Batman Şehir Merkezinde Hava Kirliliği ve Kontrolü

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ÖZ

Bu çalışmada yapılan analizler, geçmiş yılların verileri ve en önemli atmosferik hava kirliliği bileşenlerinin ölçüm değerleri kullanılarak Batman şehir merkezindeki hava kirliliği kalite indekslerine göre araştırılmıştır. Batman şehir merkezide, hava kirliliği oluşturan temel bileşenlerden olan kükürtdioksit(SO_2) ve partikül maddeler (PM) 2006-2011 yılları için incelenmiştir. Ölçülen değerler, Hava Kalitesi Kontrol Yönetmeliği (HKKY) ve Avrupa Birliğinin (AB) belirlediği sınır değerlere göre kıyaslanmıştır. Buna göre, Batman şehir merkezindeki hava kirliliği sınır değerleri HKKY değerlerinin altında kalmış fakat AB'nin belirlediği sınır değerlerin üstünde kalmıştır. Sonuç olarak, Batman şehir merkezinde düzenli hava kalitesi ölçümleri yapılmamakta olup, yerel bir çevre komitesinin oluşturulması, hava kirliliğinin önlenmesinde gerekli tedbirlerin alınması gerekmektedir. Alınması gereken tedbirler ayrıca sıralanmıştır.

Anahtar kelimeler: Hava Kirliliği, Hava Kalitesi, Batman, Partikül Maddeler, SO_2.

Air Pollution and Precautions in Batman City Center

ABSTRACT

The analysis in this paper presents the past years evaluation of the concentration of the most important substances involved in the atmospheric pollution process, emphasizing the place occupied by Batman city center according to the quality index value of the city. In the city center of Batman, the trend of sulfur dioxide (SO_2) and particulate matter (PM) emissions which are the most important factors that make up air pollution, between the years 2006-2011, were examined. The measured values has been evaluated according to the limit values of the Air Quality Control Regulations (AQCR) and limits values that were adopted by European Union (EU). Air pollution in Batman, between 2006 and 2011, did not exceed the limit values of the AQCR but the European Union (EU). As a result of this study, it can be recommended that there was not continuity in the control of air pollution in Batman city center, a local environmental committee should be organized and necessary decisions should be taken in the implementation phase of the decisions which are to be taken to control air pollution. Also, measures to be held to eliminate air pollution were listed.

Key words: Air Pollution, Air Quality, Batman, Particulate Matters, SO_2.

1. INTRODUCTION

The atmosphere is a complex natural gaseous system that is essential to support life on planet Earth. Air pollution is the introduction of particulates, biological molecules, or other harmful materials into Earth's atmosphere, causing diseases, allergies, and death to humans, damage to other living organisms such as animals and food crops, or the natural or built environment. Air pollution may come from anthropogenic or natural sources (Wikipeida, 2016).

Indoor air pollution and urban air quality are listed as two of the world's worst toxic pollution problems in the 2008 Blacksmith Institute World's Worst Polluted Places report(Blacksmith Institute, 2008).According to the 2014 WHO report, air pollution in 2012 caused the deaths of around 7 million people worldwide,(WHO, 2014) an estimate roughly matched by the International Energy Agency (World energy outlook, 2016 and New York Times 2016).

Air pollution in the atmosphere can be defined as the increase of dust, gas, smoke, odors, pollutants which may be present in the form of water vapor to harmful quantities for human and other organisms (TEF, 1998). Air quality protection is a key element in ensuring sustainable livelihoods for both present and future generations. Pollution from urban atmosphere is due to air pollutant emissions and transmissions. Emissions of sulfur dioxide are the main cause the activities in the steel industry, the oil refineries, the motor vehicles, the thermo-electric power stations. Air pollution is a result of the modern life (Müezinoğlu, 2000). Today, rapid population growth, rapid urbanization and industrialization and the increased transportation with vehicle and other engines result in air pollution as one of the environmental issues. For example over 80% of Sulphur dioxide (SO_2) emitted into the atmosphere is results of fossil fuels, industrial boilers and residual boilers.

Impact of air pollution, on a global scale, defines the CO_2 effects on ozone layer which directly result in global warming, on a regional scale presents the acid rain formation, the destruction of vegetation and the ecological balance and thus causes the acidification of waters. As for, in local-scale, the increased amount of particulate matter (PM), SO_2, CO_2, ozone and NOx have negative effects on all living beings (Özdalyan et al., 2001). Air pollution constitutes a growing hazard to human beings. Several studies have found a good relation between air pollution and respiratory illnesses and deads (Müezinoğlu, 2000), (Eğri et al., 1997), and (Uysal, 2002). Acute air pollution in Manchester (1931), Pennsylvania (1948) and London (1952) has led to many people to capture the illness and dead (Müezinoğlu, 2000).

