



Particulate matter and its effect on air quality: Case study - Bojnourd

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ABSTRACT

The dust problem and its impact on quality of life is one of the main issues of the environment. Dust particles, especially particles less than ten microns in diameter are many health effects. The aim of this study was to evaluate air quality in Bojnourd over a period of one year (1394). In this study, data collected from the Department of Environment air pollution monitoring stations in North Khorasan, then total of 365 samples of 24-hour average concentration of dust particles (PM10) analyzed. The results were compared with EPA air quality standards. The results show that within a year the frequency of standard pollutants PM10 include good, moderate, unhealthy for sensitive groups, unhealthy, very unhealthy and hazardous, respectively were, 10, 42, 34, 11, 2.5 and 0.5 percent. The March has 8 days with good, and June, July, August and September weren't any good days (50-0), respectively. The results also show that September and summer with highest emissions of PM10 had the worst air quality conditions.

OPEN ACCESS

Keywords: Dust particles, PM₁₀, Air Quality Index, Bojnourd

1. INTRODUCTION

Dust phenomenon and its complication have changed to one of the main concerns in Iran's environment. Particulate matter or PM is a mixture of solid and liquid particles coming to atmosphere by natural or human sources. Because of productive sources variety dust particles are physical (size, surface, area, density and number) and chemical diverse (Querol et al. 2004). In dry areas dust streams bring in a large amount of suspended particles to atmosphere and they may wind up to hundred kilometers away (Fu, P. et al 2008). These dust storms may have serious effects on health, such as lung ailment, allergic effect, eye infection and valley fever (Perez, L. et al. 2012). The most effect of these particulate matters is related to populated cities, with extensive human activity (Harrison, R.M. et al. 2001). Dust storms occur when wind speed gets to threshold friction velocities for dust, in areas where prone to it. Meanwhile a cloud mixed of particulate matters causes carrying particulate to air altitudinal levels (Stout, J. 2010). The main focal points producing dust are arid and semi – arid lands. Regions such as North Africa, the Middle East, South and center Asia have been increased by recent drought (Prospero, J.M. et al. 2002).

Due to proximity to these focal points, Iran is exposed to dust storms. Bojnourd that is located in Northeast of Iran, due to special situation of topography and as well as its proximity to dust production centers such as Turkmenistan's Karakum desert, is exposed to dust storms. Since particulate matters have a direct and dangerous effect on human health, Bojnourd's air quality during a year was evaluated in this study by average of data from air monitoring stations.



Figure 1 Study area

2. MATERIALS AND METHODS

This study is descriptive – analytical and data recorded in air pollution monitoring stations belong to environment department of North Khorasan in Bojnourd have been used (Figure 1). In this station, particulate matters are measured by absorption of beta ray method and with Beta Attenuation Monitor (BAM 1020) instrument. In this method, dust concentration measured in hourly. Dust particle smaller than 10 micron in diameter (PM₁₀) have the greatest effect on public health and accordingly they were considered as

an indicator in this study. For this aim, the raw data about concentration of particulate matter less than ten micron (PM_{10}) have been changed to AQI standard by means of environment protection department's guidelines. Then data classified in month and season with EXCELL. The AQI index is used for daily report of air pollution, which indicates the air quality in terms of cleans or contamination. The daily air quality report calculated with the account the following pollutants: nitrogen dioxide, sulphur dioxide, particulate matter (PM_{10}), carbon monoxide and ozone. The highest index among these pollutants is considered as air quality condition. In Bojnourd, PM_{10} is considered as index. The air quality is classified in 5 groups: If the average of index is between 0 and 50, the condition of the air quality is considered good, 51 – 100 is moderate, 101-150 is unhealthy for sensitive groups, 151-200 is unhealthy. 201 – 300 is very unhealthy and higher than 300 is hazardous (Landulfo et al, 2007). Also 0-150 is considered as the standard condition.

3. RESULTS

The results shown in table 1 say that during 2015, healthy quality class (51-100) has allocated the most days with 42 percent frequency and the least one with 2 days in a year is dangerous class aspect. By comparing different seasons shown in table 2, concluded that fall and winter are common in 16 good days and summer with no good air are considered as the best and the worst condition respectively. The result also show that during a period of year quality of air was in standard range in 85 percent of days and in the rest of days it was out of standard range. In compare between different months, results shown that September with the highest concentration particle and March with the lowest amount were in the worst and the best condition respectively (fig. 2). Also fig. 3 indicated that summer is in the worst and Winter in the best condition respectively.

Table 1 Air quality and number of days an it's frequency

Quality		Year	
PM_{10} ($\mu g/m^3$)	Air Quality	Days	(%) Frequency
0-50	Good	37	10
51-100	Moderate	153	42
101-150	Unhealthy for sensitive group	124	34
151-200	Unhealthy	40	11
201-300	Very Unhealthy	9	2.5
301-500	Hazardous	2	0.5

Table 2 Air quality in different seasons

Quality	Spring		Summer		Fall		Winter	
	Frequency (%)	Days	Frequency (%)	Days	Frequency (%)	Days	Frequency (%)	Days
Good	5	5	0	0	18	16	18	16
Moderate	56	25	40	37	32	29	39	35
Unhealthy for sensitive group	28	26	45	42	30	27	33	29
Unhealthy	8	7	10	9	17	15	10	9
Very Unhealthy	2	2	4	4	3	3	0	0
Hazardous	1	1	1	1	0	0	0	0
Total	100	93	100	93	100	90	100	89

