The aim of data was to evaluate the efficiency of chitosan extracted from shrimp waste for Arsenic adsorption and optimization by response surface methodology (RSM) with central composite design (CCD). The data showed that, with increasing contact time, the amount of adsorption increased and the optimal contact time was about 60 min. With increasing pH decreased adsorption, although this reduction was not significant. The optimum pH was obtained at 4.41. The average amount of adsorbent capacity was also about 1.3 mg/g. Overall, chitosan extracted from shrimp waste could be considered as an efficient material for the adsorption of Arsenic from aqueous solution.

© 2018 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 Science                  |
|---------------------|----------------------------------------|
| More specific subject area | Adsorption                           |
| Type of data        | Tables, Figures                        |
| How data was acquired | - The tests of As(V) adsorption with chitosan were performed under different initial As(V) concentrations, initial pH levels, contact time and chitosan dosages.  
- The response surface methodology (RSM) was used to optimize the factors affecting the adsorption and interaction of them, and the central composite design (CCD) was used to determine the number of tests.  
- The concentration of As(V) was measured with an inductively coupled plasma-mass spectrograph. |

**Data format**

- Analyzed

**Experimental factors**

- The chitosan was prepared from the waste of shrimp waste.
- Data of chitosan were acquired for As(V) removal from aqueous solution.

**Experimental features**

- Chitosan for As(V) adsorption from aqueous solution

**Data source location**

- Tehran University of Medical Sciences, Tehran, Iran.

**Data accessibility**

- Data are available in article

**Related research article**

- Dobaranaran S, Nabipour I, Mahvi AH, Keshtkar M, Elmi F, Amanollahzade F, et al. Fluoride removal from aqueous solutions using shrimp shell waste as a cheap biosorbent. Fluoride. 2014;47(3):253–7 [6]

Value of the data

- The data showed that chitosan extracted from shrimp waste can be used as an inexpensive adsorbent for arsenic removal of water and wastewater.
- This data offers a simple method for preparation of adsorbent from shrimp waste.
- This data article presents a user friendly-statistical method (RSM) to optimize Arsenic ions removal from water and wastewater using adsorption process.
- This dataset will be beneficial for researchers who want to achieve good As(V) adsorption capacities with chitosan extracted from shrimp waste and Arsenic ions removal from industrial wastewaters.

1. Data

Experimental versus predicted adsorption efficiencies for arsenic removal are also illustrated in Tables 1 and 2. Variables constraints and predicted removal of optimization of arsenic adsorption by Chitosan presented in Table 3. Analysis of variance (ANOVA) for the fitted polynomial model for Arsenic adsorption by Chitosan reported in Table 4. Fig. 1(A–F) shows the Central composite design

| Table 1 | Center indexes and dispersion indexes of arsenic removal with chitosan. |
|---------|------------------------------------------------------------------------|
| Mean    | 26.02204                                                               |
| Standard Error | 0.661758                                                               |
| Median  | 26.47059                                                               |
| Standard Deviation | 3.173682                                                               |
| Sample Variance | 10.07226                                                               |
3-D surface plots of the interaction effects of pH, contact time, arsenic concentration and adsorbent dosage chitosan extracted from shrimp waste on arsenic removal. The contour plots for the interaction effect of variables on the arsenic removal shows in Fig. 2A–F. Data on analyses showed that the data follow a Second-degree reaction. The data of the Pearson coefficient resulted from ANOVA showed that the contact time \((3.58 \times 10^{-16})\) and the adsorbent dosage \((3.16 \times 10^{-16})\) had a greater effect on the adsorption reaction.

## 2. Experimental design, materials and methods

### 2.1. Materials

All chemicals used in this article such as \(\text{Na}_2\text{HAsO}_4 \cdot 7\text{H}_2\text{O}, \text{HCl}, \text{and NaOH}\) were analytical grade. Arsenic from a 1000 ppm stock solution of sodium arsenate 7-hydrate was used to prepare solutions of the required arsenic concentration [1–6].

### 2.2. Preparation of chitosan

Chitosan was used in the laboratory to extract shrimp waste. Shrimp waste was crushed after drying by the household grinder. Then demineralized in 1 N HCl is added at a ratio of 1 to 20 for 2 h with around 125 rpm was stirred [6,7]. The acid mixture of shrimp waste was placed at room
Table 3
The results obtained from the removal of arsenic by chitosan.