Air pollution in our country has been taken into consideration since 1955. Air Pollution Control Regulation (HKYK) with the number of 2872 was prepared in the 1986 to reduce air pollution (Başar et al., 2005).

It was reported by the Ministry Of Environment and Urbanization that the air pollution is the main problem in Batman city leading the first place among the urban problems, as well as the other cities in

Southeastern Anatolia Region (Ministry Of Environment and Urbanization, 2012). Some of the pollution indicators in Batman city are presented in Figure 1.

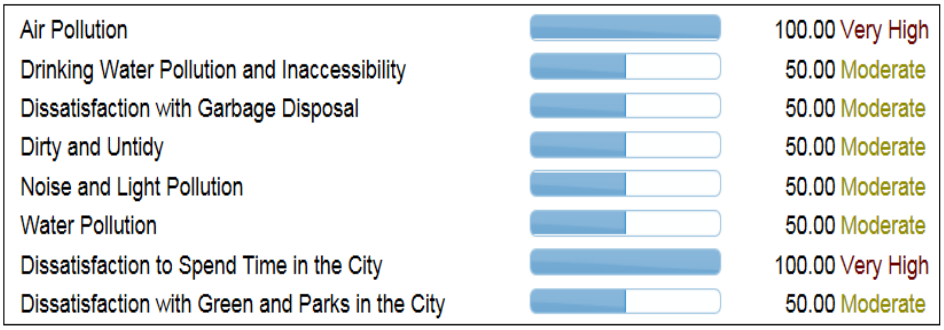

Figure 1. Some pollutions and living standards Batman, Turkey, (World Health Organization, 2016)

It was leading to an increase in air pollution that Batman city center is emplaced on a dish-like area, not to be open to the air flow in one direction, and besides especially the TUPRAS, BOTAS and TPAO which are sources of air pollution stayed in the middle of the city. The main source of PM emissions in Batman city center is residential heating especially in winters. Meteorological factors of Batman are negatively effects on air pollution and when not to be taken into account the rapid increase in the number of vehicles increases pollution. In winter, the average wind speed is 1.2-1.9 m/sec, while in spring and summer wind speed is 2.0-2.9 m / s. In the southern direction, the city's southern hills stop wind flows in winter and when inversion occurs makes it difficult to move air pollutants away from city in the horizontal and vertical direction through the city. Besides these natural factors, the urbanization, with narrow streets and high construction surrounding streets, the roads and avenues of the city are not parallel the dominant wind directions, leads to the accumulation of pollutants over the city (TRSEB, 2005).

The purpose of this study is to collect data's of air pollution in the city center of Batman, between years of 2006-2011, and to evaluate and compare with the European Union limit values and Air Quality Control Regulations in Turkey. Also results were presented by graphics and tables. Even though the present study contains data belongs to previous years, according to the report by World Health Organization, the air pollution in Batman city is still the initial problem with very high $PM_{2.5}$ and PM_{10} levels (World Health Organization, 2016).

2. MATERIALS AND METHODS

In this study, air pollution data's in the province of Batman in the period between years of 2006-2011 were evaluated. The continuous measurement of air quality parameters such as sulfur dioxide (SO_2) and particulate matter (PM) emissions are the research data. Data's were obtained from the Batman Directorate of Environment and Urbanization for the years of 2006-2011. Sulfur dioxide

(SO_2) and particulate matter (PM) measurements were made in the garden of the station of Batman Governorate.

In accordance with measurement method recommended by World Health Organization (WHO), the sulfur dioxide (SO_2) measurement is made by neutralization-titration method, measurements of particulate matter is performed by a 24 hours evaluation of Refractometric dust filter samples. The data obtained were compared with limit values from the Air Pollution Control Regulations and the European Union (EC) (Mayer, 1999).

According to Air Pollution Control Regulations, "Long-Term Limit Value (UVS) defines the average of measurement results of one-year period that should not be exceeded to limits values, "Short Term Limit Value" defines the maximum daily average value or statistically 95% of all measurement results that should not be exceeded, "Winter Average limit Value (KDOS)" defines the average values of measurements in the residential areas that should not be exceeded in the months of October to March as winter period, "Target limit Values" defines the targeted air quality limit values to maintain the lest pollutants in the air(Akpınar et al., 2007).

