Soil is an important component of life cycle affecting agriculture and food crops. Quality of soil resources is defined according to their potential impact on human health by exposure of harmful constituents through the food chain. Heavy metals especially As, Pb and Cd are among the most hazardous elements which could be released to the top soil through different wastewaters, fertilizers, herbicides and etc. In this research Aghili plain in Khuzestan province, Iran was selected as a total of 54 samples were prepared based on a systematic gridding procedure. Selected heavy metals concentrations were analyzed by inductively coupled plasma mass spectrometry (ICP-MS) and then zoning was performed using kriging method. Pollution level was assessed through single factor indices and pollution load index. A separate map dealing with each heavy metal was prepared to present the distribution of heavy metal in Aghili plain. In all samples the
heavy metals concentrations followed the below trend:
Pb > As > Cd.

Furthermore, based on the PLI, all stations were categorized as moderately to highly polluted sites (1 < PLI < 4). Due to toxic effects of mentioned heavy metal for human health, further monitoring, some control measures and remedial actions should be undertaken in the study area.

© 2017 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

Specifications Table

| Subject area                      | Environmental pollution |
|-----------------------------------|-------------------------|
| More specific subject area        | Soil pollution and monitoring |
| Type of data                      | Table and Figure |
| How data was acquired             | Sampling the designed points of the soil, extraction the samples and analyzing using ICP-MS Spectrometers, Model: SPECTRO ARCOS, Germany |
| Data format                       | Processed, Raw |
| Experimental factors              | Sampling of designed points for determination of soil characteristics and analyzing heavy metal concentration in Aghili plain, Khuzestan province, Iran. |
| Experimental features             | Upon sampling and analyzing the obtained data, the map of heavy metal contamination was prepared using kriging method. Descriptive statistics and correlation of variables including Soil characteristics and metal concentrations were performed. Pollution level was assessed using single pollution indices and pollution load index. |
| Data source location              | Shushtar city, Khuzestan province, Iran |
| Data accessibility                | Data are available in article |

Value of the data

- Determination of the concentration of three heavy metals including Pb, Cd and As in agricultural soil was investigated in Aghili plain, Shushtar city, Iran.
- A total of 54 samples were prepared throughout the entire plain according to a systematic gridding method.
- Pb concentrations were the highest in all samples compared to As and Cd.
- Zoning of heavy metal concentration was performed and a distribution map was produced for each heavy metal.

1. Data

Data presented here deal with monitoring of selected heavy metals including Cd, Pb and As in Aghili plain, Khuzestan province, Iran. Fig. 1 shows the study area and the sampling points. A summary of characteristics of soil samples are presented in Table 1. Table 2 shows descriptive statistics of results for heavy metal concentrations. The correlation between different variables are presented in
Table 3. Results of pollution level assessment are presented in Table 4. Fig. 2 shows the variations of selected heavy metals concentrations including As, Pb and Cd in entire area of research zone. Zonings of Cd, Pb and As in Aghili plain are presented in Figs. 3–5, respectively.

2. Experimental design, materials and methods

2.1. Sampling procedure

The scope of the sampling area focused on the agricultural area of Aghili plain, Khuzestan province, Iran. Aghili plain has an area of 11,000 ha. A systematic sampling procedure was performed to provide a sampling scheme over the entire plain. The plain was divided into 55 cells of 2 ha in size, within which the topsoil samples (0–20 cm) were collected [1]. A sampling density of one sample per 2 ha was adopted wherever possible in agricultural soils. Each of the soil samples consisted of

Table 1
Soil properties in Aghili plain, Iran.

| Parameter     | Value         |
|---------------|---------------|
| Clay (%)      | 39.15         |
| Silt (%)      | 42.56         |
| Sand (%)      | 18.29         |
| pH            | 8.12 ± 0.52   |
| TOM (%)       | 8.24 ± 1.38   |
| EC (ms/cm)    | 1.69 ± 0.352  |
| Moisture (%)  | 17.38 ± 2.81  |
5 subsamples collected in a 2 km × 2 km grid from the sampling plot with a stainless steel hand auger. For each cell, a total of 1 kg of soil was taken from the mixed samples using a quartile method. The collected soil samples were stored in polyethylene bags for transport and laboratory. The exact location (longitudes and latitudes) of each sample point was measured by GPS instrument.

2.2. Statistical analysis

Descriptive statistics including mean, maximum, minimum, median, coefficient of variation (CV), skewness and kurtosis were calculated for samples. The Kolmogorov–Smirnov (K–S) test was applied to check the normality of the variables (significance level was considered at $P \leq 0.05$). Pearson correlation matrix was also used to identify the relationship between soil variables.

