# Supplementary materials

# High-efficiency Removal of As(III) from Water using Siderite as Iron Source in the Electrocoagulation Process

Haitao Yu[a], Junfeng Li[ab,*], Wenying Qu[ab], Wenhuai Wang[ab], Jiankang Wang[ab]

[a] *College of Water Conservancy and Architectural Engineering, Shihezi University, Shihezi, Xinjiang, 832000, PR China;*

[b]*Key Laboratory of Cold and Arid Regions Eco-Hydraulic Engineering of Xinjiang Production & Construction Corps, Shihezi, 832000, Xinjiang, PR China.*

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**Corresponding author*

E-mail: ljfshz@126.com (J.F. Li)

Table S1 Main instruments and equipment

| Name of instrument | Model number |
|---|---|
| Magnetic stirrer | MS-H-S |
| Electric heating blast drying oven | WGL-30B |
| Portable multi-parameter water quality analyzer | SL1000 |
| Direct current power supply | MS-155D |
| Peristaltic pump | NKCP-S10B |
| Electronic balance | MS204TS |
| Ultrasonic cleaning device | KH-256DB |
| Atomic absorption spectrophotometer | AA-6880 |
| Ultraviolet visible spectrophotometer | DR6000 |

Table S2 Main test drugs

| Name of drug | Specifications | Manufacturer of products |
|---|---|---|
| $NaAsO_2$ | Super pure | Sigma-Aldrich Corporation |
| $CH_4N_2S$ | Super pure | Tianjin Yongsheng Fine Chemicals Corporation |
| L-Ascorbic acid | Super pure | Tianjin Yongsheng Fine Chemicals Corporation |
| HCl | Super pure | Tianjin Yongsheng Fine Chemicals Corporation |
| $H_2SO_4$ | Analytical pure | Tianjin Yongsheng Fine Chemicals Corporation |
| NaHB | Super pure | Tianjin Yongsheng Fine Chemicals Corporation |
| $HNO_3$ | Analytical pure | Tianjin Yongsheng Fine Chemicals Corporation |
| $Na_2SO_4$ | Analytical pure | Tianjin Yongsheng Fine Chemicals Corporation |
| NaOH | Super pure | Tianjin Yongsheng Fine Chemicals Corporation |
| $HONH_3Cl$ | Analytical pure | Tianjin Yongsheng Fine Chemicals Corporation |
| $CH_3COONH_4$ | Analytical pure | Tianjin Yongsheng Fine Chemicals Corporation |
| 1,10-Phenanthroline | Analytical pure | Tianjin Yongsheng Fine Chemicals Corporation |
| $Fe(NH_4)_2•(SO_4)_2•6H_2O$ | Analytical pure | Tianjin Yongsheng Fine Chemicals Corporation |
| $NaNO_3$ | Analytical pure | Tianjin Yongsheng Fine Chemicals Corporation |
| $Na_3PO_4$ | Analytical pure | Tianjin Yongsheng Fine Chemicals Corporation |
| $K_2Cr_2O_7$ | Analytical pure | Tianjin Yongsheng Fine Chemicals Corporation |

Table S3 Experimental design and results of arsenic removal efficiency optimization with response surface

| Test Number | A- Intensity of current（mA） | B-pH | C- Rate of circulation（mL/min） | Actual arsenic removal rate（%） |
|---|---|---|---|---|
| 1 | -1 | -1 | 0 | 73.43 |
| 2 | 1 | -1 | 0 | 78.03 |
| 3 | -1 | 1 | 0 | 63.55 |
| 4 | 1 | 1 | 0 | 73.02 |
| 5 | -1 | 0 | -1 | 61.27 |
| 6 | 1 | 0 | -1 | 75.33 |
| 7 | -1 | 0 | 1 | 80.88 |
| 8 | 1 | 0 | 1 | 70.59 |
| 9 | 0 | -1 | -1 | 80.34 |
| 10 | 0 | 1 | -1 | 58.52 |
| 11 | 0 | -1 | 1 | 71.71 |
| 12 | 0 | 1 | 1 | 73.23 |
| 13 | 0 | 0 | 0 | 98.62 |
| 14 | 0 | 0 | 0 | 99.84 |
| 15 | 0 | 0 | 0 | 99.85 |
| 16 | 0 | 0 | 0 | 98.93 |
| 17 | 0 | 0 | 0 | 96.49 |