Limit values of Air Quality Control Regulations in Turkey and the European Union limit values are given in Table 1. In addition, test was used to review the annual and monthly statistical evaluation of the measurement values of SO_2 and PM for years of 2006-2011 in winter periods.

Table 1. Air quality limit values

	Air Quality Control Regulations (AQCR)		Europe Union (EU)	
Values	SO_2 ($\mu g/m^3$)	PM ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	PM ($\mu g/m^3$)
UVS	150	150	50	40
KVS	400	300	125	50
KDOS	250	200	-	-
Annual limit of mean targeted value	60	60	-	-
Winter limit of mean targeted value	120	120	-	-

3. RESULTS AND DISCUSSION

Average SO_2 values measured during the winter months between years of 2006-2011 are given in Table 2. When average values of SO_2 in winter months were compared, December and February observed to have the highest levels. SO_2 values for all months, except for the October, exceeded the European Union limits.

Table 2. Wintertime average values of SO_2 emissions between 2006-2011 ($\mu g/m^3$)

	Months						
Years	October	November	December	January	February	March	Average
2006	51	73	118	76	95	57	78.333
2007	26	20	108	75	49	37	79.833
2008	24	17	105	91	42	24	50.667
2009	18	15	96	42	33	22	37.667
2010	16	32	90	39	31	23	38.500
2011	14	16	80	41	29	22	33.667

The average PM values measured during the winter months between years of 2006-2011 are given in Table 3. In terms of the mean value of PM, the highest levels were seen in December and January.

Table 3. Wintertime average values of PM emissions between 2006-2011

	Months						
Years	October	November	December	January	February	March	Average
2006	116	110	187	118	121	99	125.167
2007	175	134	151	219	123	90	148.667
2008	122	113	122	112	95	126	115.000
2009	190	133	105	171	144	143	147.667
2010	157	251	244	125	128	137	173.667
2011	132	118	180	157	115	101	133.833

The average SO_2 and PM levels in the winter period, between the years of 2006–2011 are given in Figure 2 and Figure 3. Wintertime measured average values of SO_2 in years of 2006, 2007, 2008, 2009, 2010 and 2011 exceeded the targets.

The annually measured SO_2 levels in the years of 2006-2011 are presented in the Figure 2. SO_2 levels are seen to be increased almost linearly from 2006 to 2011. The lowest values were observed in 2006 while the highest values of SO_2 were measured in 2011. When monthly measurements were compared, the highest values of SO_2 emissions were found in months of December and January for all above mentioned years. It can be said that the wintertime SO_2 values were considerably higher than other seasons. The lowest SO_2 emissions were ever measured in summertime months. However, the SO_2 emissions in summer season were ever increased from 2006 to 2011.

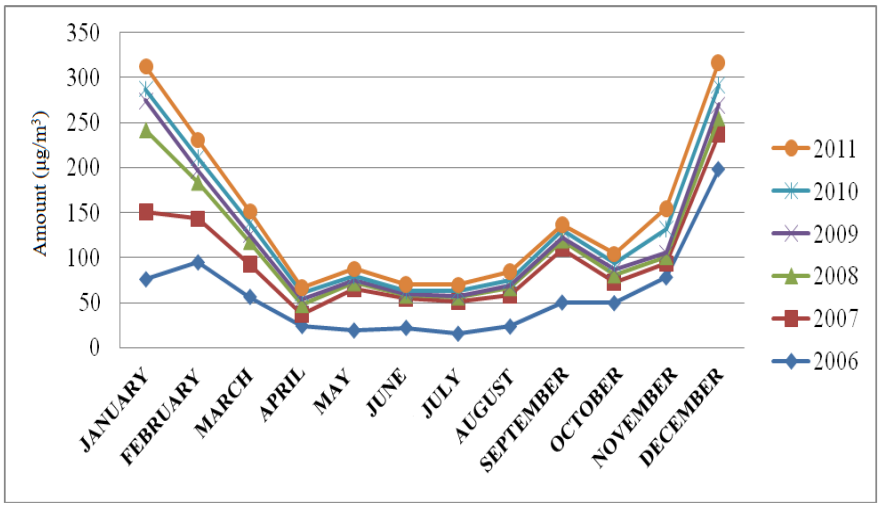

Figure 2. Change of average annual values of SO_2 with months

For the years 2006-2009, data on the number of days exceeding the short-term limit values have been obtained, according to AQCR between these years, only one time in February 2005, PM was exceeds the limit value for short-term concentrations of PM. When it was compared with the criteria of the European Union, between these years of short-term limit value of SO_2 emissions were exceeded the limit values for 12 times, and PM emissions were exceeded limit values for 28 times.

