**Supplementary material:**

**Table S-1.** Treatments of 54 designed experiment based on Box-Behnken method.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Run** | **pH** | **rpm** | **Temp** | **Fe** | **NH4** | **IQ** |
| 1 | 2 | 150 | 25 | 5 | 3 | 5 |
| 2 | 2 | 150 | 35 | 20 | 3 | 20 |
| 3 | 1.5 | 180 | 30 | 5 | 3 | 12.5 |
| 4 | 1.5 | 180 | 30 | 20 | 3 | 12.5 |
| 5 | 2 | 150 | 35 | 5 | 3 | 5 |
| 6 | 2.5 | 150 | 30 | 5 | 1 | 12.5 |
| 7 | 1.5 | 150 | 30 | 5 | 1 | 12.5 |
| 8 | 2 | 180 | 35 | 12.5 | 1 | 12.5 |
| 9 | 1.5 | 150 | 35 | 12.5 | 3 | 5 |
| 10 | 2 | 180 | 35 | 12.5 | 5 | 12.5 |
| 11 | 2.5 | 150 | 25 | 12.5 | 3 | 5 |
| 12 | 2 | 150 | 30 | 12.5 | 3 | 12.5 |
| 13 | 2.5 | 150 | 25 | 12.5 | 3 | 20 |
| 14 | 2 | 150 | 30 | 12.5 | 3 | 12.5 |
| 15 | 1.5 | 150 | 30 | 5 | 5 | 12.5 |
| 16 | 2 | 150 | 30 | 12.5 | 3 | 12.5 |
| 17 | 2 | 120 | 30 | 12.5 | 1 | 5 |
| 18 | 2 | 180 | 30 | 12.5 | 5 | 20 |
| 19 | 2.5 | 120 | 30 | 20 | 3 | 12.5 |
| 20 | 2 | 180 | 30 | 12.5 | 1 | 5 |
| 21 | 1.5 | 150 | 25 | 12.5 | 3 | 20 |
| 22 | 2 | 120 | 30 | 12.5 | 1 | 20 |
| 23 | 2.5 | 150 | 30 | 20 | 5 | 12.5 |
| 24 | 2 | 150 | 25 | 5 | 3 | 20 |
| 25 | 2 | 120 | 30 | 12.5 | 5 | 5 |
| 26 | 2 | 150 | 30 | 12.5 | 3 | 12.5 |
| 27 | 2.5 | 150 | 30 | 5 | 5 | 12.5 |
| 28 | 2 | 150 | 25 | 20 | 3 | 20 |
| 29 | 2 | 150 | 25 | 20 | 3 | 5 |
| 30 | 2.5 | 180 | 30 | 5 | 3 | 12.5 |
| 31 | 1.5 | 120 | 30 | 5 | 3 | 12.5 |
| 32 | 1.5 | 150 | 25 | 12.5 | 3 | 5 |
| 33 | 2 | 180 | 25 | 12.5 | 1 | 12.5 |
| 34 | 2 | 180 | 30 | 12.5 | 1 | 20 |
| 35 | 2 | 150 | 35 | 20 | 3 | 5 |
| 36 | 2 | 120 | 25 | 12.5 | 5 | 12.5 |
| 37 | 1.5 | 150 | 30 | 20 | 1 | 12.5 |
| 38 | 2 | 120 | 35 | 12.5 | 5 | 12.5 |
| 39 | 2.5 | 120 | 30 | 5 | 3 | 12.5 |
| 40 | 1.5 | 150 | 30 | 20 | 5 | 12.5 |
| 41 | 2 | 180 | 30 | 12.5 | 5 | 5 |
| 42 | 1.5 | 150 | 35 | 12.5 | 3 | 20 |
| 43 | 2.5 | 150 | 30 | 20 | 1 | 12.5 |
| 44 | 2 | 120 | 35 | 12.5 | 1 | 12.5 |
| 45 | 2 | 120 | 30 | 12.5 | 5 | 20 |
| 46 | 2 | 180 | 25 | 12.5 | 5 | 12.5 |
| 47 | 2 | 150 | 30 | 12.5 | 3 | 12.5 |
| 48 | 2.5 | 150 | 35 | 12.5 | 3 | 5 |
| 49 | 1.5 | 120 | 30 | 20 | 3 | 12.5 |
| 50 | 2 | 150 | 35 | 5 | 3 | 20 |
| 51 | 2.5 | 150 | 35 | 12.5 | 3 | 20 |
| 52 | 2.5 | 180 | 30 | 20 | 3 | 12.5 |
| 53 | 2 | 150 | 30 | 12.5 | 3 | 12.5 |
| 54 | 2 | 120 | 25 | 12.5 | 1 | 12.5 |

Fe: FeSO4, Tem: Temperature, NH4: (NH4)2SO4, IQ: Inoculum.

