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Hydrocarbon and trace elements concentrations in Najaf city, Iraq.

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ABSTRACT

There are many sources of air pollution as a result of urbanization, industrial, and population growth in the Najaf city, Iraq. This study included estimating the concentrations of some trace elements such as Pb, Mn, Ti, Zn, Cr, Ni, Co, Cd, Fe, Ag and Hg and Lower Explosive Limit (LEL) of oxygen (O_2) with simultaneous measurements of weather conditions with the time of sampling during December 2012 in 20 sites in the city of Najaf. As well as, the hydrocarbons (VOCs) are measured. All the concentration values are higher than the recommended limit of VOCs, except three sites. The Lower Explosive Limit of O_2 is ranged (ND-8.3%) in 22 sites. A trace element concentration varies according to the following order: traffic > industrial > commercial > housing. The Pb concentration is less than the National Air Quality Standards of the US. Cu concentrations are below the level of detection, whereas Cd concentration value was found to be within recommended limit.

Keywords: Oxygen (O_2); trace elements; Najaf city air; air pollution, hydrocarbons.

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INTRODUCTION

Air is one important component of the environment. Gas pollution can be felt by the smoke emitted from factories, fires, gases with cars exhaust, aircraft, and volcanoes. Air pollution problem is exacerbated in intensity and impact day after day. Air represents an unstable environment, which is reflected in the air pollutants variation on place to place by the impact on climatic conditions. Numerous air pollution sources in cities where the exhaust and transportation, particularly cars of the most important of these pollutants as specialized studies have shown that pollution from the exhaust gas for vehicles with internal combustion amounted to about 55% of the total pollutants air and other pollutants can be classified as air pollutants, according to several foundations such as major and minor or pollutants to the standard pollutants air (VOCs) and pollutants toxic and usual and non-usual contaminants (Almayahi et al. 2014). These pollutants are classified into pollutants gaseous and Particulate Matter (2.5 µm to 10 µm) (Harrison, 2001). The pollutants gaseous high into the cities, which are islands of heat rather than in the open countryside to the fact that the movement of wind where faster compared to cities which are hampering the movement of wind and instability due to the large number of buildings which adversely affect the comfort physiological human and environmental effects on plant and animal and buildings. This study aims to measure the concentrations of pollutants air in 22 sites distributed among the industrial, commercial, residential, traffic sites, and the other including agricultural reference stations in the city of Najaf as shown in Fig.1. Pollutants air measured in the study area in December 2012 and March, July 2013.

MATERIALS AND METHODS

Table 1 shows sampling sites and climatic conditions at the moment of measurement to reveal the reality of the air pollution. Table 1 shows the LEL oxygen (O_2) and VOCs concentrations in 20 sites in the city of Najaf, Iraq are measured using Lower Explosive Limit (LEL) Analytical system, K61311, Canada and VOCs Measurements Mimi-Rae 3000, USA, respectively. Trace elements (Pb, Mn, Ti, Zn, Cr, Ni, Co, Cd, Fe, Ag, and Hg) concentrations on 20 sites in the city of Najaf are measured using (Scanning Electron Microscope / Inspect S50 and EDX). Sampling sites are classified into industrial, residential, commercial, agricultural, and traffic sites. Sampling sites coordinates are recorded using GPS, 12 Channel, Taiwan. Digest models operations are made by dissolving filters containing contaminants mixtures (1:4) sizes of acidic per chlorate and nitric (HNO_3, $HCLO_4$) and put the mixture in a closed bottle into a vibrator water bath for an hour at a temperature of 45 °C until the solution is homogeneous (Perry and Young, 1977; Sisovic and Fugas, 1987; Koren and Bisesi 2003; Danniel and Edward 2010). The solution is transferred to a beaker cleaned with nitric acid and distilled water. Non-ionic water is added to the solution until become the size of 25 ml. Then the solution is ready to be revealed by Scanning Electron Microscope / Inspect S50 Device.