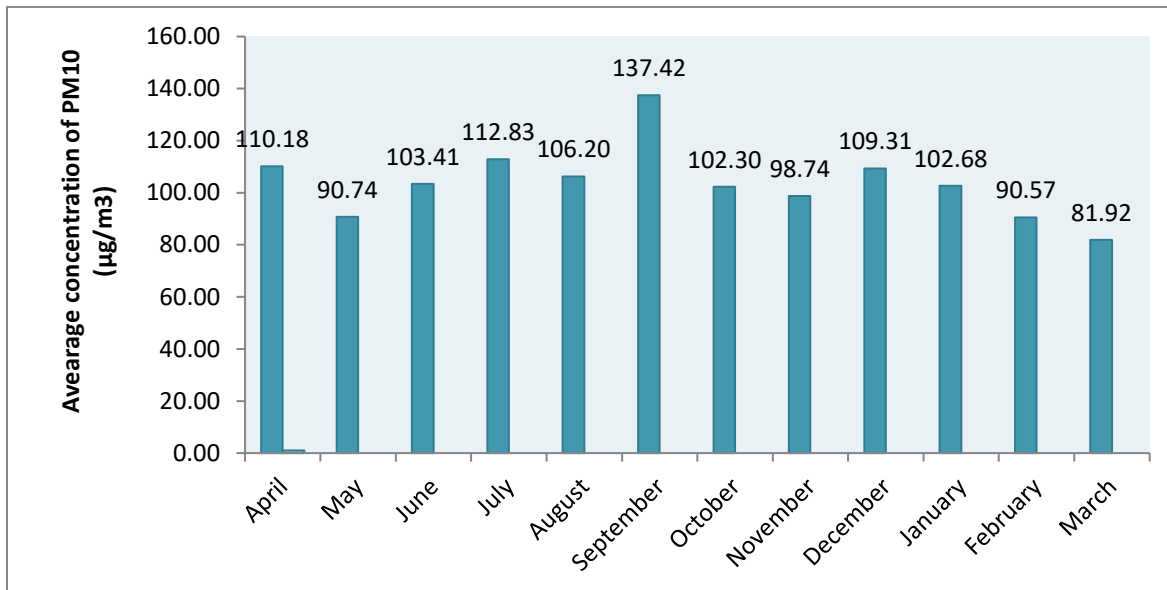


Figure 2 Average of PM10 in different months

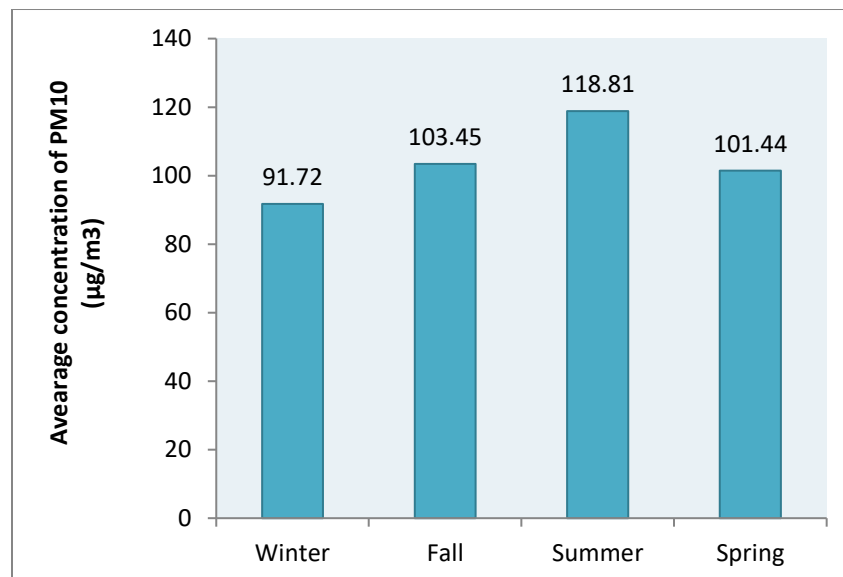


Figure 3 Average of PM10 in different seasons

4. DISCUSSION

The result shows that, according to dust particle, summer and September were overall in the worst condition. It could be due to the weather condition and lack of rainfall and draught in this season and also wind's speed and direction. The significant different between months and seasons of year show that climate factors, and weather conditions may have a direct impact on dust phenomenon occurrence. North Khorasan province and Bojnourd nearby with Turkmenistan and it's karakum desert, one of the dust production centers (Shen, H., et al. 2016), had also on effect on Bojnourd's air quality. This result are consistent with Pirsahab in 2014. The highest value with 137.42 µg/m³ belong to September because of a higher incidence of severe wind and drought

phenomenon in this month and agricultural lands as well. Studies by Shahsavari et al (2012) in Ahvaz reported the highest dust concentration in June and July. Also by measuring particulate matters in Ilam by Amarlooyee in 2013, concluded that June had the highest dust concentration. This difference could be dependent on different weather condition and geographical position and distances away from center of dust production. According to the survey results and occurrence of dust in the event of the year, especially summer in Bojnourd and threaten public health it is necessary to eliminate or reduce the adverse affects of environmental measures to be taken.

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