Quantitative Analysis of Precipitated Dust in Nineveh, Tikrit and Kirkuk Cities- IRAQ for the years 2011 and 2012 Compared with the Previous years

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Abstract

In this study, twelve location (6 in Nineveh, 3 in Kirkuk and Tikrit) were chosen to measure the precipitated dust for the years 2011and 2012. The stations were located in residential, commercial, industrial areas. The results showed a variation in the precipitated dust mean within the same year (different results with months) and an increase in 2012 compared to 2011 for Kirkuk and Tikrit by a ratio of 16% and 6.5%, respectively. The precipitated dust analysis in Nineveh showed decreasing of precipitated dust in 2012 compared to 2011 by a ratio of 21%. The precipitated dust in Tikrit was the highest, then Kirkuk and Nineveh in the last order in 2011 and 2012. In 2011, the mean value was 53.39, 37.2 and 16.3 g/m^2 respectively; while in 2012 the mean value was 57, 44.4 and 12.8 g/m^2, respectively as Tikrit area is widely affected by desertification and dust storms from Iraqi- Syrian border. The results also showed that the average mean of the precipitated dust was Five times more the standard limits of the Iraqi regulation (10 g/m^2) which impacts on the human health as the dust particles contain many air pollutants and heavy metals attached to these particles.

Key words: precipitated dust, pollution, storms, compared

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التحليل الكمي للغبار المتساقط على مدن العراق (كركوك، تكريت، نينوى) للسنوات 2011- 2012 مقارنة بالأعوام السابقة

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الخلاصة

تبين من نتائج قياس كمية الغبار المتساقط في محافظات (نينوى ، كركوك ، صلاح الدين) والتي اعتمدت على (12) موقع قياس (6) في مدينة الموصل (3) في مدينة كركوك و (3) في مدينة تكريت وزعت هذه المحطات على ثلاث مناطق (سكنية ،تجارية وصناعية) وللأعوام (2011) و (2012) تباينا في معدلات الغبار المتساقط خلال العام الواحد وان هناك زيادة في كمية الغبار المتساقط خلال عام (2012) بالمقارنة مع عام (2011) في كل من محافظتي كركوك وصلاح الدين بنسبة بلغت (16%) و (6.5%) على التوالي. بينت النتائج ايضا انخفاضا في كمية الغبار المتساقط في محافظة نينوى خلال عام (2012) بنسبة بلغت (21%) عن العام (2011)، كما أظهرت النتائج إن محافظة صلاح الدين احتلت الترتيب الأول في معدلات الغبار المتساقط ثم تلتها محافظة كركوك ثم نينوى حيث كان معدل كمية الغبار المتساقط (53.3 غم/ م^2) في عام (2011) في محافظة صلاح الدين و (37.2 غم/ م^2) في كركوك بينما كان في نينوى (16.3 غم/ م^2) أما خلال عام (2012) فكانت النتائج كالأتي صلاح الدين (57غم/ م^2) ، كركوك (44.4غم/ م^2) ونينوى (12.8غم/ م^2) ذلك لكون محافظة صلاح الدين من المحافظات المتأثرة بشكل كبير بالتصحر ووقوعها على مسار العواصف الترابية الإقليمية القادمة من منطقة الجزيرة في الحدود العراقية- السورية ووجود بؤر للكثبان الرملية في المحافظة والتي تساهم في زيادة كمية الغبار المتساقط خلال العواصف الترابية وتبين من نتائج الدراسة أن معدلات الغبار المتساقط السنوي كانت أعلى من المحدد الوطني المقترح بخمس أضعاف تقريبا وهذا مؤشر خطير على صحة الإنسان كون الغبار المتساقط يعد من المشاكل البيئية الخطرة لاحتوائه على العديد من ملوثات الهواء والعناصر الثقيلة.

الكلمات المفتاحية:- غبار متساقط ، تلوث، عواصف،مقارنة

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Introduction

Dust is any substance has the ability to spread on the air such as dust, smoke, soot particles and the solid combustion products from industrial and urban sources. Dust particles spread to a long distances away from its sources depending on several factors like its weight (particles size), wind speed and direction, topography and vegetation density [1]. Dust particles size varies depending on its sours (natural, urban) and soil type. In addition, drought, desertification, vegetation, density, rainfall scarcity and wind speed play a major role in the spread of dust and formation of dust storms [2].The suspended particles are measured in µg of dust per cubic meter of Air [3]. The particles with size more than 100 µm and less than 1000 µm include particles difficult to precipitate , while particles with size in the range of (1-100) µm has the ability to participate more easily [4].It's important to mention that dust particles still suspending in air to certain periods of time depending on its size and wind speed [5].