Table 1: Sampling sites and climatic conditions (2012) (MMPW, 2013; Alduhaidahawi et al. 2015)

Site Code	Site	Site Type	Coordinates	Date	Time	T (°C)	Wind Speed (km h^{-1})
S1	Limestone Brick Factory	Industrial	N 31.57.05 E 44.25.04	2012/12/7	10.00 am	17	10
S2	Brick Factory	Industrial	N 31.57.14 E 44.17.07	2012/12/7	11.00 am	17	10
S3	Medina Street	Commercial	N 31.59.26 E 44.19.18	2012/12/7	11.30 am	17	8
S4	Aljudaida-4	Residential	N 31.95.02 E 44.19.20	2012/12/7	12.00 pm	20	6
S5	Aleskaan Street	Traffic	N 32.00.07 E 44.21.00	12.2012/7	12.30 pm	20	8
S6	Asphalt Factory	Industrial	N 32.08.59 E 44.17.37	2012/12/7	2.00 pm	24	10
S7	Alaskari district	Residential	N 32.03.36 E 44.20.01	2012/12/7	3.00 pm	23	8
S8	Almaydain Square	Commercial	N 31.59.45 E 44.10.12	2012/12/12	9.00 am	14	6

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S9	Alhadhaba Edge	Residential	N 31.59.35 E 44.18.33	2012/12/12	9.30 am	14	10
S10	Alrasoul Street	Commercial	N 31.59.33 E 44.18.56	2012/12/12	10.00 am	14	2
S11	Internal Garage	Traffic	N 32.00.03 E 44.19.52	2012/12/12	10.40 am	19	3
S12	Almadena-Abouscker Junction Street	Traffic	N 31.59.44 E 44.20.01	2012/12/12	11.10 am	19	6
S13	Aden District	Industrial	N 31.59.38 E 44.20.50	2012/12/12	12.00 pm	20	6
S14	Herafeyeen District	Industrial	N 31.59.23 E 44.21.55	2012/12/12	12.45 pm	20	6
S15	Kufa Tires Factory	Industrial	N 31.59.27 E 44.21.15	2012/12/12	1.30 pm	21	7
S16	Greenbelt Junction	Traffic	N 32.10.11 E 44.20.28	2012/12/12	2.10 pm	21	7
S17	Sadrain Square	Traffic	N 32.00.34 E 44.21.14	2012/12/12	2.40 pm	21	8
S18	Snai district	Industrial	N 32.00.38 E 44.22.47	2012/12/15	11.00 am	21	10
S19	Almelad District	Residential	32.03.06N 44.18.45E	2012/12/15	12.30 pm	21	8
S20	Faculty of Science	Agricultural	N 32.06.46 E 44.22.30	2012/12/18	10.00 am	16	7

RESULTS AND DISCUSSION

Table 2 shows that the concentration of Lower Explosive Limit of oxygen (O_2) in 20 sites in the city of Najaf. The Lower Explosive Limit of oxygen O_2 (8.3%) in S5 site. While, (ND) is found at the 13 sampling sites.

Table 2: The concentration of LEL of oxygen O_2 in the study area, December 2012

Site Code	LEL%
S1	ND
S2	ND
S3	ND
S4	ND
S5	8.3
S6	ND
S7	ND
S8	ND
S9	ND
S10	ND
S11	6.5
S12	4.8
S13	5.4
S14	4.6
S15	ND
S16	ND
S17	1.9
S18	2.9
S19	ND
S20	ND

