

## Effects of Dust Phenomenon and Impacts with Emphasis in Khuzestan (Iran)

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### A-R-T-I-C-L-E-I-N-F-O

#### Article Notes:

##### Article Notes:

Received: Jan 17, 2018

Received in revised form:

Apr 19, 2018

Accepted: Apr 28, 2018

Available Online: May 1, 2018

#### Keywords:

Dust Phenomenon,  
Particulate Matter,  
Crisis,  
Khuzestan,  
Iran.

### A-B-S-T-R-A-C-T

**Background & Aims of the Study:** According to statistics reported by the international organization, 500,000 people annually due to airborne particulate matter exposure of the air are dying prematurely. Studies show the dust storm is responsible for the 7.1 % increase of fatality. Control of particulate matter is one of the most important methods of direct and indirect effects of particles reduction. The aim of the study was the analysis of the relationship between exposure to particulate matter of plants, environment and human, which is a kind of crisis.

**Methods:** This research is conducted the overview of studies, examining the relationship of dust phenomenon impacts with emphasis on dust problems and present solutions in Khuzestan, Iran.

**Conclusion:** The evidence was considered inconclusive the environmental impact such as reducing vision loss caused by visible light availability, efficacy on the level of solar radiation and waste material. Short-term effects of dust, including more sensitive eyes, nose and throat, respiratory tract infections, headache, nausea and allergic reactions, this phenomenon can be long-term chronic respiratory and cardiovascular disease, lung cancer incidence and mortality.

**Proposed solution:** Measures taken to decrease the impact of dust particles: avoid the outdoor activities, created ventilation system, increasing fluid intake to excretion of heavy metals associated with suspended particles such as mercury and lead, using a mask creation and design of clean room and sprayed mulch .

**Please cite this article as:** Geravandi S, Yari AR, Jafari M, Goudarzi G, Dastoorpoor M, Vosoughi M, Farhadi M, Mohammadi MJ, Effects of Dust Phenomenon and Impacts with Emphasis in Khuzestan. Arch HygSci 2018;7(2):134-138.

## Background

Climate change as an effect of greenhouse gases emission in the last decade was the main cause of the severity of droughts, dust phenomenon, society, economics and health endpoint (1). Dust phenomenon cause considerable artistic, social and economic losses (2). The industrial revolution, despite all its benefits in improving human living condition, had adverse effects in terms of

environmental aspects (3-5). Nowadays, one of the most environmental problems that threatens the world is dust storms (2). Mainly, dusty phenomena in the atmosphere caused by fine grains prevalent in the deserts and dry land of the world (6). Dust phenomenon due to various agents like climate change, drought in all of the world, geographical environment, change in land cover and desertification phenomenon (3,7). In the Middle East, dust phenomenon is generally one of the challenges facing sustainable development goals (5,7). Khuzestan

province has a special status in Iran due to its natural conditions and characteristics. These features include geological, climatic, hydrological, geo-morphological and soil characteristics (6). All of the above mentioned have a huge effect on the reduction or increase of recent dust storms in the province and neighboring areas. Recent droughts have intensified the phenomenon of dusts of over-the-surface origin. The most important factors in the creation of dust phenomenon are the development of deserts in the western Khuzestan and Iraq, the decrease in volume and flow of rivers, wetlands and pastures. Unfortunately, with the creation of several dams on the roads of the Iraqi rivers, Turkey has become a descendant of agricultural land in the eastern part of Iraq (8,9). There is no doubt that healthy air breathing is the most basic right of every human being, while the microspheres not only capture a large part of the western and southern parts of the country, but the sky of the capital also has not survived the drama and now the health of many citizens is at serious risk.

#### Aims of the study:

The aim of the study was the analysis of the relationship between exposure to particulate matter of plants, environment, human, which is a kind of crisis with emphasis in Khuzestan.

### Materials & Methods

#### Methods

The authors conducted a scientific review of available literature published in the last years about the effects of dust phenomenon and impacts in Khuzestan. We initiated a Google Scholar database search, using the MESH terms of “dust phenomenon,” “Khuzestan,” and “particulate matter.” This study tried to use both positive and negative appropriate studies.

#### Description of study area

Khuzestan, a typical city of heavy reliance on petroleum and diesel as a source of heat and power, is located in the south west of Iran with a population of approximately 4.7 million. The urban land areas of Khuzestan are about 64057

km<sup>2</sup> is one of the biggest province in Iran (10-14). The description of study area is presented in Figure1.

