O 36. INVESTIGATION OF AIR QUALITY IN THE PROVINCE OF KARAMAN CITY CENTRE

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ABSTRACT: Karaman, which has a very old historical background and mixes different economies and cultures, has cradled many civilizations. Karaman is geographically located in the south of Central Anatolia region. The period of the Republic of Turkey took its name Karaman. It became the 70th province of Turkey on June 15, 1989. Economy and industry developed in Karaman, which has fertile lands, based on agriculture. There are modern industrial facilities that employ a large number of labour force in Karaman city centre. It can be accepted that it has a great industrial potential during last 20 years. The total area of 886,900 ha of Karaman province; 228,820 ha of it (26%) is flat, and 653.645 ha of it (74%) is mountainous. The population size is 250.000 people. 35% of biscuit production and 20% wheat production of Turkey is produced by Karaman industry. As with many developed cities in Turkey, which are used fossil fuel consumption for heating in cold winter, air pollution is observed. Vehicle exhausts in traffic and industry are other important sources of pollution in the city centre. In Turkey, in March 2020, Covidien-19 measures thus markedly obvious improvement in air quality. The Saharan dust event, which occurred after the virus measures, especially PM pollution increase was observed.

Keywords: Air quality, Pollution, Karaman province, Covidien-19 measure

1. INTRODUCTION

The change in the basic composition of atmospheric gases is primarily energy production and burning of fossil fuels used in vehicles (Kampa and Castanas, 2008). The pollution of atmospheric air is explained by the presence of one or more substances in the ambient air in values and times above natural excesses (Seinfeld & Pandis, 2006; Seinfeld & Pandis, 2008). Plants producing NO2 are also produced as NO more than oxidized rapidly with ozone or other radicals in the atmosphere. On the other hand, Oozon in low-level atmospheric layers is created by many reactions that produce volatile organic compounds and NO2, a process initiated by short-wavelength sunlight. Carbon monoxide, on the other hand, is an incomplete product of combustion of organic carbon materials (Kampa and Castanas, 2008).

Recently, particulate matter (PM) for air pollution, especially substances smaller than 2.5 μm, have been the focus of most outdoor pollution studies with the ability to penetrate living tissue and to induce local and systemic effects (Nemmar et al., 2013). . Although there are many reasons for air pollution, it is possible to examine them in two main groups as a result of air pollution due to natural causes and various activities performed by people. Air pollution feature damages human health and the environment. In Europe, many air pollutant emissions have been significantly reduced in recent years, resulting in improved air quality in the region. However, the current concentrations of air pollutants are still quite high and problems with air quality are reported to continue. An important part of its population in Europe lives in areas where air quality standards are exceeded, especially in large cities: nitrogen dioxides pose serious health risks in terms of ozone and particulate matter pollution. One or more of the 2010 emission limits has been exceeded for four major air pollutants in various countries. Therefore, reducing air pollution is still important (Seinfeld & Pandis, 2008).

The long-term goal of the European Union is to achieve air quality that will not create unacceptable impacts and risks on human health and the environment. The European Union operates at various levels to reduce pollutant levels and reduce exposure to air pollution: Regulated laws; In addition to sectors responsible for air pollution, it collaborates and researches with international, national and regional authorities and informal organizations. The environmental policies of the European Union aim to reduce exposure to air pollution by setting air quality limit values and target values and reducing emissions. As

part of these efforts, in late 2013, the European Commission adopted the Clean Air Quality Package proposal, which includes new measures to reduce air pollution (URL-1).

In the incident in London, about five hundred people died in 1873 due to heavy fog, and again more than two thousand people died in 1880 (Heidorn, 1979), and even though more serious measures were taken in the following period, air pollution was about five thousand in 1952. Welded death has occurred. The deaths in Meuse Valley, an industrial area in Belgium in 1930, Pennsylvania in the USA in 1948 and London in 1952, were effective in revealing the seriousness of the problem and legal regulations (Jun, 1980). Meteorological and topographic conditions can strongly influence the spatial and temporal variability of air pollution in cities. The particles are injected mainly through diesel engine fuel combustion transport, industrial processes, agriculture and coal combustion for different purposes (Ünal et al., 2011).