The precipitated dust measurement includes the total amount of precipitated dust generated from regional and local or generated from natural and urban sources because local dust in some cases was more in its amount especially in unpaved streets and in areas near constructional and buildings projects in urban areas with motor vehicles movement. Rainfall and humidity reduces the amount of dust generation while temperature, wind speed and lack of vegetation cause an increase in dust generation.[6] The industrial sources (furnaces, smelters, construction of new building and demolition of old building) make the dust particle more pollute compared to other sites away from these sours of pollution. This research aims to calculate the monthly and annual mean of precipitated dust variation and to compare the results with previous years to determine the increasing or decreasing rate in the proportion of quantities.

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Study Area and Methods

Twelve locations (6 in Nineveh, 3 in Kirkuk and Tikrit) were chosen to measure the precipitated dust for the years (2011-2012).The stations were located in residential, commercial, industrial areas as shown in table (1) Figure (1). Samples were taken on monthly basis for the years (2011-2012).

Table (1) Sampling stations within the study area

Province	The number of containers (sampling sites)					
	residential	commercial	industrial	Hamdania	Tilkaif	Hamam al-Alil
Kirkuk	1	1	1			
Salah-Al-Din	1	1	1			
Nineveh	1	1	1	1	1	1

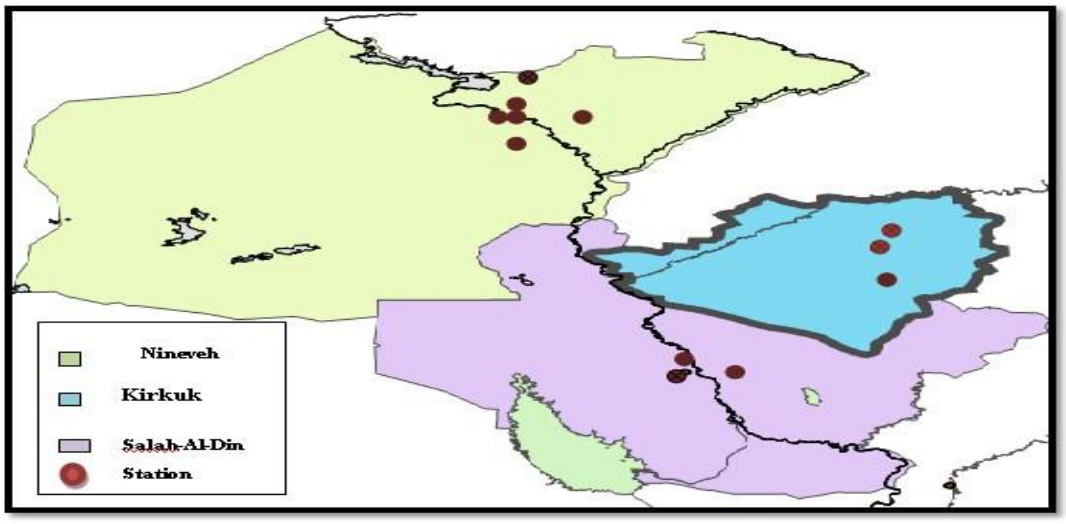

Figure (1) location of stations at study area

Methods

Especial containers were adopted to collect precipitated dust samples and these containers comply within the standards of EPA. The containers were assembled in building roof with 3m height as average and covered by metal cones with specific holes to prevent sample contamination by birds feces and other solid things that may contribute to the amount of dust collected. Every month, the container was brought to the lab and replaced with new one. The procedure of measurement was as follows: [7]

1- Collect the dust in the container by washing with distilled water several times.
2- Collect the solution in 500ml backer.
3- Drying the solution to the lowest possible size (up to 50ml).
4- Transfer the solution to new, clean, dry known weight (w_1).
5- The backer then dried in oven at 105 ^{0}C and leaves it to cool and then weighted again (w_2).

The equation used to calculate the amount of precipitated dust.

Amount of precipitated dust in g/m^2=$\frac{w*10000}{0.7855*225}$ [7]

Where $w=w_2-w_1$

Results and discussion

- Kirkuk:-

The highest value for 2011 was 73g/m^2 in April in the Industrial Area of Kirkuk (fig 2), while in 2012 the highest value was 91g/m^2 in May for the same monitoring station (fig 3). Generally speaking, the average precipitated dust in 2011 was 38.2g/m^2 compared to 44.4g/m^2 in 2012 with an increasing percentage of 13% due to the dust storms and climate change as well as construction and building projects that increased dramatically in 2012 (fig

4). The results showed that maximum (annual average) was recorded in the industrial Area

(49.8, 42.08) g/m^2 in 2011 and 2012 respectively, while the minimum value (annual average) was for the residential monitoring station (35.6, 41.4) g/m^2 in 2011 and 2012, respectively.

