

## **An effective and recyclable decolorization method for polysaccharide from *Isaria cicadae* Miquel by magnetic chitosan microspheres**

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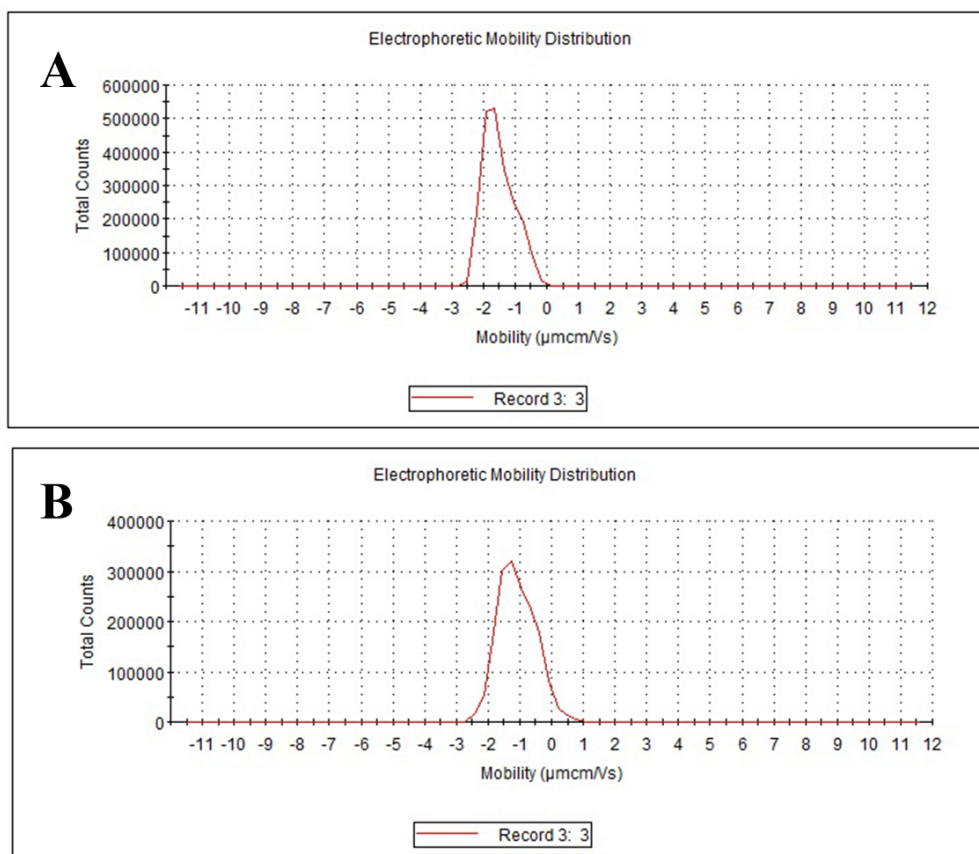
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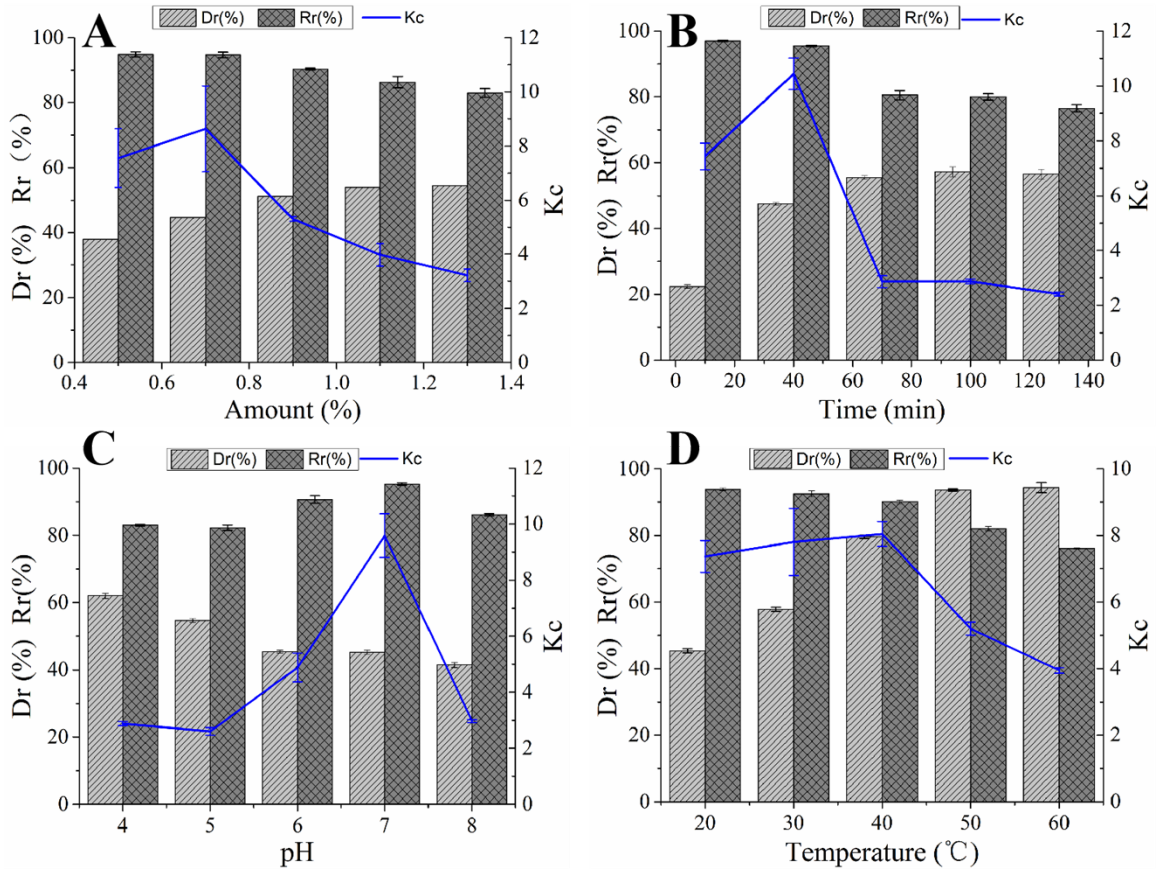
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**Figure S1.** Zeta potential scanning diagram before (A) and after (B) decolorization. (Zeta potential value before decolorization was -19.3mV; Zeta potential value after decolorization was -13.8mV)



