In this article, three variables including laccase dose, 2,2'-Azinobis-(3-ethylbenzothiazoline-6-sulfonate) (ABTS) dose and pH were used to modeling of Direct Red 81 (DR81) elimination from aqueous solutions by laccase-mediated system. Obtained data indicated that the predicted and experimental values were close for DR81 elimination, and the regression was also able to give a good prediction of response for DR81 elimination ($R^2$-Squared = 0.9983). From the experimental, the highest elimination of the DR81 was 95.5% after 30 min incubation at pH 5, temperature 40 °C, ABTS 0.2 mM, and initial concentration of DR81 50 mg L$^{-1}$ in the presence of 0.2 U mL$^{-1}$ of the laccase. The data showed that the laccase can be used as a "green" technology for treating of dyes from aqueous solutions. Data analysis was performed using Design-Expert version 7.0.0 (Stat-Ease, trial version). © 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 Sciences |
|--------------------|------------------------|
| More specific subject area | Biotechnology |
| Type of data       | Figure and table |
| How data was acquired | The study was started by adding laccase to the reaction solutions (final volume of 5 mL). Samples were taken after incubation time (30 min). The residual concentrations of DR81 were done through a calibration curve by reading the maximum absorbance wavelength 509 for DR81, using UV–vis spectrophotometer (Shimadzu UV 1700, Japan). Digital pH meter (Metrohm) was applied for pH analyzing. |
| Data format        | Raw, analyzed |
| Experimental factors | The main and interaction influence of solution pH, laccase activity and ABTS concentration was evaluated during the experiments of DR81 elimination. |
| Experimental features | DR81 elimination by enzymatic process was done and its efficiency was determined. |
| Data source location | Department of Environmental Health Engineering, School of Health, Guilan University of Medical Sciences, Rasht, Iran. |
| Data accessibility | All data are available within paper. |

Value of the data

- The data of laccase-mediated process was described for DR81 elimination from aqueous solution.
- The data will be useful for application of laccase for treatment of industrial wastewater including DR81 and similar synthetic dyes. Enzymatic elimination of pollutants from the environment is one of the interesting methods that known as a “green” technology.
- This data will be useful to the researchers and scientific community wanting to analyze the ability of laccase for DR81 elimination from aqueous solution.

1. Data

The data of this paper showed the elimination of DR81 dye using the laccase-mediated system. Data in Table 1 gives information about general characteristic of DR81 dye. The three studied variables (pH, laccase dose and ABTS dose) and their levels have been shown in Table 2. The experimental design by Box–Behnken Design (BBD), actual, predicted, and residual values of DR81 elimination efficiency have been provided in Table 3. According to the obtained data from experiments, the maximum elimination of DR81 was 95.5%, whereas its predicted value was 96.25% from model indicating a good agreement between experiment and model. According to the p-value of main and interaction effects of all three studied variables that obtained by Analysis of Variance, ANOVA, (Table 4), the main and interaction effects of laccase dose, ABTS dose and pH on DR81 elimination process were statically significant (p-value < 0.05). The interaction effects of studied variables on the DR81 elimination efficiency have been shown in Figs. 1–3. The normal probability plot of the residuals and the parity plot comparing the elimination efficiency of the experimental vs model predicted have been shown in Figs. 4 and 5, respectively. The Box–Cox plot of a natural log (Ln) of the residual sum of square vs lambda has been shown in Fig. 6. By ANOVA, the quadratic equation for DR81 elimination using pH (A), laccase dose (B), and ABTS dose (C) as the main variables is as Eq. (1);

\[
(\%) R = +75.67 - 5.62A + 4.69B + 10.81C - 1.25AB - 5AC - 15.02A^2 - 2.4B^2 + 6.35C^2 \quad (1)
\]
2. Experimental design, materials and methods

2.1. Materials

Laccase (EC 1.10.3.2, p-benzenediol:dioxygen oxidoreductases) from *Trametes Versicolor* (activity $4 \times 10^4$ U mg$^{-1}$) [1,2], and ABTS, were purchased from Sigma Aldrich (St. Louis, MO, USA). The synthetic dye (DR81) was obtained from Alvan Sabet Co. (Tehran, Iran). All other chemicals were of the highest purity available.

2.2. Analytical measurements

2.2.1. Laccase assay

As described by Rekuć et al. [1–3], monitoring the oxidation of 1 mL of 2 mM ABTS as a substrate (using UV–Vis spectrophotometer, $\lambda_{\text{max}}$ 420 nm) in a reaction mixture containing 0.1 M sodium citrate buffer (pH 4.5) and 1 mL of diluted enzyme sample at 40 °C, the laccase activity was calculated. One activity unit was defined as the amount of enzyme that oxidized 1 μmol of ABTS per min [1,3].