Table S4 Regression analysis results of the actual arsenic removal rate model and regression coefficient

| Source of information | Sum of squared deviations | Degree of freedom | Mean square | F | *P* | Significance of significance |
|---|---|---|---|---|---|---|
| model | 3132.47 | 9 | 348.05 | 71.38 | <0.0001 | ** |
| A- Intensity of current | 39.78 | 1 | 39.78 | 8.16 | 0.0245 | * |
| B-pH | 154.79 | 1 | 154.79 | 31.75 | 0.0008 | ** |
| C- Rate of circulation | 54.86 | 1 | 54.86 | 11.25 | 0.0122 | * |
| AB | 5.93 | 1 | 5.93 | 1.22 | 0.3066 | |
| AC | 148.23 | 1 | 148.23 | 30.4 | 0.0009 | ** |
| BC | 136.19 | 1 | 136.19 | 27.93 | 0.0011 | ** |
| $A^2$ | 693.68 | 1 | 693.68 | 142.26 | <0.0001 | ** |
| $B^2$ | 813.87 | 1 | 813.87 | 166.91 | <0.0001 | ** |
| $C^2$ | 812.7 | 1 | 812.7 | 166.67 | <0.0001 | ** |
| Residual error | 34.13 | 7 | 4.88 | | | |
| Loss of fit term | 26.58 | 3 | 8.86 | 4.69 | 0.0848 | ns |
| Pure error | 7.55 | 4 | 1.89 | | | |
| Sum | 3166.61 | 16 | | | | |
| | | | $R^2$=0.9892 Adj $R^2$=0.9754 Pre $R^2$=0.8620 | | | |

Note: $P < 0.01$ is highly significant and is represented by "**" ; $P < 0.05$ is significant and is represented by "*" ; $P > 0.05$ is not significant and is represented by "ns".