**Figure S2.** Effects of different amount of activated carbon (A), adsorption time (B), pH (C) and adsorption temperature (D) on the efficiency of decolorization. (n=3)

**Table S1.** Design and results of activated carbon adsorption response surface methodology.

No.	A(%)	B(min)	C	D(°C)	K <sub>C</sub>
1	0.50	40.00	6.00	40.00	6.66005
2	0.90	40.00	7.00	50.00	4.76597
3	0.70	70.00	6.00	40.00	6.14895
4	0.70	10.00	8.00	40.00	5.98488
5	0.70	10.00	7.00	50.00	5.6687
6	0.50	40.00	7.00	50.00	7.29
7	0.70	40.00	7.00	40.00	7.96436
8	0.70	10.00	7.00	30.00	4.64446
9	0.70	40.00	7.00	40.00	8.15839
10	0.50	10.00	7.00	40.00	5.75
11	0.70	40.00	8.00	50.00	5.64398
12	0.70	70.00	7.00	50.00	5.01128
13	0.70	10.00	6.00	40.00	6.06418
14	0.50	40.00	8.00	40.00	5.99112
15	0.70	40.00	7.00	40.00	7.90734
16	0.90	40.00	6.00	40.00	6.23969
17	0.90	40.00	8.00	40.00	5.12598
18	0.70	40.00	7.00	40.00	8.19519
19	0.50	40.00	7.00	30.00	5.18663

20	0.70	70.00	8.00	40.00	4.8708
21	0.90	10.00	7.00	40.00	5.23866
22	0.70	70.00	7.00	30.00	5.3659
23	0.50	70.00	7.00	40.00	6.24351
24	0.70	40.00	6.00	50.00	7.71247
25	0.70	40.00	70.00	40.00	7.83561
26	0.90	70.00	70.00	40.00	4.89007
27	0.90	40.00	7.00	30.00	5.10136
28	0.70	40.00	8.00	30.00	5.81921
29	0.70	40.00	6.00	30.00	5.93517

A, B, C, D are the amount of activated carbon, adsorption time, pH and adsorption temperature.