2.3. Soil Pollution Assessment

To assess the contamination level of selected heavy metals in Aghili plain, single factor contaminant index (PI) and pollution load index (PLI) were calculated using Eqs. (1) and (2) [2,3]:

$$PI = \frac{C_n}{B_n}$$  \hspace{1cm} (1)

$$PLI = \sqrt[PI1 \times PI2 \ldots \times PI_n}$$  \hspace{1cm} (2)

Where $C_n$ and $B_n$ is the concentration of metal in the soil sample and background, respectively (mg/kg). n is the number of pollutants assessed (i.e., 3) and PI is the single factor pollution index of each metal. The PLI below 1 implies no pollution whereas PLI greater that 1 shows polluted site. Background concentrations were determined from the mean concentrations of the ghili plain, Iran.

2.4. Analytical methods

In order to extract adsorbed Cd, Pb and As in studied soil samples, acid digestion procedure was performed. The collected soil samples were dried for 7 days at 40 °C, sieved through a 2 mm in a
plastic sieve and ground to fine powder using agate and a pestle [4]. For the digestion of samples, a representative 2g sample was digested with repeated additions (10 mL) of nitric acid (HNO₃) and hydrogen peroxide (H₂O₂) based on USEPA 3050B method. The resultant digestate is reduced in volume while heating and then diluted to a final volume of 100 mL. Particulates in the digestate were

| Sample | PI  | PLI | Sample | PI  | PLI |
|--------|-----|-----|--------|-----|-----|
| As     | Cd  | Pb  | As     | Cd  | Pb  |
| 1      | 3   | 2.76| 2.09   | 2.59| 28  |
| 2      | 1.81| 2.15| 2.52   | 2.14| 29  |
| 3      | 2.54| 2.53| 3.06   | 2.70| 30  |
| 4      | 5.63| 2.07| 5.10   | 3.91| 31  |
| 5      | 2.63| 2.61| 3.17   | 2.79| 32  |
| 6      | 1.54| 2.15| 2.68   | 2.07| 33  |
| 7      | 2.63| 2.76| 4.03   | 3.08| 34  |
| 8      | 0.09| 2   | 1.29   | 0.61| 35  |
| 9      | 1.81| 2.61| 3.17   | 2.47| 36  |
| 10     | 2.72| 2.46| 5.64   | 3.35| 37  |
| 11     | 1.27| 2.23| 2.58   | 1.94| 38  |
| 12     | 3.18| 2.30| 4.03   | 3.09| 39  |
| 13     | 1.90| 3.61| 4.78   | 3.20| 40  |
| 14     | 1.18| 2.69| 2.63   | 2.03| 41  |
| 15     | 1.27| 2.38| 3.17   | 2.12| 42  |
| 16     | 2.72| 2.46| 5.64   | 3.35| 43  |
| 17     | 1.45| 2.30| 2.79   | 2.10| 44  |
| 18     | 0.63| 2.23| 2.58   | 1.54| 45  |
| 19     | 0.72| 2.15| 2.58   | 1.59| 46  |
| 20     | 2.09| 2.23| 2.63   | 2.30| 47  |
| 21     | 2.36| 2.69| 3.81   | 2.89| 48  |
| 22     | 1.45| 2.61| 3.17   | 2.29| 49  |
| 23     | 1.81| 2.30| 3.22   | 2.38| 50  |
| 24     | 0.63| 2.69| 3.49   | 1.81| 51  |
| 25     | 2.4 | 2.07| 2.79   | 2.42| 52  |
| 26     | 0.545| 2.156| 1.987 | 1.32| 53  |
| 27     | 0.90| 2.61| p3.22  | 1.97| 54  |

Note: Pollution level based on PI: PI < 1 (Non-polluted); 1 < PI < 2 (Slight polluted). 2 ≤ PI < 3 (Moderately polluted); PI ≥ 3 (Highly polluted) [2,3].

Note: Pollution level Based on PLI value: PLI = 0 background concentration; 0 < PLI ≤ 1 unpolluted; 1 < PLI ≤ 2 moderately to unpolluted; 2 < PLI ≤ 3 moderately polluted; 3 < PLI ≤ 4 moderately to highly polluted; 4 < PLI ≤ 5 highly polluted; PLI > 5 very highly polluted [2,3].

Fig. 2. Variations of concentrations of Cd, Pb and As in Aghili plain, Khuzestan province, Iran.
Fig. 3. Map dealing with zoning of Cd concentration in surface soil of Aghili plain, Khuzestan province, Iran.