In London, about five hundred people died in 1873 due to heavy fog, and more than two thousand people died in 1880 (Heidorn, 1979) and these events took place more seriously in the following period. The deaths in Meuse Valley, an industrial zone in Belgium in 1930, in Pennsylvania in the USA in 1948 and in London in 1952, were effective in revealing the seriousness of the problem and making legal arrangements (Jun, 1980). Meteorological and topographic conditions can strongly influence the spatial and temporal variability of air pollutant in cities. Particles matter are mainly injected by diesel powered fuel combustion transportation, industrial processes, agriculture and coal burning for different purposes (Unal *et al*., 2011).

Air pollution is associated with a broad spectrum of acute and chronic illness, such as lung cancer, chronic obstructive pulmonary disease (COPD) and cardiovascular diseases. In the year 2016, ambient air pollution was responsible for 4.2 million deaths. Worldwide, ambient air pollution is estimated to cause about 16% of the lung cancer deaths, 25% of chronic obstructive pulmonary disease (COPD) deaths, about 17% of ischaemic heart disease and stroke, and about 26% of respiratory infection deaths (URL-2). Environmental problem increases due to world population and fossil fuels increases. Land cover areas changes from natural to agricultural areas food production. Automation and mass production lead to increase in industry and mining produce environmental problems especially air, land and water pollution. Bio-systems that settle in natural and waste areas as a result of excessive consumption, wastes lead to increasing microbe diseases in contact with human beings worldwide.

Viruses pandemics become whole worldwide and serious spreads around people. Last Covid-19 is being important problem and necessary to protect all nations on World. Mainly, virus pandemic disputed from city of Wuhan, China and infecting all world. Nowadays virus infectious diseases are spreading fast than before years (Zhu et al., 2020). Increasing human contact which increase the spread rate.

WHO reported that more than 14 million confirmed cases, including more than 600 thousand deaths end of June, 2020 worldwide (URL-3; URL-4). Emerging infectious diseases continue to infect and reduce human populations. The COVID-19 pandemic infection has spread to about 110 countries. According to the WHO, countries must detect, test, treat, isolate, trace every contact, and mobilise their citizens in the response.

2. METHOD

Research area

It is included The records shows that Karaman and its surroundings was settled in 8000 BC. Karaman province is located in the Central Anatolia region. Konya is located in the north, Ereğli in the east, Mersin, Silifke in the southeast and Antalya in the west. Its height above sea level is 1033 meters, the southern region of the region is covered with the Taurus mountains parallel to the Mediterranean Sea. The passing of the highway and railway connecting Central Anatolia to the Mediterranean has also had a great impact on today's economic life on the historical silk road. Karaman is one of the important cities of our country in terms of geographical location, agricultural and economic activities. Karaman is a typical Anatolian city built on a flat land extending from the skirts of the Taurus Mountains to the Konya Plain. Separated by individual hills from the Konya Plain, this plain is an alluvial plain consisting of reeds and marshes on its side, which opens in the east-west direction with light inclines towards the east. The surface area of Karaman province is 8,924 km² and ranks 2nd after Konya among the provinces of the Konya Plain Project (KOP) Region after Konya. Karaman province has total 892,400 ha area; 230,358 ha (25.8%) is flat, 658,039 ha (73.7%) is mountainous and 4,003 ha (0.4%) is wetland.

Climate and vegetation of Karaman province are diverse. Typical Central Anatolian climate type in this province is generally hot and dry in summer; winters are seen in cold and snowy continental climate. This climate type is seen in the parts of the province in Central Anatolia Region. These parts are the regions where Karaman Centre district, the towns and villages of this district and the towns of Kazımkarabekir and Ayranci. However, in the western and southern parts of the province, the summers of the Central Taurus Mountains and the valleys where this river is deeply split by the tributaries are dry and hot in the summer; The Mediterranean climate is mild and rainy in winters. Precipitation is usually snow in winter; In the spring months it is in the form of rain mean of the last 50 years (URL-6).

According to 2019 Address Based Registration System data, the central city population is 106.000 and the total population of Karaman is 253,279. The population growth rate is 4.5 for 2019. There are 6 districts, 16 towns and 154 villages within the city borders. The area of Karaman province is 8,869 km^2 and it has 1.13% of the country's territory. There is an agricultural land of 233,527 ha.