ND: Not detected

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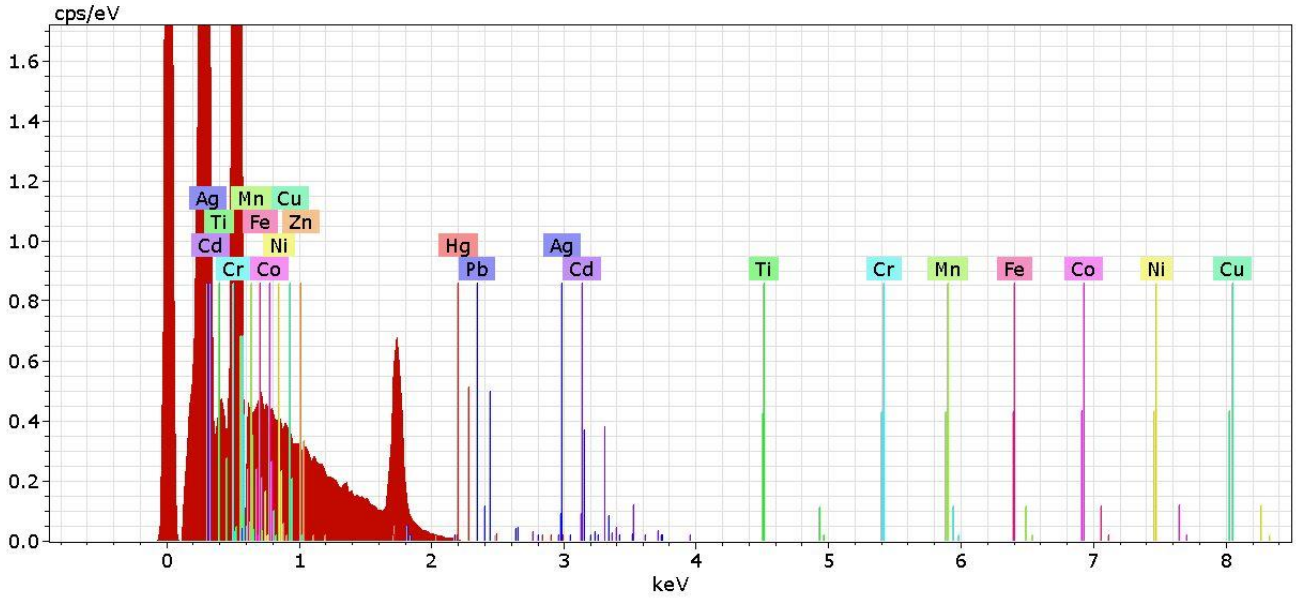
Table 3 shows that the highest VOCs concentration (0.7 ppm) in site (18) and lower concentration (ND ppm) was found at the site (17). However, all the concentration values are higher than the recommended limit (0.24 ppm) for VOCs, except sites (17, Alansar, and Aljameha). The burning fuel that contains a high amount of VOCs is a source of providing VOCs and industrial and commercial activates.

Table 3: The concentration of VOCs (ppm) in study area (March 2013)

Site Code	VOCs
S17	ND
S11	0.2
S12	0.4
S13	0.3
S14	0.5
Alansar	0.1
S18	0.7
Aljameha	0.1
S19	0.2

Some trace elements Pb, Mn, Ti, Zn, Cr, Ni, Co, Cd, Fe, Ag and Hg are measured as shown in Fig. 1. Fig. 1 presents the results for the weight percentage of elements, such as: Pb, Mn, Ti, Zn, Cr, Ni, Co, Cd, Fe, Ag and Hg obtained from EDS for all samples. Typical microphotograph and spectrum of samples using SEM and EDS are shown in Figs. 1, 2.

Fig. 1. Spectrum represents the concentration of trace elements.