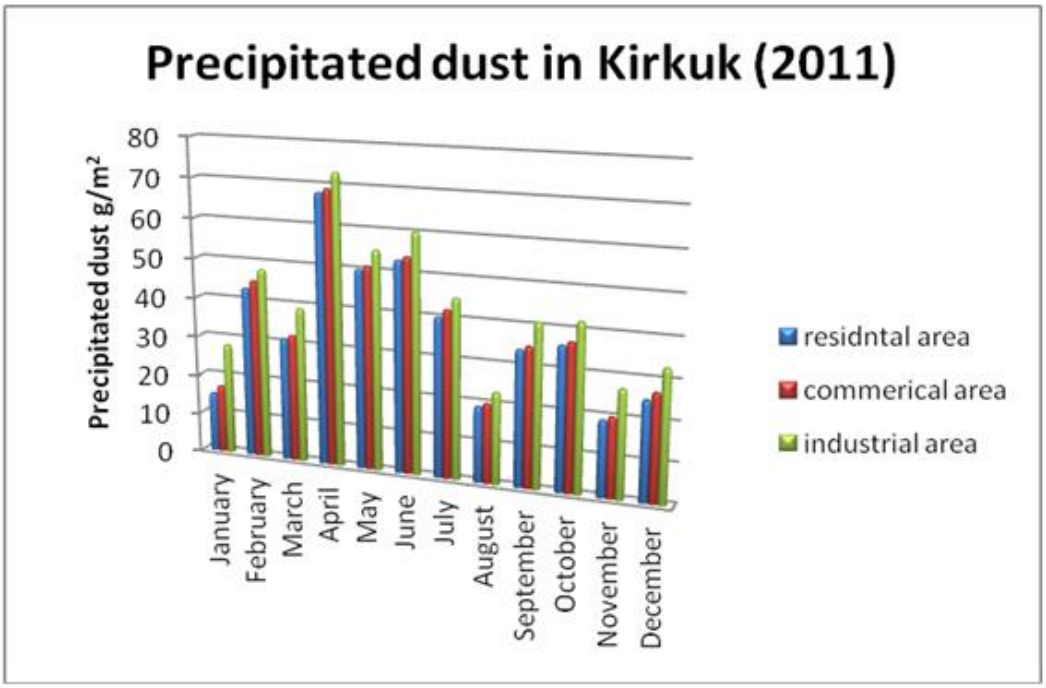

Fig (2) Precipitated dust amounts in Kirkuk (2011)