| Run.order | dose_As | dos_ads | pH  | time | Result | removed | %removal |
|-----------|---------|---------|-----|------|--------|---------|----------|
| 1         | 306     | 3       | 5   | 60   | 231    | 75      | 24.51    |
| 2         | 397     | 4       | 6   | 75   | 274    | 123     | 30.98    |
| 3         | 397     | 4       | 6   | 45   | 318    | 79      | 19.90    |
| 4         | 397     | 2       | 4   | 75   | 298    | 99      | 24.94    |
| 5         | 194     | 4       | 6   | 75   | 126    | 68      | 35.05    |
| 6         | 306     | 3       | 5   | 60   | 221    | 85      | 27.78    |
| 7         | 306     | 3       | 5   | 60   | 225    | 81      | 26.47    |
| 8         | 306     | 3       | 5   | 60   | 223    | 83      | 27.12    |
| 9         | 194     | 4       | 4   | 75   | 121    | 73      | 37.63    |
| 10        | 397     | 4       | 4   | 45   | 314    | 83      | 20.91    |
| 11        | 194     | 4       | 6   | 45   | 154    | 40      | 20.62    |
| 12        | 399     | 2       | 6   | 75   | 301    | 98      | 24.56    |
| 13        | 306     | 3       | 5   | 60   | 227    | 79      | 25.82    |
| 14        | 194     | 2       | 6   | 75   | 131    | 63      | 32.47    |
| 15        | 194     | 2       | 4   | 45   | 152    | 42      | 21.65    |
| 16        | 397     | 4       | 4   | 75   | 272    | 125     | 31.49    |
| 17        | 397     | 2       | 4   | 45   | 325    | 72      | 18.14    |
| 18        | 306     | 3       | 5   | 60   | 224    | 82      | 26.80    |
| 19        | 194     | 4       | 4   | 45   | 151    | 43      | 22.16    |
| 20        | 397     | 2       | 6   | 45   | 339    | 58      | 14.61    |
| 21        | 306     | 3       | 5   | 60   | 222    | 84      | 27.45    |
| 22        | 194     | 2       | 4   | 75   | 133    | 61      | 31.44    |
| 23        | 194     | 2       | 6   | 45   | 153    | 41      | 21.13    |
| 24        | 306     | 3       | 5   | 60   | 226    | 80      | 26.14    |
| 25        | 306     | 3       | 5   | 30   | 276    | 30      | 9.80     |
| 26        | 306     | 3       | 5   | 90   | 198    | 93      | 35.29    |
| 27        | 306     | 3       | 5   | 60   | 223    | 83      | 27.12    |
| 28        | 306     | 3       | 5   | 60   | 225    | 81      | 26.47    |
| 29        | 306     | 3       | 5   | 60   | 224    | 82      | 26.80    |
| 30        | 306     | 3       | 5   | 60   | 221    | 85      | 27.78    |
| 31        | 306     | 3       | 5   | 60   | 222    | 84      | 27.45    |
| 32        | 306     | 3       | 5   | 60   | 223    | 83      | 27.12    |

Table 4
One-way ANOVA to determine the effective factors on the reaction of Arsenic adsorption with chitosan.

| Source       | Df | Sum Sq | Mean Sq | F value | Pr( > F) |
|--------------|----|--------|---------|---------|----------|
| dose_As      | 1  | 6026   | 6026    | 770.325 | 3.16E-16***|
| dos_ads      | 1  | 630    | 630     | 80.505  | 4.61E-08***|
| pH           | 1  | 50     | 50      | 6.435   | 0.020661* |
| Time         | 1  | 5942   | 5942    | 759.515 | 3.58E-16***|
| l(dose_As²)  | 1  | 156    | 156     | 19.995  | 0.000295***|
| l(dos_ads²)  | 1  | 6      | 6       | 0.733   | 0.403036  |
| l(Time²)     | 1  | 730    | 730     | 93.359  | 1.51E-08***|
| dose_As:dos_ads | 1 | 275   | 275    | 35.17   | 1.30E-05***|
| dose_As:Time | 1  | 165    | 165     | 2.704   | 0.117451  |
| dos_ads:pH   | 1  | 0      | 0       | 0       | 0.982592  |
| dos_ads:Time | 1  | 92     | 92      | 11.796  | 0.002956**|
| pH:Time      | 1  | 8      | 8       | 1.081   | 0.312307  |
| Residuals    | 18 | 141    | 8       |         |          |
Fig. 1. Central composite design 3-D surface plots showing effect of (1A) pH and contact time, (1B) contact time and adsorbent dosage, (1C) adsorbent dosage and pH, (1D) contact time and arsenic concentration, (1E) arsenic concentration and pH, (1F) arsenic concentration and adsorbent dosage, on Arsenic removal efficiency with the adsorbent.
temperature for 24 h to remove its minerals, including calcium carbonate. The solution was then filtered with Whatman filter paper and dried at room temperature for 24 h [6,8–10]. The powder obtained with a weight ratio of 1 to 20 was mixed with 1 N sodium hydroxide and placed on a stirrer at 60 rpm for 4 h to extract the chitin. Then, the obtained Chitin was mixed in sodium hydroxide 50% w/w for 2 h and placed on a stirrer at 100 °C. Finally, the obtained materials were chitosan and used for arsenic adsorption experiments [6,8–12].