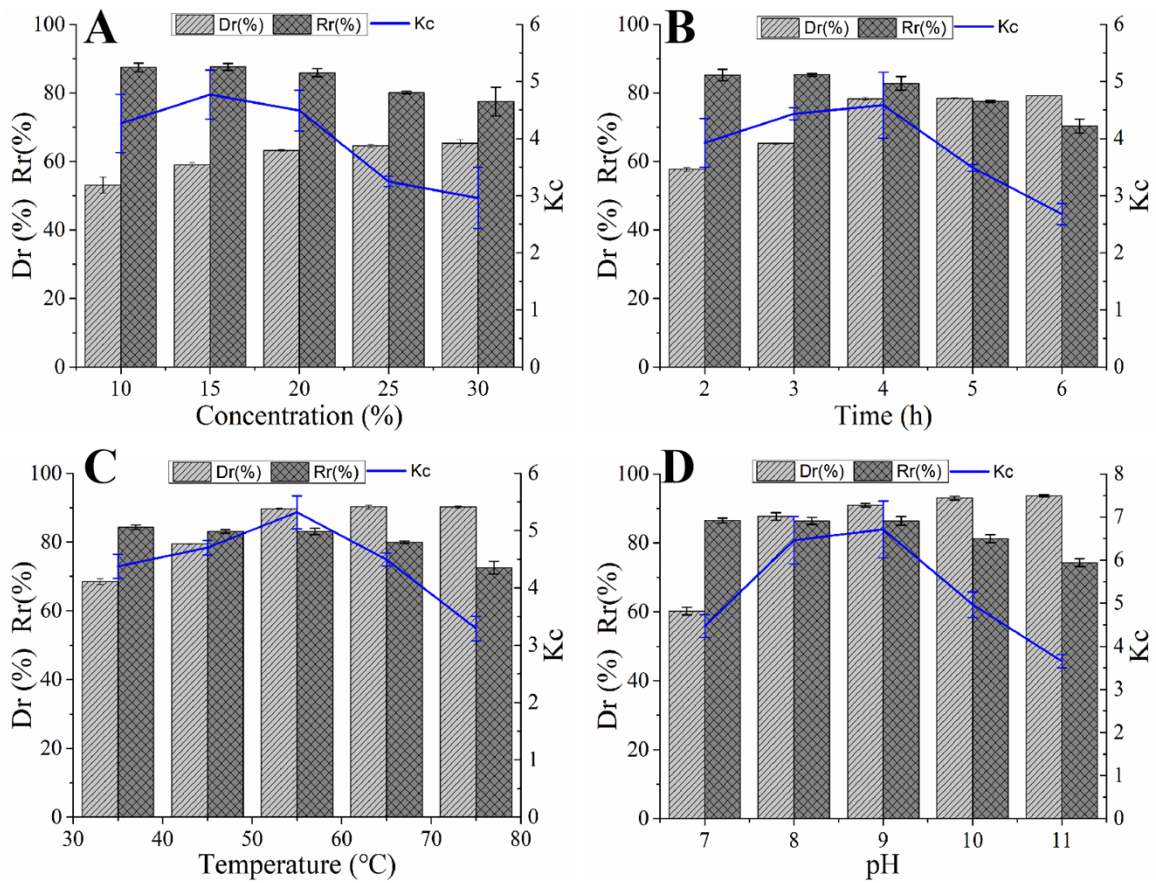
**Table S2.** Analysis of variance for fitted quadratic polynomial model

Source	SS	DF	MS	F-value	P-value	Significance
Model	34.29	14	2.45	28.11	< 0.0001	**
A	2.76	1	2.76	31.72	< 0.0001	**
B	0.056	1	0.056	0.64	0.4358	
C	2.36	1	2.36	27.11	0.0001	**
D	1.36	1	1.36	15.61	0.0015	**
AB	0.18	1	0.18	2.03	0.1757	