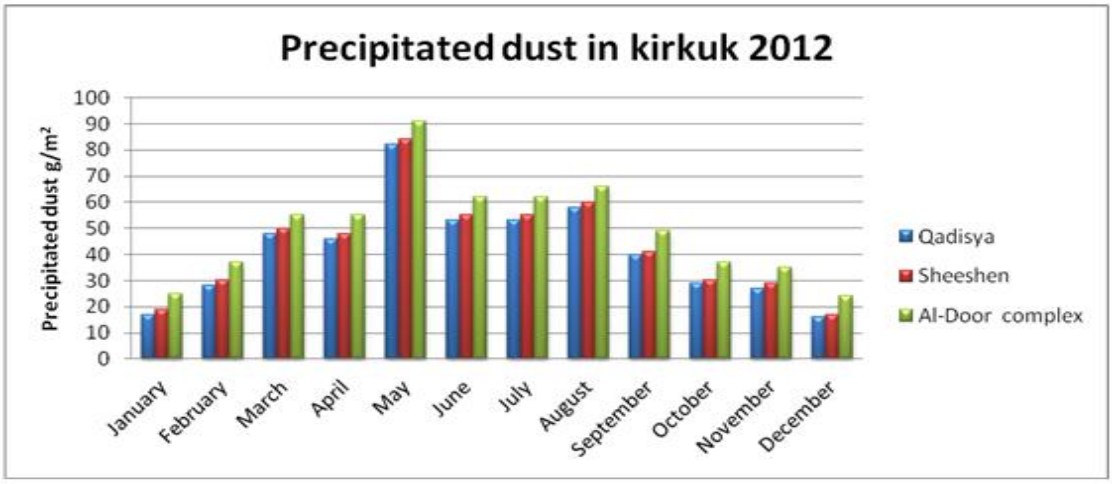

Fig (3) Precipitated dust amounts in Kirkuk, 2012

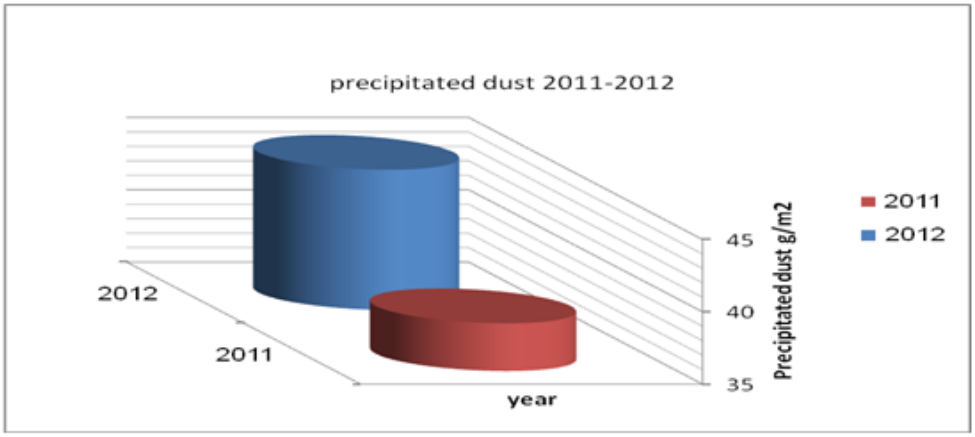

Fig (4) Precipitated dust quantities (annual rate) in Kirkuk for the years (2011) and (2012)

The results of the current study were compared with the previous studies. The author note that in 2004, precipitated dust (annual rate) was 19g/m^2 and 25, 36, 45, 46, 67 for 2005, 2006, 2007, 2008, 2009, respectively (fig 5). These finding indicate increasing in the amount of dust because of some climate change factors like the lack of rainfall which causes land deterioration and drought (table 2).

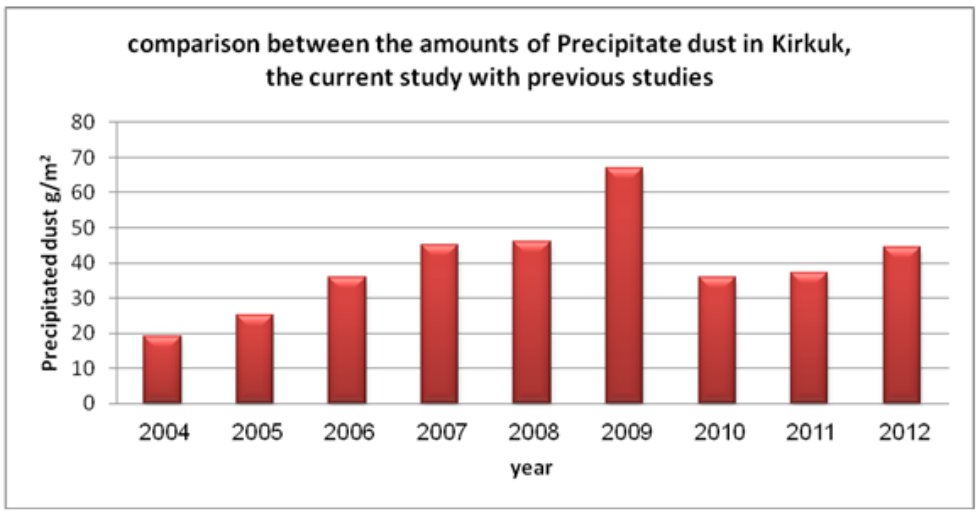

Fig (5) a comparison between the amounts of precipitated dust in Kirkuk, the current study with previous studies

Table (2) the annual rates of rainfall public .Iraqi Meteorological Organization and Seismology

Year	2006	2007	2008	2009
Quantity / mm	458.4	173.1	134.9	225.8

- Tikrit:-

The highest value of the precipitated dust for the year 2011 was 97.1g/m^2 in residential Area monitoring station in June which within highest proportion of dust storm in that year. In 2012, the highest value was 117.6g/m^2 in May of the some monitoring station. The lowest value of dust was 8.5g/m^2 in November 2011 and 6.9g/m^2 in January 2012 (fig 6, 7).