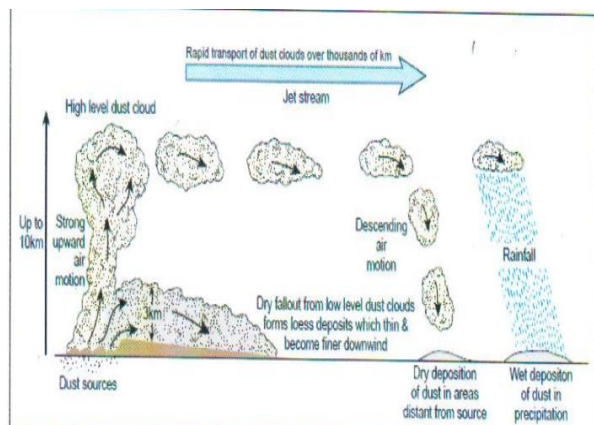


Figure1)Locations of description of study area

### Results

#### The process of forming dust

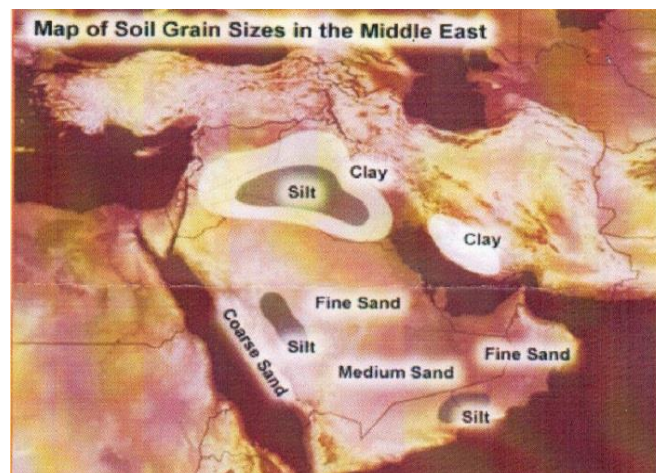
Dust phenomena due to soil erosion (the ground cover, wind speed) materials are displaced in two ways by rolling and pushing (15). Medium matter moves forward as a series of jumps, the particles of the air are raised and usually propelled 4 times as high as the air is raised. But, very fine particles such as silt and clay remain suspended for a long time in the air because of lightness; they collapse after long distances (2). Presence or absence of moisture is the most important conditions for the formation of dust with stable air. Precipitation, storm and thunder-storm, if not humid, it creates a dust storm (7,8).



**Figure 2) The process of produce dust storm and displacement of soil particles**

### Dust particle size

The size of dust particles is usually expressed in microns, one of the oldest measurements of dust particle size reported in America by Udden 1986. On this scale, the particle ranges from 62.5  $\mu\text{m}$  to 15.6  $\mu\text{m}$  can be the coarse particles which are deposited in the first stage of harvesting and felling; smaller particles tend to settle down at a distance away from their origin. Coarse particles, measuring from 31 to 62 micrometers, can be spaced 320 kilometers from their source. Particles of the average size of 16 to 30 micrometers can go about 1,600 kilometers from their origin (15). Small grain particles, which are smaller than 16 micrometers in size, can go far beyond their origin. Based on the result of different studies some of the areas of the world that including soft and alluvial soils, especially clay particles with a diameter of 2 to 50 microns, like dried lakes and deserts such as Iraq and Saudi Arabia, the desert in Africa, the Gulf of Sahara, Mongolia, in northern China, the dust rises in compact and dense clouds up to a few kilometers from the surface of the earth, and they go a long way through sedimentation (8,9).



**Figure 3) Map size dust particles in the Middle East**

### The frequency of dust

The frequency of dust is usually determined by the number of days of dust that occurs within a year. This process is usually determined for dust storms with a visibility of less than 1000 meters (8). Climatic conditions, the area of the desert and the droughts occurring are the most important factors in the occurrence of the number of dusty days in different parts of the world. Several studies showed that the numerous dusty days in the central holes of Iran, for example, in the 120-day winds of Sistan province, the frequency of days with dust increases to more than 150 days. In southwest and west areas of the country, which are adjacent to large deserts such as Iraq, Saudi Arabia, Syria, and Jordan (9). The mean time of dust is significant, with the frequency of occurrence in August which was more than the other months (8). Khuzestan province, located in the southwest of Iran, has been repeatedly affected by this undesirable environmental phenomenon and the biodiversity of this province has become extremely critical due to recent droughts, which have led to the abundance of days with dust, especially in warm years. The effects of dusty phenomena may persist up to 4000 kilometers from the main source and lead to adverse biological effects and damage to agricultural, industrial, transportation and telecommunication systems.



### Dust major hub in the Middle East

The abundance of drought phenomena in some Middle Eastern countries, including Iraq, Jordan, Syria, the peninsula of Saudi Arabia and Kuwait, and Iran today, have been particularly noticeable; they have been forced to examine this phenomenon in a special way. Dust is the biggest crises in these countries. The major dust producers in the Middle East are small, discrete and discontinuous regions. Although, these areas are small in size from the Middle East, they have a very high potential for dust production. Dust originating from these areas is first raised in compressed and dense columns of dust; then, affected over large distances.