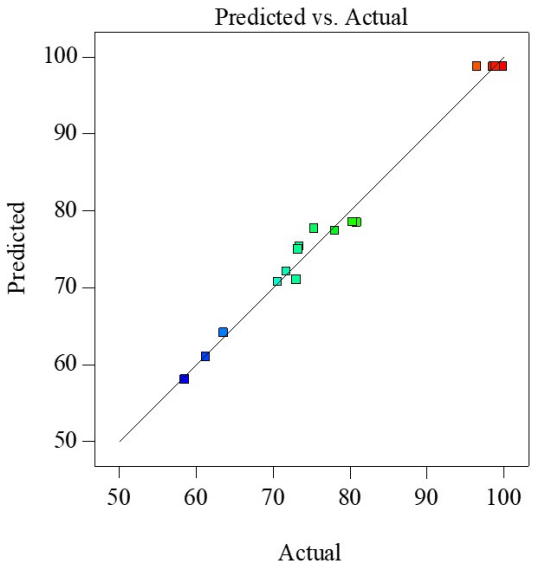


Figure S1. Fitting curve of actual and predicted value of Arsenic removal rate

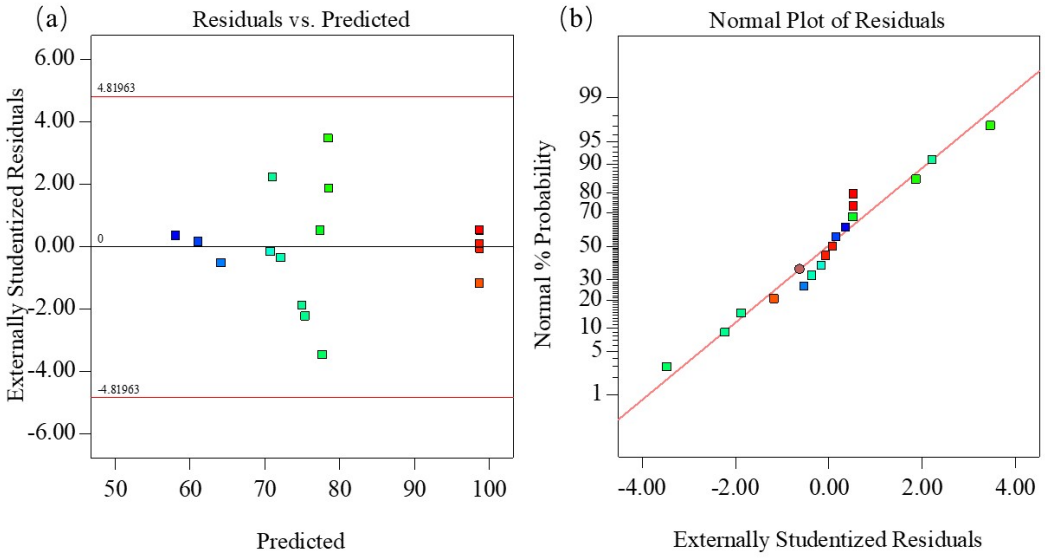


Figure S2. (a) based on the predicted As removal rate residual diagram, (b) Asrenic removal residual diagram

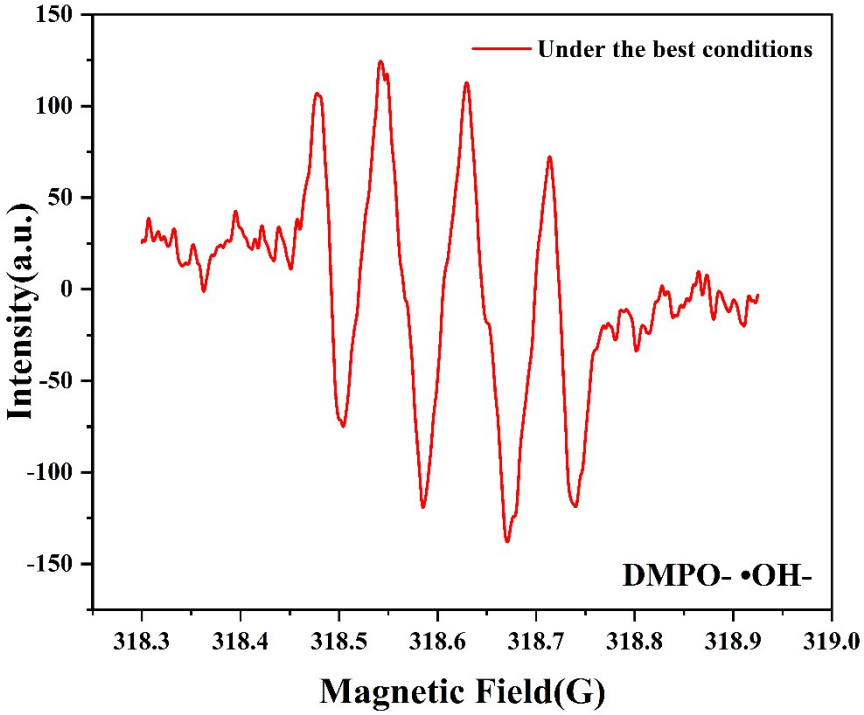


Figure S3. The ESR spectrum of the simulation system (•OH).