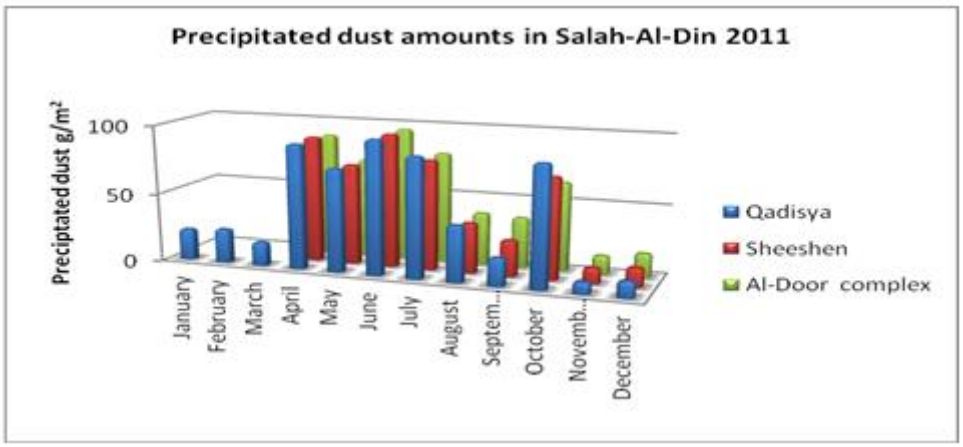

Fig (6) Precipitated dust amounts in Salah-Al-Din **2011**

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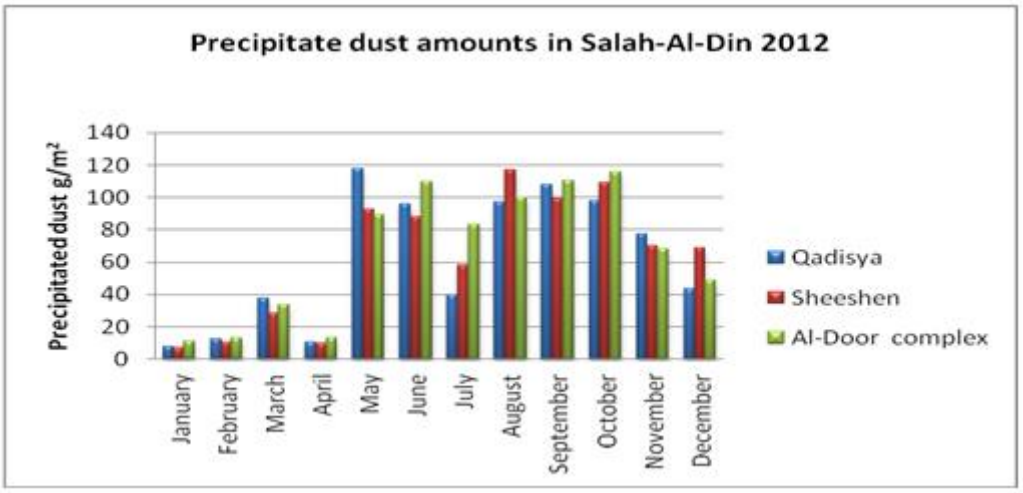

Fig (7) Precipitate dust amounts in Salah-Al-Din **2012**

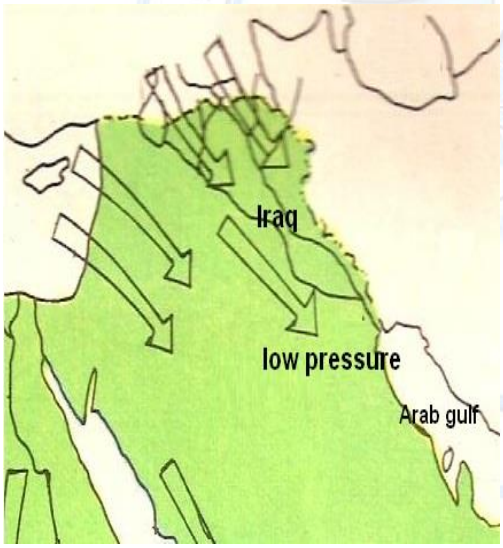

Fig (8) Wind direction

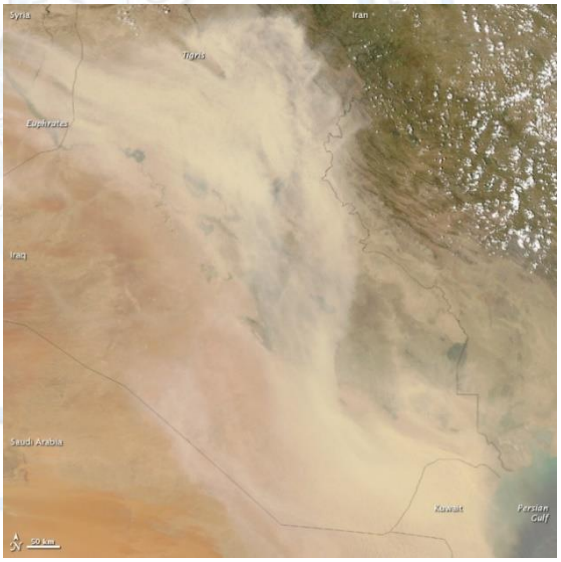

Fig (9) Dust Storm over Iraq May 24, 2012

The results of this research showed that the annual average dust was 53.3 and 57 g/m^2 for the years 2011, 2012 respectively with increasing by 6.5% by comparing between the two years (fig10).