Data

Air quality values for four sampling station in Karaman city centre. Measurement data in the form of hourly averages obtained from the stations are monitored via a private network by transferring them to the Data Operation Center located in Gölbaşı, Ankara of the Laboratory, Measurement and Monitoring Department of the Ministry of Environment and Urbanization. In this center, validation study is performed on the data by considering the calibration and alarm information of the devices. Accordingly, monthly and annual reports are prepared with the data evaluated and the raw data obtained from the monitoring network are published simultaneously on the address www.havaizleme.gov.tr. Verified data is transferred to the website after the data validation works done at the end of each month. Measurable parameters for Karaman air quality station are PM_{10}, $PM_{2.5}$, SO_2, NO_X, O_3 and CO, but available data enough quality for this investigation are PM_{10}, SO_2, NO_2, and CO. If the data not be measure or available less than 80%, it is not suitable calculation and statistical test for the study.

Data period

In addition to comparison of 2020 epidemic period and before, effect of seasonal conditions on air quality, 2020 epidemic period data and normal period of 2018 and 2019 data were also compared if any relation with air pollution to understand the effect of time period of seasons. Period 1 is before the Covid-19 measures (between January 1 and March 15). Period 2 is after the Covid-19 struggle started (between March 16 and April 15). R-program, an open code statistics program, was used to create the distribution maps of the data. Daily air pollutant data of 01.01.2018-15.06.2020 compared with Covid-19 measures period (URL-7).

3. RESULTS AND DISCUSSION

Residential heating and traffic, which are among the important sources of air pollution, are among the issues that should be taken into account when determining the air quality of the city along with the negative weather conditions caused by some meteorological events (Mayer, 1999). Diesel vehicles are also the main source of PM emissions when it comes to road transport, but the difference in relation to petrol vehicle is much less than for NO_x, as PM emissions are also generated from brake and tyre wear and from road abrasion. Fuel consumption for heating purposes constitutes a large share in sulphur oxides and particulate matter emissions (Tayanç, 2000; Özden *et al*., 2008; Koçak *et a*l., 2011). Especially in winter, fuels whose content is not fully known can have an adverse effect on air pollution (Taşdemir, 2002; Enteşe & Yarimtepe, 2012).

Urbane airborne particulate matter is a variable mixture of numerous classes and subclasses of contaminants. Particle properties and their associated health effects differ by size. The World Health Organization (WHO) estimates that urban air pollution contributes to approximately 800 thousand deaths and 4.6 million infections worldwide (WHO, 2002). Particles consist of a core to which numerous other compounds, organic as well as inorganic are associated, e.g. nitrogen oxide reacts to form nitrate and sulphur dioxides to form sulphates. These secondary particles do have diverging toxicity from the original particle (Schlesinger & Cassee, 2003).

Sulphur dioxide (SO_2) is a gaseous by-product of the combustion of fossil fuels that certain coals, liquid fuels and natural gas contains sulphur. Exposure to SO_2, even at low level is linked to increased bronchoconstriction in people with asthma, and reduction in lung function has been observed at higher

concentrations. Long-term exposure to SO_2 has been associated with decreased pulmonary function and increased mortality (Krewski *et al*, 2000).

Any region where the industry is high developed, provincial centres where traffic is heavy and settlements where winter is cold, low-quality fossil fuel consumption affects quality of life especially in people with respiratory diseases. As explained by the World Health Organization (WHO), 91% of the world population lives in places where air quality limits are exceeded. However, according to WHO data, 4.2 million people die every year due to air pollution (URL-8). In the Turkey, Istanbul (5,851), Bursa (3,098) and Ankara (2,139) were the first three provinces with the highest number of deaths due to air pollution. These were followed by İzmir (2,518), Konya (2,082), Manisa (1,957), Mersin (1,628), Balıkesir (1,452), Adana (1,417) and Antalya (1,226) respectively (URL-8).

Seeing how pollutants change over time is very important in analysis. Situations where the density of pollution increases, decreases or reaches the highest level can be observed with the help of graphics. In addition, the simultaneous increase and decrease of two different pollutant parameters is also important in terms of determining the pollutant source. The time change graph of the pollutants must be given in figures.

Daily mean values of PM_{10} Karaman city centre sampling station for time period from beginning of January 2018 to middle of June 2020. PM_{10} values of Karaman city centre were generally less than 100 µg/m³ and annual mean values about 50 µg/m³ that were lower than national air quality limits of Turkey. When the looking at the figure 3, it is not very easy to group the all data, that many factors may be considered to be effective. While the amount of fuel plays an important role in the winter season, PM from all vehicle exhausts covers the entire season. However, meteorological factors changing throughout the year are as effective as emission sources.