2.2.2. Determination of dye concentration

The analysis of dye concentration was done through a calibration curve by reading the maximum absorbance wavelength 509 nm for DR81, using UV–vis spectrophotometer. The removal percentage

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Table 1

General characteristic of DR81 [4,9].

| Parameter                  | Characteristic |
|----------------------------|----------------|
| Chemical name              | Direct Red 81  |
| C.I. number                | 28,160         |
| Classification             | Diazo          |
| Apparent colour            | Red            |
| Molecular weight           | 675.59         |
| Molecular formula          | $\text{C}_{29}\text{H}_{19}\text{N}_{5}\text{Na}_{2}\text{O}_{8}\text{S}_{2}$ |
| $\lambda_{\text{max}}$ (nm) | 509            |

Table 2

Three studied variables and levels.

| Independent variables | Unit   | Factors | Actual and coded values |
|-----------------------|--------|---------|-------------------------|
|                       |        |         | −1        | 0  | 1    |
| pH                    |        | A       | 3         | 5  | 7    |
| Laccase dose          | U mL$^{-1}$ | B   | 0.05     | 0.125 | 0.2 |
| ABTS dose             | mM     | C       | 0.05     | 0.125 | 0.2 |
was then determined by the following equation (Eq. (2));

\[
\text{Removal (\%)} = 100\% \frac{C_0 - C_t}{C_0}
\]  

(2)

where \(C_t\) is the concentration (mg L\(^{-1}\)) at the end of process time and \(C_0\) is the initial concentration (mg L\(^{-1}\)) of dye [4,5].

2.3. Experimental design

2.3.1. BBD by Response Surface Methodology (RSM)

RSM can be used as a statistical tool to determine the main and interaction effects of variables [6–8]. In order to evaluate the effect of three variables (pH, laccase dose and ABTS dose) on DR81
elimination efficiency and elimination optimum conditions, an experimental design using BBD was used by using Design-expert version 7.0.0 (Stat-Ease, trial version) software. The results of the experimental design were analyzed and along with the main effects, interactions and quadratic effects of all variables were determined.
Fig. 4. Normal probability plots of internally studentized residuals for DR81 elimination.

Fig. 5. Comparison of experimental data with the RSM model predictions.

Fig. 6. Box-Cox plot of RSM model transformation.
2.3.2. DR81 elimination experiments

DR81 (50 mg L\(^{-1}\)) solution was prepared in citrate sodium buffer (0.1 M). The elimination studies were started by adding laccase according to the pH and ABTS (Table 3), solution volume of 5 mL, temperature 40 °C, and 150 rpm under dark for 30 min [2,3].

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Transparency document. Supplementary material

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.dib.2018.03.012.

References

[1] A. Rekuć, J. Bryjak, K. Szymańska, A.B. Jarzębski, Very stable silica-gel-bound laccase biocatalysts for the selective oxidation in continuous systems, Bioresour. Technol. 101 (2010) 2076–2083.
[2] S.D. Ashrafi, S. Nasseri, M. Alimohammadi, A.H. Mahvi, M.A. Faramarzi, Optimization of the enzymatic elimination of flu-mequine by laccase-mediated system using response surface methodology, Desalin. Water Treat. 57 (2016) 14478–14487.
[3] S.D. Ashrafi, S. Rezaei, H. Forootanfar, A.H. Mahvi, M.A. Faramarzi, The enzymatic decolorization and detoxification of synthetic dyes by the laccase from a soil-isolated ascomycete, Paraconiothyrium variabile, Int. Biodeterior. Biodegrad. 85 (2013) 173–181.
[4] Z. Cheng, L. Zhang, X. Guo, X. Jiang, T. Li, Adsorption behavior of direct red 80 and congo red onto activated carbon/surfactant: process optimization, kinetics and equilibrium, Spectrochim. Acta Part A: Mol. Biomol. Spectrosc. 137 (2015) 1126–1143.
[5] N. Yousefi, A. Fatehizedeh, K. Ghadiri, N. Mirzaei, S.D. Ashrafi, A.H. Mahvi, Application of nanofilter in removal of phosphate, fluoride and nitrite from groundwater, Desalin. Water Treat. 57 (2016) 11782–11788.
[6] S.D. Ashrafi, H. Kamani, J. Jafarzadeh, A.H. Mahvi, Experimental design and response surface modeling for optimization of fluoroquinolone removal from aqueous solution by NaOH-modified rice husk, Desalin. Water Treat. 57 (2016) 16456–16465.
[7] H. Kamani, E. Bazrafshan, S.D. Ashrafi, F. Sancholi, Efficiency of sono-nano-catalytic process of TiO\(_2\) nano-particle in removal of erythromycin and metronidazole from aqueous solution, J.-Mazand.-Univ.-Med.-Sci. 27 (2017) 140–154.
[8] S.D. Ashrafi, H. Kamani, H. Soheil Arezomand, N. Yousefi, A.H. Mahvi, Optimization and modeling of process variables for adsorption of Basic Blue 41 on NaOH-modified rice husk using response surface methodology, Desalin. Water Treat. 57 (2016) 14051–14059.
[9] S.D. Ashrafi, H. Kamani, A.H. Mahvi, The optimization study of direct red 81 and methylene blue adsorption on NaOH-modified rice husk, Desalin. Water Treat. 57 (2016) 738–746.