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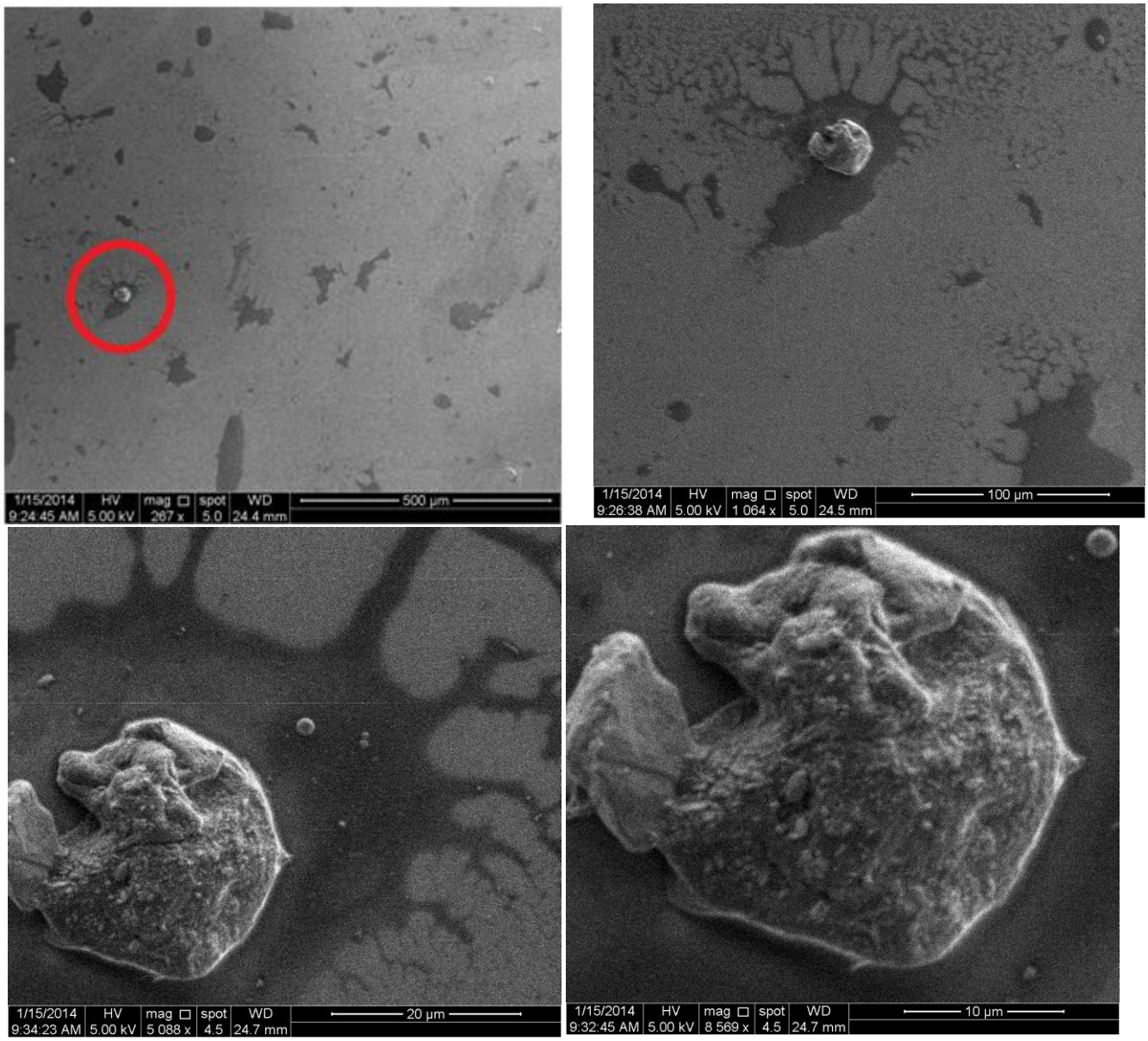