**Table S-2.** The analysis of variance (ANOVA) for the response surface quadratic model.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Source** | **DF** | **Seq SS** | **Adj SS** | **Adj MS** | **F** | **P** |
| Regression | 27 | 27325.8 | 27325.8 | 1012.07 | 18.41 | 0 |
| Linear | 6 | 5178.6 | 7813 | 1302.17 | 23.69 | 0 |
| pH | 1 | 468.2 | 4202.9 | 4202.94 | 76.47 | 0 |
| rpm | 1 | 3243.4 | 4546.4 | 4546.38 | 82.72 | 0 |
| Tem | 1 | 30.4 | 324.4 | 324.35 | 5.9 | 0.022 |
| Fe | 1 | 308.2 | 95.9 | 95.94 | 1.75 | 0.198 |
| NH4 | 1 | 35 | 122.6 | 122.6 | 2.23 | 0.147 |
| IQ | 1 | 1093.5 | 6.6 | 6.55 | 0.12 | 0.733 |
| Square | 6 | 20129.6 | 20129.6 | 3354.93 | 61.04 | 0 |
| pH\*pH | 1 | 6240 | 9163.1 | 9163.1 | 166.72 | 0 |
| rpm\*rpm | 1 | 9198.5 | 7715.8 | 7715.84 | 140.38 | 0 |
| Tem\*Tem | 1 | 782.7 | 775 | 775.05 | 14.1 | 0.001 |
| Fe\*Fe | 1 | 601.7 | 1210.2 | 1210.24 | 22.02 | 0 |
| NH4\*NH4 | 1 | 1992 | 2435.8 | 2435.84 | 44.32 | 0 |
| IQ\*IQ | 1 | 1314.7 | 1314.7 | 1314.67 | 23.92 | 0 |
| Interaction | 15 | 2017.6 | 2017.6 | 134.5 | 2.45 | 0.022 |
| pH\*rpm | 1 | 60.5 | 60.5 | 60.5 | 1.1 | 0.304 |
| pH\*Tem | 1 | 0 | 0 | 0 | 0 | 1 |
| pH\*Fe | 1 | 4 | 4 | 4 | 0.07 | 0.789 |
| pH\*NH4 | 1 | 0.5 | 0.5 | 0.5 | 0.01 | 0.925 |
| pH\*IQ | 1 | 2 | 2 | 2 | 0.04 | 0.85 |
| rpm\*Tem | 1 | 21.1 | 21.1 | 21.12 | 0.38 | 0.541 |
| rpm\*Fe | 1 | 4.5 | 4.5 | 4.5 | 0.08 | 0.777 |
| rpm\*NH4 | 1 | 45.6 | 45.6 | 45.56 | 0.83 | 0.371 |
| rpm\*IQ | 1 | 50 | 50 | 50 | 0.91 | 0.349 |
| Tem\*Fe | 1 | 450 | 450 | 450 | 8.19 | 0.008 |
| Tem\*NH4 | 1 | 0.1 | 0.1 | 0.13 | 0 | 0.962 |
| Tem\*IQ | 1 | 110.2 | 110.2 | 110.25 | 2.01 | 0.169 |
| Fe\*NH4 | 1 | 60.5 | 60.5 | 60.5 | 1.1 | 0.304 |
| Fe\*IQ | 1 | 1200.5 | 1200.5 | 1200.5 | 21.84 | 0 |
| NH4\*IQ | 1 | 8 | 8 | 8 | 0.15 | 0.706 |

Fe: FeSO4, Tem: Temperature, NH4: (NH4)2SO4, IQ: Inoculum.

**Table S-3.** Statistical evaluation of regression coefficients for the quadratic response.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Term** | **Coef** | **SE Coef** | **T** | **P** |
| Constant | -1380.830 | 175.467 | -7.869 | 0.000 |
| pH | 496.970 | 56.831 | 8.745 | 0.000 |
| rpm | 9.290 | 1.022 | 9.095 | 0.000 |
| Tem | 16.100 | 6.626 | 2.429 | 0.022 |
| Fe | -4.210 | 3.184 | -1.321 | 0.198 |
| NH4 | 17.220 | 11.529 | 1.493 | 0.147 |
| IQ | -1.030 | 2.986 | -0.345 | 0.733 |
| pH\*pH | -119.390 | 9.246 | -12.912 | 0.000 |
| rpm\*rpm | -0.030 | 0.003 | -11.848 | 0.000 |
| Tem\*Tem | -0.350 | 0.092 | -3.755 | 0.001 |
| Fe\*Fe | -0.190 | 0.041 | -4.692 | 0.000 |
| NH4\*NH4 | -3.850 | 0.578 | -6.657 | 0.000 |
| IQ\*IQ | -0.200 | 0.041 | -4.891 | 0.000 |
| pH\*rpm | -0.180 | 0.175 | -1.049 | 0.304 |
| pH\*Tem | 0.000 | 1.048 | 0.000 | 1.000 |
| pH\*Fe | -0.130 | 0.494 | -0.270 | 0.789 |
| pH\*NH4 | -0.250 | 2.621 | -0.095 | 0.925 |
| pH\*IQ | 0.130 | 0.699 | 0.191 | 0.850 |
| rpm\*Tem | 0.010 | 0.017 | 0.620 | 0.541 |
| rpm\*Fe | 0.000 | 0.012 | 0.286 | 0.777 |
| rpm\*NH4 | 0.030 | 0.031 | 0.910 | 0.371 |
| rpm\*IQ | 0.010 | 0.012 | 0.954 | 0.349 |
| Tem\*Fe | 0.200 | 0.070 | 2.861 | 0.008 |
| Tem\*NH4 | -0.010 | 0.262 | -0.048 | 0.962 |
| Tem\*IQ | 0.070 | 0.049 | 1.416 | 0.169 |
| Fe\*NH4 | 0.180 | 0.175 | 1.049 | 0.304 |
| Fe\*IQ | 0.220 | 0.047 | 4.674 | 0.000 |
| NH4\*IQ | 0.070 | 0.175 | 0.382 | 0.706 |

R2 = 95.03%, R2adj = 89.87%

Fe: FeSO4, Tem: Temperature, NH4: (NH4)2SO4, IQ: Inoculum.