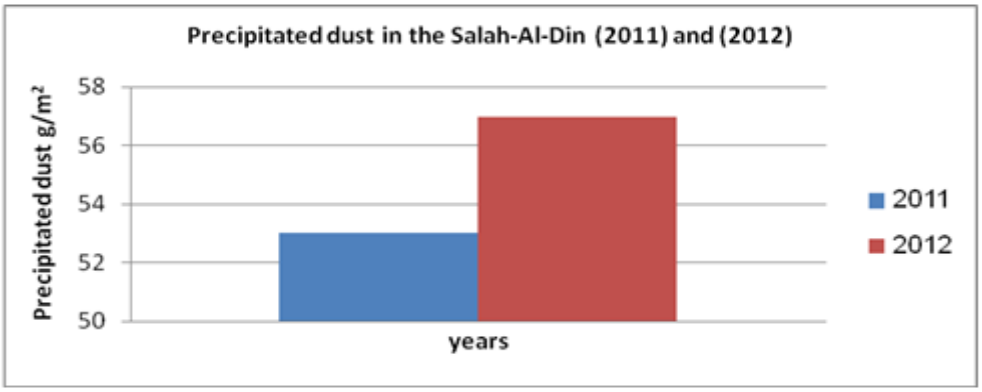

Fig (10) Precipitated dust quantities (annual rate) in the Salah-Al-Din **(2011) and (2012)**

- Nineveh:-

The results showed that the highest value of precipitated dust was 51g/m^2 in March 2011 for the residential Area station (fig11), while it was 35g/m^2 in September 2012 in Hamdania monitoring station (fig13), the lowest value for 2011 was 3g/m^2 in January for Tillkaif monitoring station and 6g/m^2 in November 2012 for the some monitoring station too.

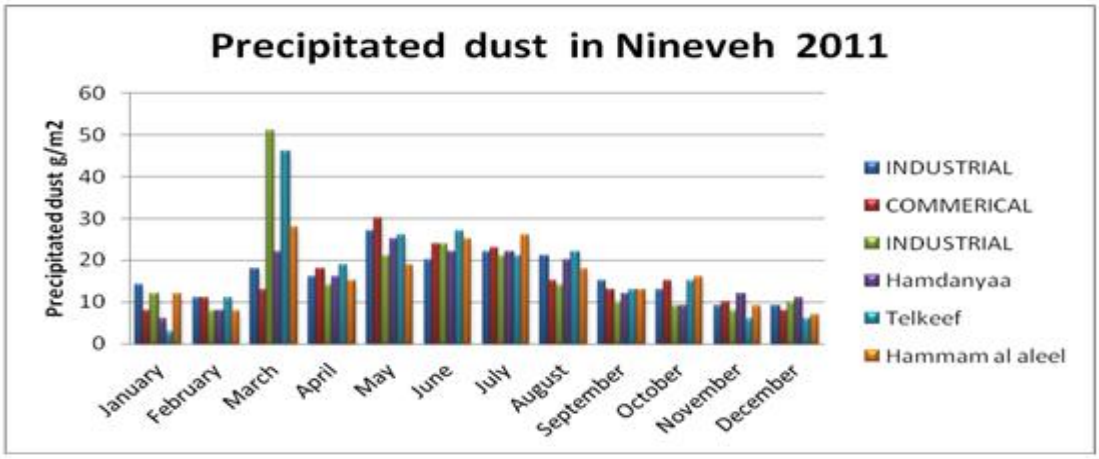

Fig (11) Precipitated dust quantities (annual rate) in Nineveh for the year (2011)

