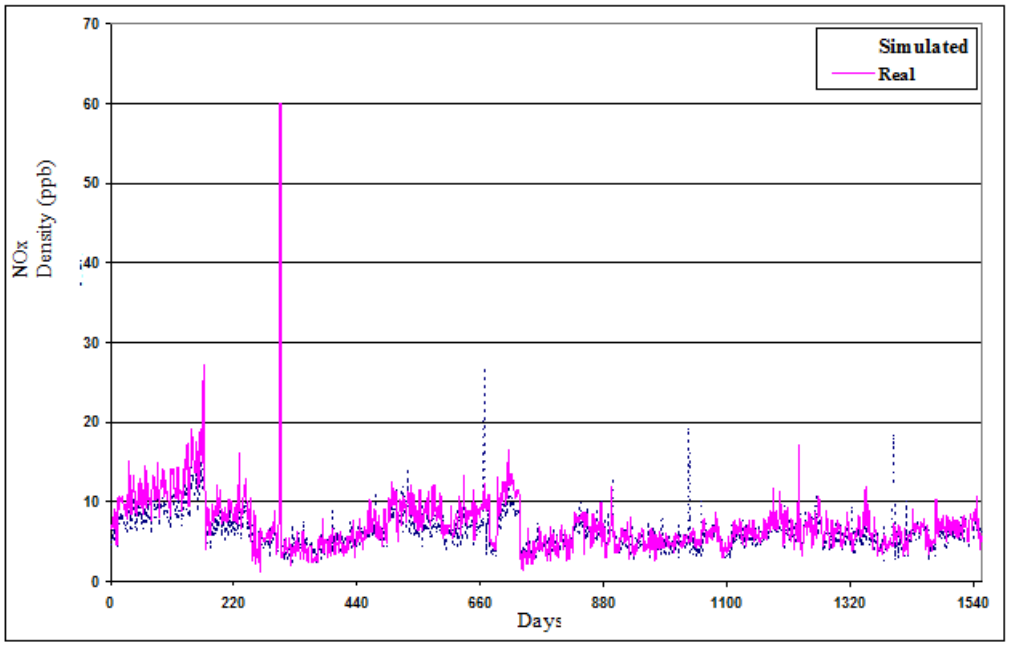


Fig-11: Comparing the observed CO concentration with the simulated amounts

CONCLUSIONS

Based on present study following results have been achieved.

- The odd and even cars plates number, BRT buses and fuel sharing all led into a remarkable decrease both in air pollutions and pulmonary patients.
- The municipal areas 2,4 and 6 in Tehran own the biggest share of pollutions made by different sources, but from the surface extension point of view; municipal areas 6, 11 and 12 polluted the air highly and the residents are greatly exposed to pulmonary diseases.
- Cars are the main moving sources to produce hazardous pollutions in Tehran.
- There are less concentration of pollutants in spring and summer season in comparison to autumn and winter. In fact, air pollution affects people during the first half of the year.
- The amount of different kinds of air pollutants not only follows cars' fuel on odd and even days but also is in a direct connection with

geographical and atmospheric conditions, temperature and season.

- The trend of the pollution changes of the nitrogen oxides and hold a maximum sinus form, moreover, they can be transformed into mathematical relationships and exercised to predict Tehran future air pollutions.
- All hazardous pollutants including carbon monoxide, all types of carbon and nitrogen oxides, all sorts of sulfur oxides, ozone and the solid floating particles display a very high correlation with the pulmonary patients every month.
- The number of pulmonary patients can be predicted through the monthly prediction of pollutants by neural network and the regressive relations embracing a high coefficient of correlation.

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