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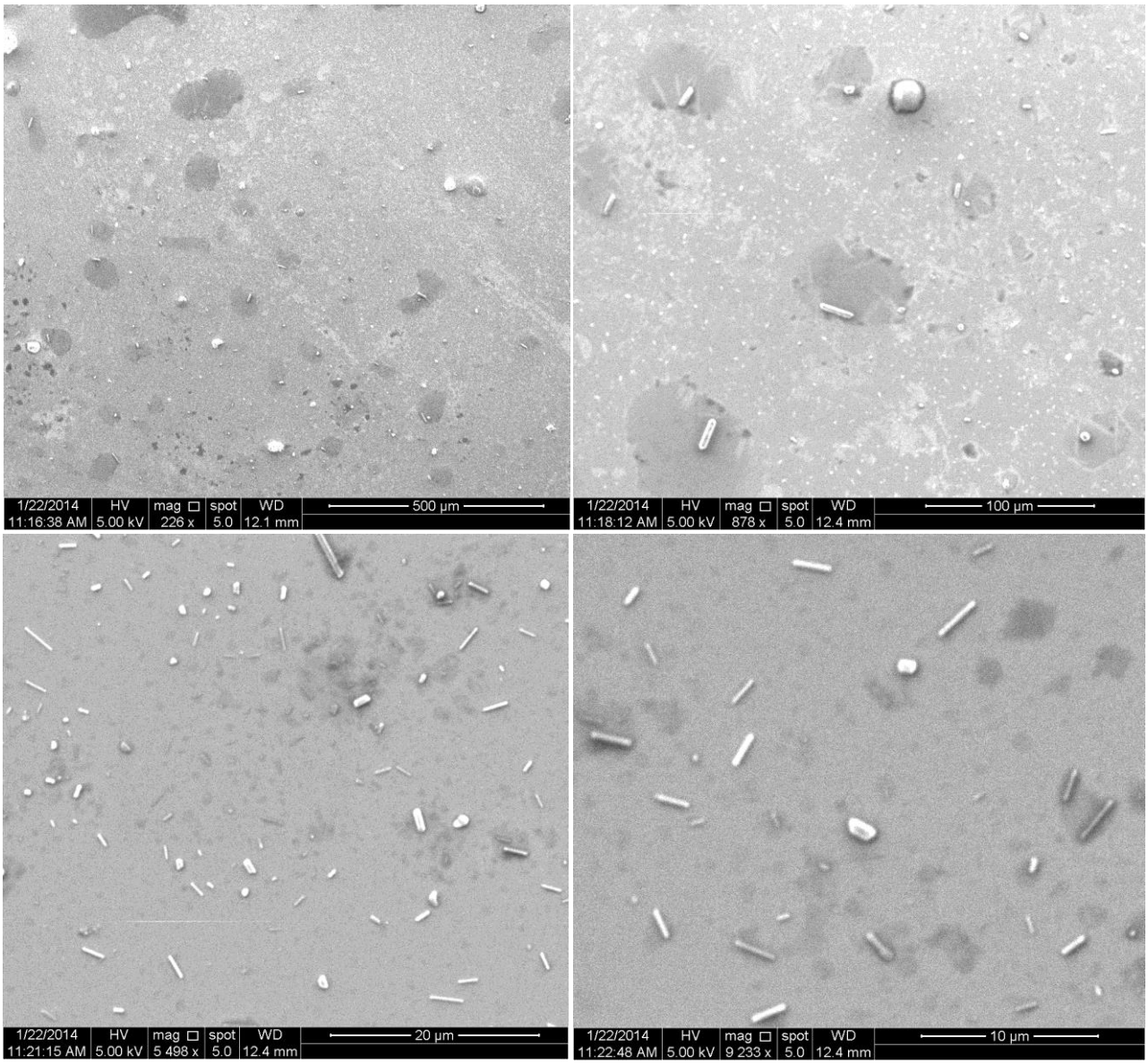