SO_2 daily mean values can be seen for Karaman city centre sampling station for time period from beginning of January 2018 to middle of June 2020. Less than 0.03% of daily mean SO_2 values were 100 µg/m³ for Karaman city centre and annual mean values about 20 µg/m³ that were lower than national air quality limits of Turkey. When the looking at the figure 4, SO_2 daily mean values were higher during cold winter period, because using fossil fuels for heating system in residents. While the amount of fuel plays an important role in the winter season. Fluctuations of SO_2 daily mean values may be explained with fluctuations meteorological factors for the sampling period. Main emission source of SO_2 is fossil fuels for the investigation region. Very low amount may be raised from industry and transportation.

Carbon monoxide values are only available after June 2019 for statistical analysis, before this time data are not enough to use for CO daily mean values can be seen for Karaman city centre sampling station for time period of investigation. Daily mean CO values were higher comparing with the other parameter for Karaman city centre. Annual mean value was about 600 µg/m³ and maximum value was 2000 µg/m³ that were lower than national air quality limits of Turkey. When the looking at the figure 5, CO daily mean values were higher during winter period, because usage of fossil fuels for heating system is increasing residents, while the amount of fuel effect an important role in the winter season. Changing of CO daily mean values may be explained with changing meteorological factors for the sampling period affect dispersion of air pollutants. Main emission source of CO is fossil fuels for the investigation region and other sources were from industry and transportation.

Daily average data about NO_2, which is the 4th parameter measured as air pollutants in Karaman city centre, can be seen in Figure 6. The pollutant with the most missing data among the measured air pollutant parameters is NO_2. Exhaust gases of vehicles in traffic can be cited as the main source of NOx for the research area. According to the available data, it is very difficult to get an idea about the NO_2 change according to the seasons because the data is insufficient for the region.

PM_{10} values show that PM_{10} values decreased during pandemic measures taken in 2nd period middle of March and middle of May 2020 comparing 1st of January to 15 March 200 (1st period. PM_{10} values were decreased with covid-19 measures and then return to normal levels of region.

The SO_2 values in as air quality values for Karaman city centre sampling station during first 6 months of 2020. They show that SO_2 values are mostly lower than 20 µg/m³, after end of February, they were decreased less than 10 during µg/m³. Comparing between before and after pandemic outbreak measures, it is difficult to see significant differences. Because, is the source of SO_2 values was accepted as fossil fuels usage for heating system, with increasing ambient temperature, there is not important SO_2 emission source. All value is lower than Turkish national and European Comity limits.

SO_2 values for Karaman city centre sampling station during first 6 months of 2020 that show the CO values are mostly lower than 1500 µg/m³, for the first 6 mounts of 2020. After February, they were decreased less than 600 during µg/m³. Comparing between before and after pandemic outbreak measures, it is clear to see significant differences decreasing values. The source of CO values was accepted as fossil fuels usage for heating system and vehicle in traffic, with increasing ambient temperature, there is important decrease for heating system but traffic emission source is still available. All values are lower than Turkish national and European Comity limits for first 6 months of 2020 year.

Emissions sources and amount are air pollution in ambient air. Fluctuation of air pollutant concentration in shot time show different factors may effect on air quality. The topographic structure and climatic features of a region are as effective as emission sources in the formation of air pollution. Specially during the winter months, there is increase in the emission levels with the temperature decreases. However, the negativity caused by meteorological conditions causes lower than expected levels of air quality. Using the data of the existing air quality monitoring station in the Karaman city centre: it is seen that the air quality increases and then returns to normal levels during the period when curfew is restricted for measures taken due to the Covid-19 outbreak for PM_{10} and CO. The restrictions that cause the reduction of vehicle exhaust emissions, which are important factors in the formation of some air pollutants, are thought to be effective in improving the air quality.

However, particulates such as sulphur dioxide (SO_2), nitrogen oxides (NO_x) and ozone (O_3) are the leading substances that are known to pollute the air. Sulphur dioxide (SO_2) and Nitrogen Oxides (NOx) are the primary causes of acid rain. It occurs when these gases react in the atmosphere with water, oxygen and other chemicals to form various acidic compounds. Sunlight increases the rate of most of these reactions. The particulate matter in question is classified as PM_{10} and $PM_{2,5}$ by size. The most dangerous of air pollutants is known as $PM_{2,5}$. Covidien-19 measures in Turkey after middle of March 2020 were markedly obvious improvement in air quality in second period of this study, It was seen the positive effects Covid-19 measure on air quality in the city centre it has been found to be examined in PM_{10} parameters.

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