Annual change in the levels of SO_2 and PM emissions are given in Figure 3. The results of measurements of SO_2 in 2006, 2007, 2008, 2009, 2010 and 2011 exceeded the annual average targeted limit values. In 1990, the values of long-term were exceeded limits. PM measurement results in 2006, 2007 and 2009 were exceeded the annually targeted average limit values. The concentration of SO_2 and PM does not exceed the annual average limit values of European Union, 2006-2010 between.

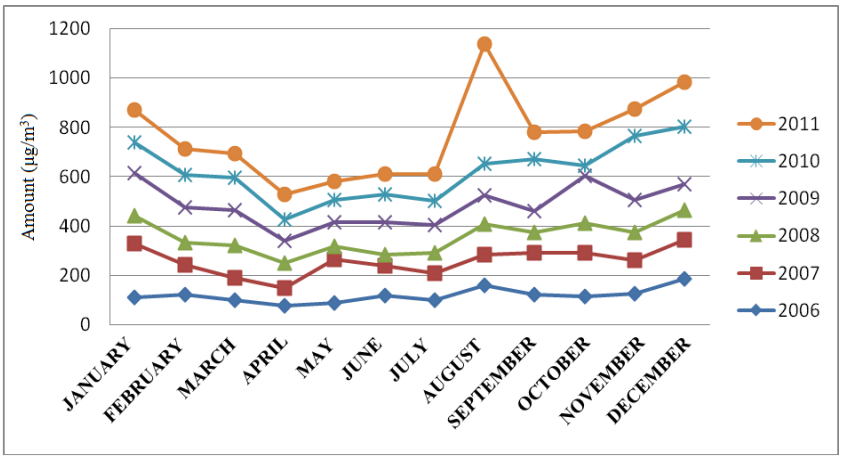

Figure 3. Change of average annual values of PM with months

4. CONCLUSIONS AND RECOMMENDATIONS

Type of data used in assessing air quality in a center limits measurements. In Batman, single point measurements have been performed since September 2006 as mentioned in the Materials and Methods section. Measuring emission parameters in only one location is thought to be inadequate, although it is appropriate to represent the city center air pollution. For this purpose, regions which represent all city centers should be selected as a suitable solution. Moreover, only one measurement point is provided to obtain a long-term data.

When the average winter values and annual average values evaluation is made in terms of the target limit values, between years, the decrease and the increase in the level of air pollution limit values are not consistent and sometimes the target values is exceeded. When Figures 2 and 3 are examined, in the years 2006-2009, air pollution in Batman had been under the control and AQCR and the European Union limit values are not exceeded.

According to State Institute of Statistics (DİE), in the years of 2002-2003, the highest concentration of SO_2 during the winter was observed in the provinces of Kütahya, Erzurum and Batman. Major role in this was that of the fuels used for heating purposes (Başar et al., 2005).

In the aim of criteria of the European Union to be achieved 2006-2009 between the city centers of Batman, the necessary measures that may be taken in the future may provide criteria for the European Union.

Thanks to the natural gas that is expected to be used in city center of Batman, the targeted values can be achieved and air pollution can be reduced. Because the air pollution may be lower for more populated cities like Ankara and İstanbul probably thanks to the usage of natural gas especially in heating systems (Taşdemir, 2002).

As a result, control of air pollution in the Batman is a very important issue. The problem of the air pollution in Batman city is still leading the first place according to WHO report identifying that Pollution Index is 89.66 and Pollution Exp Scale is still 175.19(World Health Organization, 2016). Especially, in winter months, due to adverse meteorological conditions along with increased fuel consumption in heating, air pollution is increasing. In addition, even low levels of air pollutants have a negative impact on our health. Therefore, making decisions for the control of air pollution is not just enough; also necessary implementations should be taken to reduce the problem of air pollution.

Precautions that can be taken against air pollution in Batman city is summarized bellow;

• First, instead of fossil fuel the use of natural gas in the city center should be encouraged. In addition, solar energy and geothermal energy fields located in Şelmo should be evaluated.

•Industrial facilities should be established away from the city center.

• People should be encouraged to public transport, railways, and rail system in the city can be used.

•Natural gas should be used as fuel in the municipal buses.

• The destruction of the forest should be prevented, especially; reforestation efforts in Western Raman, Kıra Mountain areas, etc. should be accelerated.

•Buildings shall apply the chimney filters.

• Number of mobile stations of stationary air pollution measurement should be increased in our city.

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