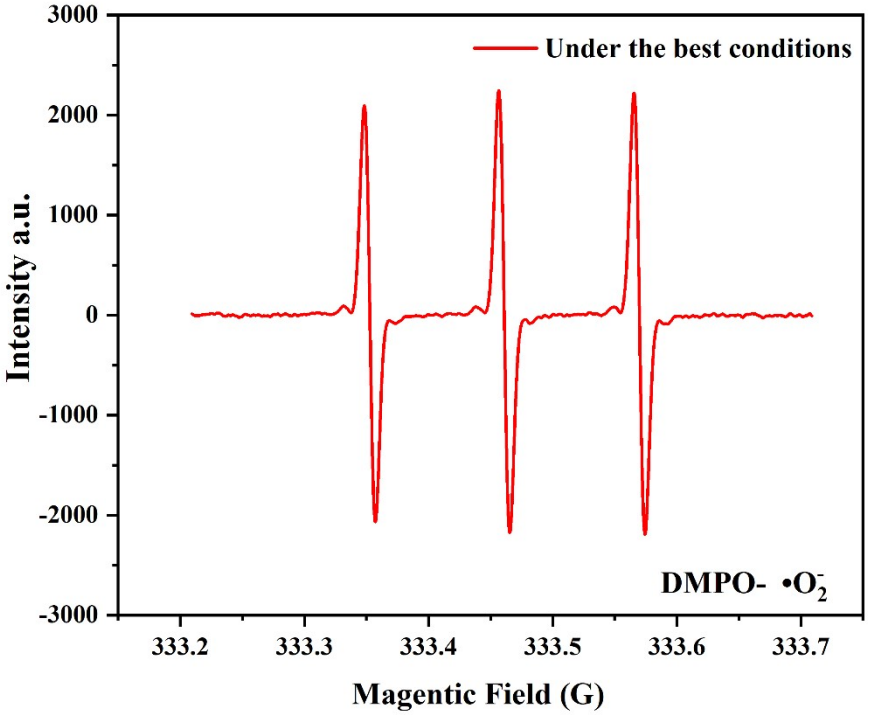


Figure S4. The ESR spectrum of the simulation system (•O-2).

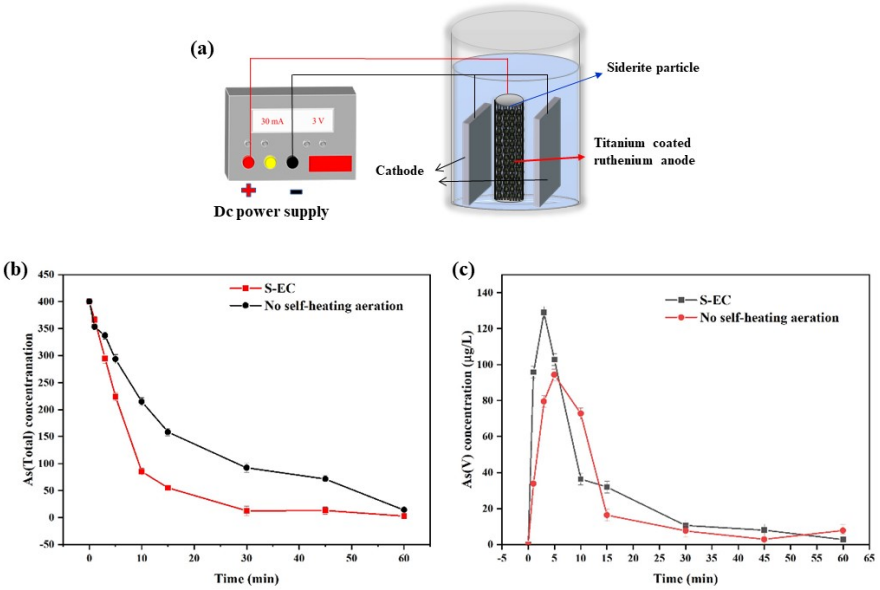


Fig. S5. (a). Schematic representation of an electrocoagulation reaction（no peristaltic pump） apparatus. Comparison of the electrocoagulation system filled with siderite anode and the electrocoagulation system with a siderite-filled anode but no-overflow conditions(no peristaltic pump): (b). Arsenic removal efficiency; (c). Change in As(V) concentration.