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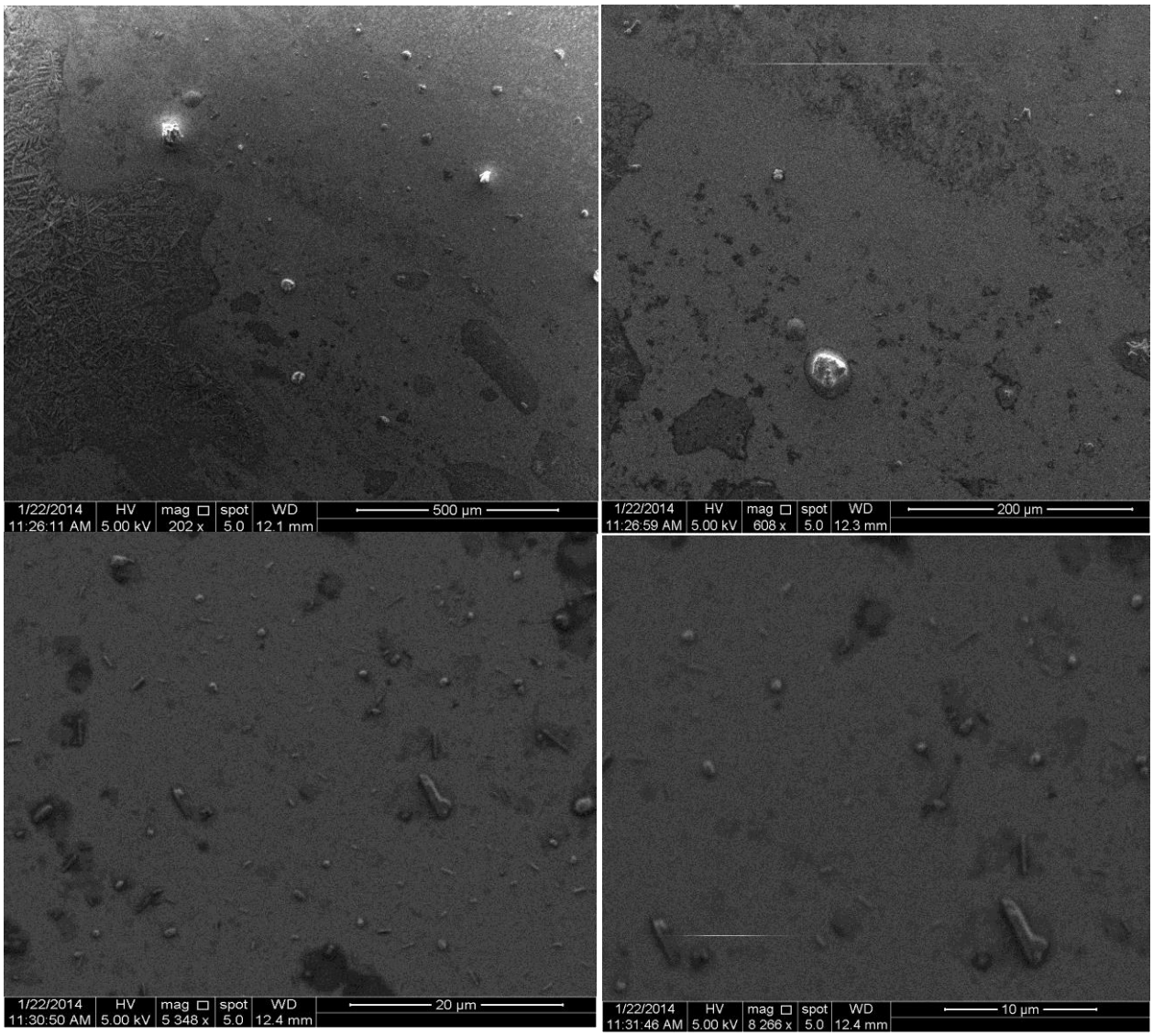