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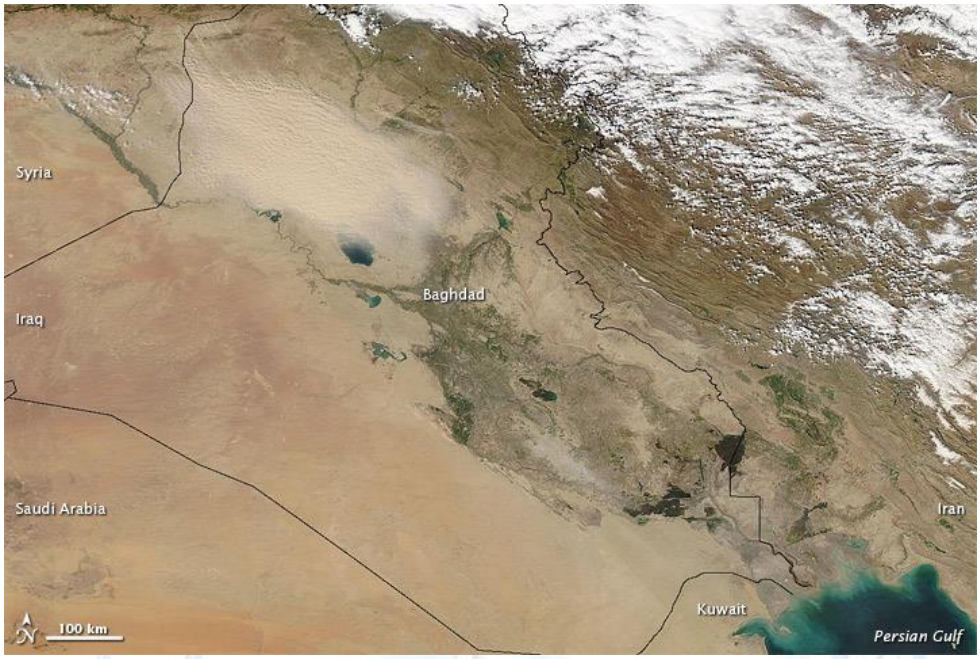

Fig (12) Dust Storm over Iraq March 3, 2011

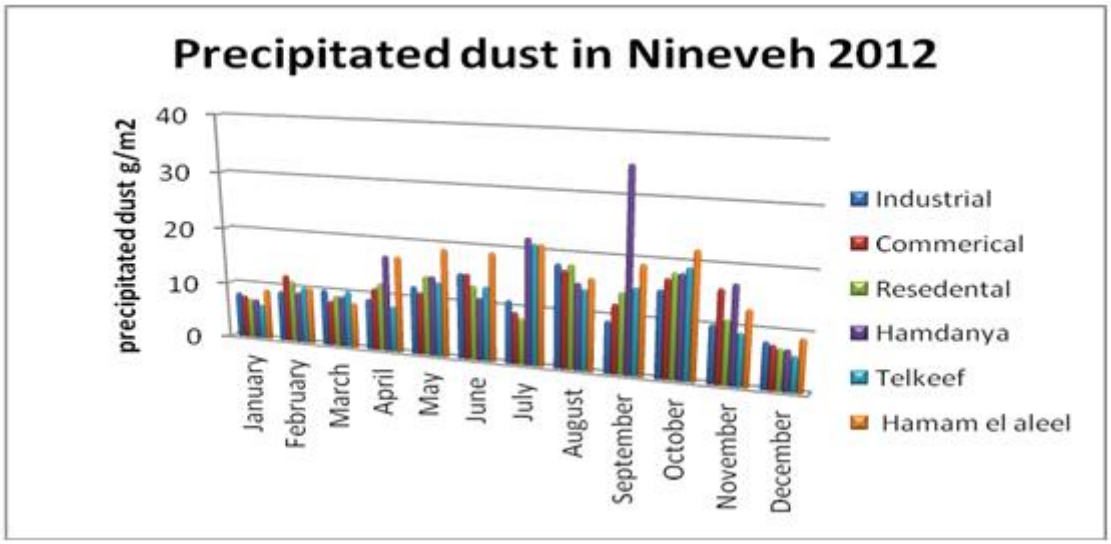

Fig (13) Precipitated dust quantities (annual rate) in Nineveh for the year (2012)

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The results showed that annual mean of precipitated dust in 2011 was 16.3g/m^2 while it was 12.7g/m^2 in 2012 by 22% decreasing ratio. When we compare the annual mean for all the six monitoring station in this research we notice that the highest value (annual mean) was 18g/m^2 in Tilkif station , while the lowest value was 15g/m^2 in AL- Hamdanyia station in 20. In the other hand, the 2012 year results showed a different trend as the highest value was 15g/m^2 in Hamam al-alil and 11g/m^2 as lowest value in industrial Area monitoring station. When comparing the results of this research to that of previous years as illustrated in (fig14) we can conclude that the trend of precipitated dust is decreased in general (fig15).