Fig. 2. Contour plots for the interaction effect of variables on the Arsenic removal. (2A) contact time and adsorbent dose (g/L). (2B) contact time and pH. (2C) pH and adsorbent dosage (2D) contact time and arsenic concentration. (2E) pH and arsenic concentration (2F) adsorbent dose (g/L) and arsenic concentration (mg/L).
2.3. Design of experiments

The entire batch adsorption experiments were carried out in 50 mL Erlenmeyer flask. The pH of the solutions were adjusted prior to the adsorption by using 0.1 M solutions of HCl and NaOH (16–19). The effects of operational parameters including pH (4, 5 and 6), contact time (30, 45, 60, 75 and 90 min), initial As (V) concentration (200, 300 and 400 mg/L), and adsorbent dosage (2, 3 and 4 mg/L) were assessed. The samples were stirred at 250 rpm for given contact times and after centrifugation at 2000 rpm, and passing through a 0.2 μm membrane filter, Then, the concentration of Arsenic was determined by ICP device [2,7]. The design of experiments was carried out using central composite design [9]. Then use the data and its analysis in software R (version R 3.5.1) to response surface methodology (RSM) factors affecting the optimum value was determined [1,3,5]. The complete design of the factor was made for four independent variables in three levels with 4 center points and 2 axial points. Experiments were performed in 2 blocks and repeated twice.

Acknowledgements

The authors want to thank authorities of Tehran University of Medical Sciences for their comprehensive support for this study.

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.2018.09.003.

References

[1] A. Teimouri, H. Esmaeili, R. Foroutan, B. Ramavandi, Adsorptive performance of calcined Cardita bicolor for attenuating Hg (II) and As (III) from synthetic and real wastewaters, Korean J. Chem. Eng. 35 (2) (2018) 479–488.
[2] M. Radfard, M. Yunesian, R. Nabizadeh, H. Biglari, S. Nazmara, M. Hadi, et al., Drinking water quality and arsenic health risk assessment in Sistan and Baluchestan, Southeastern Province, Iran, Hum. Ecol. Risk Assess.: Int. J. (2018) 1–17. https://doi.org/10.1080/10807039.2018.1458210.
[3] S. Delshab, E. Kouhgardi, B. Ramavandi, Data of heavy metals biosorption onto Sargassum oligocystum collected from the northern coast of Persian Gulf, Data Brief 8 (2016) 235–241.
[4] F.B. Asghari, J. Jaafari, M. Yousefi, A.A. Mohammadi, R. Dehghanizadeh, Evaluation of water corrosion, scaling extent and heterotrophic plate count bacteria in asbestoses and polyethylene pipes in drinking water distribution system, Hum. Ecol. Risk Assess.: Int. J. 24 (4) (2018) 1138–1149.
[5] D.R. Vakilabadi, A.H. Hassani, G. Omrani, B. Ramavandi, Catalytic potential of Cu/Mg/Al-chitosan for ozonation of real landfill leachate, Process Saf. Environ. Prot. 107 (2017) 227–237.
[6] S. Dobarakaran, I. Nabipour, A.H. Mahvi, M. Keshtkar, F. Elmi, F. Amanollahzade, et al., Fluoride removal from aqueous solutions using shrimp shell waste as a cheap biosorbent, Fluoride 47 (3) (2014) 253–257.
[7] M. Yousefi, S.M. Arami, H. Takallo, M. Hosseini, M. Radfard, H. Soleimani, et al., Modification of pumice with HCl and NaOH enhancing its fluoride adsorption capacity: kinetic and isotherm studies, Hum. Ecol. Risk Assess.: Int. J. (2018), https://doi.org/10.1080/10807039.2018.1469968.
[8] B. Ramavandi, M. Jafarzadeh, S. Sahebi, Removal of phenol from hyper-saline wastewater using Cu/Mg/Al–chitosan–H2O2 in a fluidized catalytic bed reactor, React. Kinet. Mech. Catal. 111 (2) (2014) 605–620.
[9] A. Mohammadi, A. Alinejad, B. Kamarehie, S. Javan, A. Ghaderpour, M. Ahmadpour, et al., Metal-organic framework UiO-66 for adsorption of methylene blue dye from aqueous solutions, Int. J. Environ. Sci. Technol. 14 (9) (2017) 1959–1968.
[10] Z. Heidarinejad, O. Rahamanian, M. Fazlizadeh, M. Heidari, Enhancement of methylene blue adsorption onto activated carbon prepared from date press cake by low frequency ultrasound, J. Mol. Liq. 264 (2018) 591–599.
[11] B. Ramavandi, S. Farajzad, M. Ardjmand, Mitigation of orange II dye from simulated and actual wastewater using bi-metallic chitosan particles: continuous flow fixed-bed reactor, J. Environ. Chem. Eng. 2 (3) (2014) 1776–1784.
[12] A. Hajivandi, S. Farjzad, B. Ramavandi, S. Akbarzadeh, Experimental data for synthesis of bi-metalized chitosan particle for attenuating of an azo dye from wastewater, Data Brief 7 (2016) 71–76.