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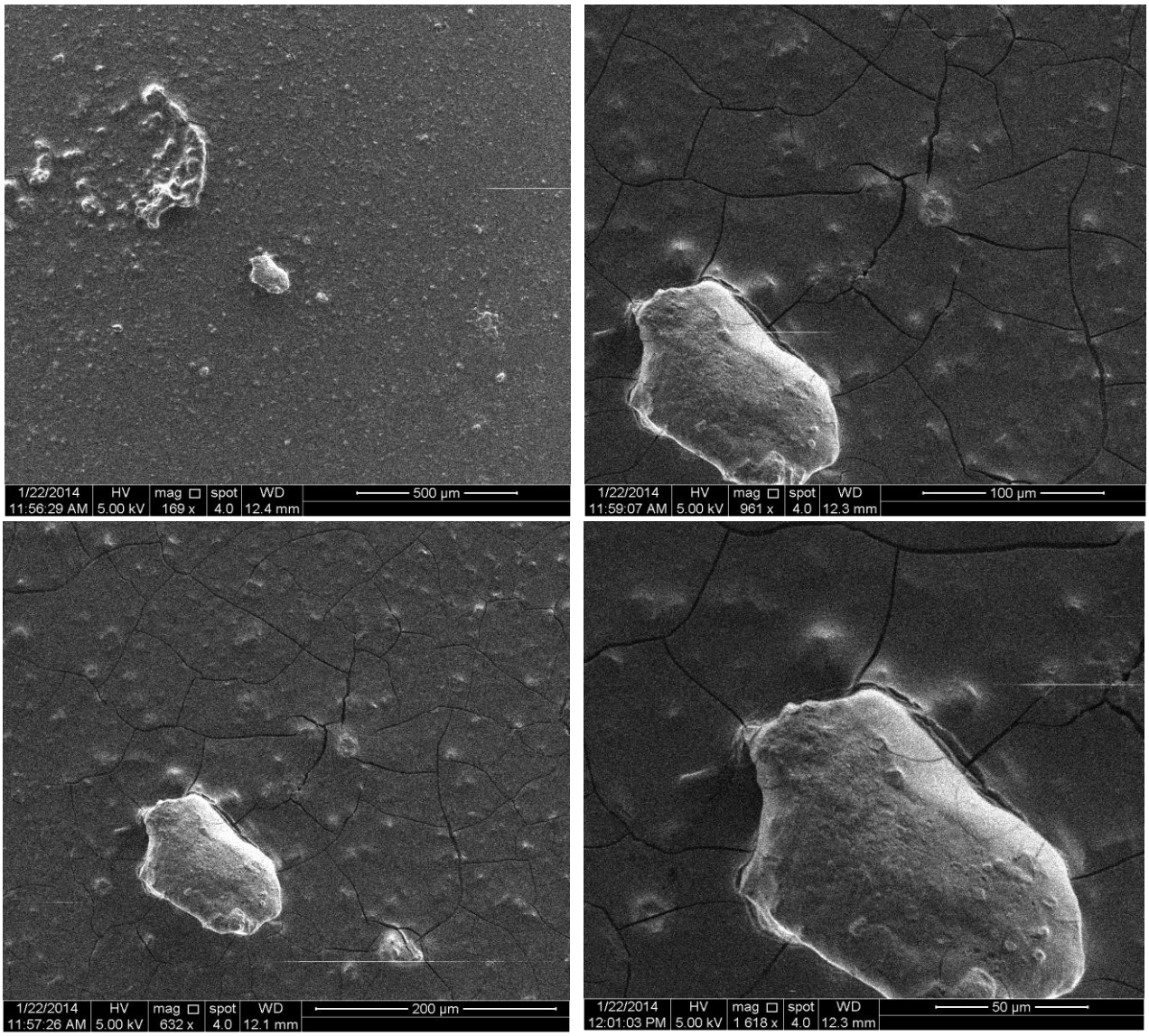

d

CONCLUSION

The highest VOCs concentration (0.7 ppm) in site (18) and lower concentration (ND ppm) was found at the site (17). However, all the concentration values are higher than the recommended limit of VOCs, except sites (17, Alansar, and Aljameha). The Lower Explosive Limit of O_2 (ND-8.3%) in 22 sites. Pb, Mn, Ti, Zn, Cr, Ni, Co, Cd, Fe, Ag and Hg concentrations varies according to the following order: traffic > industrial > commercial > housing. The lead concentration is less than the National Air Quality Standards of the US. Copper concentrations are below the level of detection, whereas Cd concentration value was found to be within recommended limit.

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