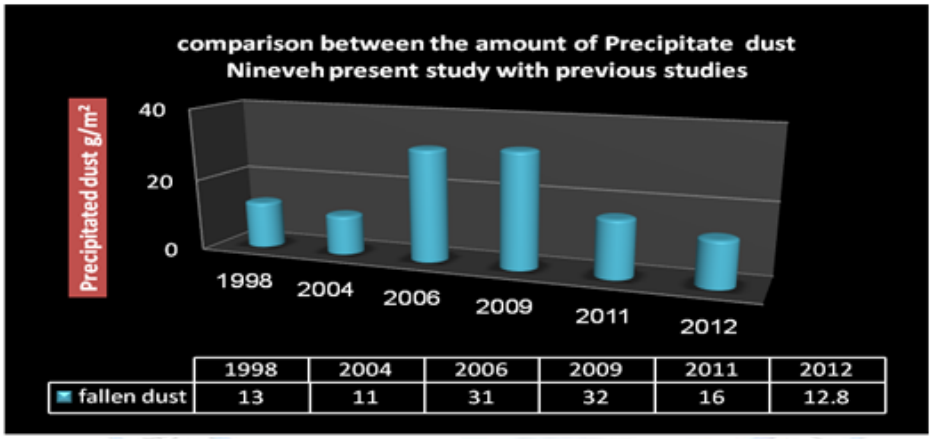

Fig (14) a comparison between the amount of Precipitate dust Nineveh present study with previous studies

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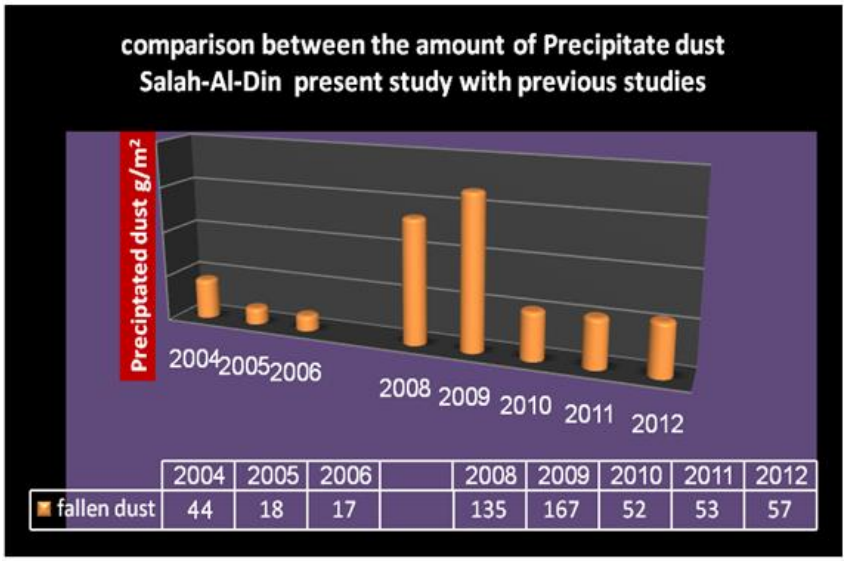

Fig (15) a comparison between the amount of Precipitate dust Salah-Al-Din **present study with previous studies**

We noticed that an increase in the amount of precipitated dust along the years with a peak value in (2008, 2009) periods which can be related to number and intensity of dust storm in these periods of time. In general, Tikrit has the highest value of dust followed by Kirkuk and Nineveh in last order (table 3).

Table (3) annual of precipitate dust in the research g/m^2

year	2001	2012
Tikrit	53.3	57
Kirkuk	37.2	44.4
Nineveh	16.3	12.8

These results can related to the fact of the large desert area near and around Tikrit as well as Tikrit lies on the dust storm paths as the core of dust storm in Iraq – Syrian border and the sand dunes around Tikrit which gives evidence to the relation between dust storms, vegetation and amount of precipitated dust. [6] These findings confirm other researcher's findings [12].

Conclusion

1. April and May has the highest value of the precipitated dust.
2. January, December, February and March have the lowest value of precipitated dust.
3. Kirkuk and Tikrit has shown an increase in the amount of dust in 2012 compared to 2011 with 16%, 6.5% increasing ratio.
4. Tikrit has the highest value of dust followed by Kirkuk the Nineveh.
5. Nineveh has shown decreasing in value of dust in 2012 comparing to 2011 by 21% ratio.
6. The annual mean value was higher than the Iraqi national limits ($10g/m^2$).

Recommendation:-

1- The need to expand in the study of the factors affecting on precipitate dust like rainfall and other climate factors.

2- Qualitative analysis for dust samples containing heavy metal and other chemical pollutants analysis.

3- Increasing the numbers of monitoring station way to get more reliable results and findings.

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