Fig. 4. Map dealing with zoning of Pb concentration in surface soil of Aghili plain, Khuzestan province, Iran.
removed by centrifugation at 3000 rpm for 10 min [5,6]. The Limit of Detection (LOD) was evaluated as the ratio of three times of the standard deviation of seven blank readings with respect to the pre-concentration factor as shown in Eq. (3) [7,8]:

\[
\text{LOD} = 3 \text{STD}/\text{PF}
\]

where, STD is the standard deviation of seven blank readings, and PF is the pre-concentration factor. While the Limit of quantification LOQ was calculated using following equations (4) [7]:

\[
\text{LOQ} = 3\text{LOD}
\]

Physiochemical characteristics of soil samples were also determined. The grain size of soil samples were determined Hydrometer method [9] and the sand, silt and clay content were assessed. Total organic carbon (TOC) content of the soil was determined using the loss on ignition (LOI) method [10]. Soil pH and salinity were measured by mixing soil and distilled water in a 1:2.5 (g:mL) ratio and shaking for 15 min before measuring pH [10].

Acknowledgements

This paper is issued from thesis of Amaneh Azarmansuri and financial support was provided by Ahvaz Jundishapur University of Medical Sciences (Grant no: ETRC 9426).
Transparency document. Supplementary material

Transparency data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.dib.2017.07.008.

References

[1] A. Rezaee, H. Godini, S. Jorfi, Nitrate removal from aqueous solution using MgCl₂ impregnated activated carbon, Environ. Eng. Manag. 9 (2010) 449–452. (http://omicron.ch.tuiasi.ro/EEMJ/).
[2] C. Zhang, Q. Qiao, J. Piper, B. Huang, Assessment of heavy metal pollution from a Fe-smelting plant in urban river sediments using environmental magnetic and geochemical methods, Environ. Pollut. 159 (2011) 3057–3070. http://dx.doi.org/10.1016/j.envpol.2011.04.006.
[3] C. Wei, H. Wen, Geochemical baselines of heavy metals in the sediments of two large freshwater lakes in China: implications for contamination character and history, Environ. Geochem. Health 34 (2012) 737–748. http://dx.doi.org/10.1007/s10653-012-9492-9.
[4] A. Qishlaqi, F. Moore, G. Forghani, Characterization of metal pollution in soils under two land use patterns in the Angouan region, NW Iran; a study based on multivariate data analysis, J. Hazard. Mater. 172 (2009) 374–384. http://dx.doi.org/10.1016/j.jhazmat.2009.07.024.
[5] M. Habila, Z. AlOthman, A. El-Toni, Puzon Labis, M. Soylak, Synthesis and application of Fe₃O₄@SiO₂@TiO₂ for photocatalytic decomposition of organic matrix simultaneously with magnetic solid phase extraction of heavy metals prior to ICP-MS analysis, Talanta 154 (2016) 539–547. http://dx.doi.org/10.1016/j.talanta.2016.03.081.
[6] M. Ahmadi Moghaddam, A. Mahvi, A. Asgari, M. Yunesian, G.H. Jahed, S. Nazmara, Determination of aluminum and zinc in Iranian consumed, Environ. Monit. Assess. 144 (2008) 23–30. http://dx.doi.org/10.1007/s10661-007-0006-7.
[7] Z. Atafar, A. Mesdaghinia, J. Nouri, M. Homaeae, M. Yunesian, M. Ahmadi Moghaddam, A. Mahvi, Effect of fertilizer application on soil heavy metal concentration, Environ. Monit. Assess. 160 (2010) 83–89. http://dx.doi.org/10.1007/s10661-008-0659-x.
[8] M. Nurisepehr, S. Jorfi, R. Rezaei Kalantary, H. Akbari, R. Darvishi Cheshme Soltani, M. Samaei, Sequencing treatment of landfill leachate using ammonia stripping, Fenton oxidation and biological treatment, Waste Manag. Res. 30 (2012) 883–887. http://dx.doi.org/10.1177/0734242X11433526.
[9] S. Jorfi, A. Rezaee, G. Mohebali, N. Jaafarzadeh, Application of biosurfactants produced by pseudomonas aeruginosa SP4 for bioremediation of soils contaminated by pyrene, Soil Sediment. Contam. Int. J. 22 (2013) 890-911. http://dx.doi.org/10.1080/15320383.2013.770439.
[10] S. Jorfi, M. Samaei, R. Darvishi Cheshme Soltani, A. Talaei Khozani, M. Ahmadi, G. Barzegar, N. Reshadatian, N. Mehrabi Enhancement of the bioremediation of pyrene-contaminated soils using a hematite nanoparticle-based modified Fenton oxidation in a sequenced approach, Soil Sediment. Contam. Int. J. 26 (2) (2017) 141–156. http://dx.doi.org/10.1080/15320383.2017.1255875.