### Conclusion

The results showed that dust is a phenomenon that has been repeated several times over the years and has many problems for economic, industrial, tourism, social and environmental point of view. The main factors of occurrence and increase dust phenomenon are being on the dry and semi-arid belt of the world, the lack of annual precipitation and its proximity to the deserts of the surrounding countries. Considering the impact of this phenomenon on different economic, social and environmental aspects, it is necessary to examine these consequences and try to control and prevent them. Therefore, the present study examines the economic consequences of micro-nodes and the expression of some methods for estimating the economic effects of dust. The results of the studies showed that dust in a variety of ways, such as cancellation of airline flights, reduced crop production, disturbance in the industrial sector, the establishment of medical and costs for the treatment of diseases caused by this phenomenon increased the number of patients, increased immigration rates, reducing the effective demand of households and the number of working days can have a negative tire economy. This includes a 29% reduction in

corn and the loss of \$ 4149512 in passenger and air transport services. Another noteworthy point is that the results of research conducted in other countries show the high impact of dust on the economy. For example, in Australia, asthma due to this phenomenon cost \$ 10- \$ 50. While, the results of studies in Iran show that the cost of respiratory illness caused by this in Zabul only cost \$ 70 million, it can be concluded that the cost of the Iranian economy is much higher as a result of dust. Also, some methods for estimating the economic effects of micro grid have been explained, each with its own specific advantages and disadvantages in accurate measurements of these works. The general results that can be derived from this study are undeniable impacts of dust on various economic sectors and the need to consider and apply appropriate strategies for controlling and preventing this phenomenon.

### Footnotes

#### Acknowledgement:

The authors would like to thank students' research committee and Ahvaz Jundishapur University of Medical Sciences for providing financial supported by grant: (94s6),(93s109), (U-90005) of this research.

#### Conflict of Interest:

The Authors have no conflict of interest.

### References

1. Geravandi S, Sicard P, Khaniabadi YO, De Marco A, Ghomeishi A, Goudarzi G, et al. A comparative study of hospital admissions for respiratory diseases during normal and dusty days in Iran. *Environmental science and pollution research*. 2017;24(22):18152-9.
2. Amiraslani F, Dragovich D. Combating desertification in Iran over the last 50 years: an overview of changing approaches. *Journal of Environmental Management*. 2011;92(1):1-13.
3. Bateson TF, Schwartz J. Who is sensitive to the effects of particulate air pollution on mortality?: a case-crossover analysis of effect modifiers. *Epidemiology*. 2004;15(2):143-9.
4. Izzotti A, Parodi S, Quaglia A, Fare C, Vercelli M. The relationship between urban airborne pollution

and short-term mortality: quantitative and qualitative aspects. *European journal of Epidemiology*. 2000;16(11):1027-34.

5. Miri A, Ahmadi H, Ghanbari A, Moghaddamnia A. Dust storms impacts on air pollution and public health under hot and dry climate. *Int J Energy Environ*. 2007;2(1):101-5.

6. Kang KK, Chu JM, Jeong HS, Han WJ, Yu NM. A Study on the Analysis of Damages of Northeast Asian Dust and Sand Storm and of the Regional Cooperation Strategies. *Korea Environment Institute*. 2004;2(1):112-8.

7. Akbari S. Dust storms, sources in the Middle East and economic model for survey its impacts. *Australian Journal of Basic and Applied Sciences*. 2011;5(12):227-33.

8. Mohammadiha ARMMA. Investigation of Formation and Propagation of Dust Storms Entering to the West and Southwest of Iran Using Lagrangian Particle Diffusion Model, HYSPLIT. *Journal of Climate Research* 2015;1392(13):1-16.

9. Sissakian V, Al-Ansari N, Knutsson S. Sand and dust storm events in Iraq. *Journal of Natural Science*. 2013;5(10):1084-94.

10. Goudarzi G, Geravandi S, Idani E, Hosseini SA, Baneshi MM, Yari AR, et al. An evaluation of hospital admission respiratory disease attributed to sulfur dioxide ambient concentration in Ahvaz from 2011 through 2013. *Environmental Science and Pollution Research*. 2016:1-7.

11. Goudarzi G, Geravandi S, Forouzanmehr H, Babaei AA, Alavi N, Niri MV, et al. Cardiovascular and respiratory mortality attributed to ground-level ozone in Ahvaz, Iran. *Environmental monitoring and assessment*. 2015;187(8):1-9.

12. Neisi A, Goudarzi G, Akbar Babaei A, Vosoughi M, Hashemzadeh H, Naimabadi A, et al. Study of heavy metal levels in indoor dust and their health risk assessment in children of Ahvaz city, Iran. *Toxin Reviews*. 2016;35(1-2):16-23.

13. Geravandi S, Goudarzi GR, Vosoughi Niri M, Mohammadi MJ, Saeidimehr S, Geravandi S. Estimation of the cardiovascular and respiratory mortality rate resulted from exposure to sulfur dioxide pollutant in Ahvaz. *Journal of Environmental Studies*. 2015;41(2):341-50.

14. Nashibi R, Afzalzadeh S, Mohammadi MJ, Yari AR, Yousefi F. Epidemiology and treatment outcome of mucormycosis in Khuzestan, Southwest of Iran. *Archives of Clinical Infectious Diseases*. 2017;12(1):e37221.

15. Vidal J. Dust storms spread deadly diseases worldwide. *the guardian*. 2009.