AC	0.049	1	0.049	0.57	0.4637	
AD	1.49	1	1.49	17.06	0.0010	**
BC	0.36	1	0.36	4.12	0.0617	
BD	0.48	1	0.48	5.45	0.0349	*
CD	0.95	1	0.95	10.94	0.0052	**
A <sup>2</sup>	8.86	1	8.86	101.68	< 0.0001	**
B <sup>2</sup>	14.48	1	14.48	166.13	< 0.0001	**
C <sup>2</sup>	3.22	1	3.22	36.95	< 0.0001	**
D <sup>2</sup>	9.51	1	9.51	109.16	< 0.0001	**
Residual	1.22	14	0.087			
Lack of fit	1.12	10	0.11	4.51	0.0797	
Pure error	0.099	4	0.025			
Cor. total	35.51	28				

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$R^2=0.9656$ ,  $R_{adj}^2=0.9313$ , “\*\*\*” was very significant ( $P<0.01$ ), “\*\*” was significant ( $P<0.05$ ), SS denotes sum of squares; DF denotes degree of freedom; MS denotes mean square.



**Figure S4.** Effects of different concentration of hydrogen peroxide (A), adsorption time (B), adsorption temperature (C) and pH (D) on the efficiency of decolorization. (n=3)

**Table S3.** Design and results of hydrogen peroxide oxidation response surface methodology

No.	A(%)	B(min)	C(°C)	D	K <sub>C</sub>
1	15.00	240.00	55.00	9.00	6.7922
2	10.00	300.00	55.00	9.00	5.543
3	20.00	180.00	55.00	9.00	5.86584
4	15.00	240.00	55.00	9.00	6.69963
5	15.00	300.00	65.00	9.00	4.72802
6	10.00	180.00	55.00	9.00	6.2595
7	20.00	240.00	65.00	9.00	4.84775
8	10.00	240.00	55.00	9.00	6.07799
9	15.00	300.00	55.00	8.00	6.07326
10	15.00	240.00	55.00	9.00	6.73735
11	20.00	300.00	55.00	9.00	4.50276
12	15.00	240.00	55.00	9.00	6.83257
13	15.00	180.00	55.00	8.00	6.01247
14	15.00	180.00	65.00	10.00	5.02065
15	15.00	240.00	65.00	10.00	5.08233
16	15.00	240.00	65.00	8.00	6.02562
17	20.00	240.00	55.00	10.00	5.22141
18	15.00	240.00	45.00	8.00	6.00526
19	15.00	180.00	55.00	10.00	6.28471



20	15.00	180.00	45.00	9.00	6.51351
21	15.00	300.00	45.00	9.00	5.87543
22	15.00	240.00	45.00	10.00	6.47326
23	10.00	240.00	55.00	10.00	5.86891
24	20.00	240.00	55.00	9.00	4.96873
25	20.00	240.00	55.00	8.00	6.06979
26	15.00	300.00	55.00	10.00	5.0428
27	15.00	240.00	55.00	9.00	6.1922
28	10.00	240.00	65.00	9.00	5.62795
29	10.00	240.00	45.00	9.00	6.2808

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A, B, C, D are the concentration of Hydrogen peroxide, adsorption time, adsorption temperature and pH.

**Table S4.** Analysis of variance for fitted quadratic polynomial model

Source	SS	DF	MS	F-value	P-value	Significance
Model	11.17	14	0.8	9.04	< 0.0001	**
A	1.46	1	1.46	16.52	0.0012	**
B	1.46	1	1.46	16.59	0.0011	**
C	1.91	1	1.91	21.62	0.0004	**
D	0.44	1	0.44	4.96	0.0429	*
AB	0.10	1	0.10	1.18	0.2948	
AC	0.071	1	0.071	0.80	0.3858	
AD	0.10	1	0.10	1.16	0.3001	
BC	0.030	1	0.030	0.34	0.5702	
BD	0.42	1	0.42	4.81	0.0457	*
CD	0.50	1	0.50	5.64	0.0324	*
A <sup>2</sup>	2.43	1	2.43	27.49	0.0001	**
B <sup>2</sup>	1.88	1	1.88	21.29	0.0004	**
C <sup>2</sup>	2.12	1	2.12	24.07	0.0002	**
D <sup>2</sup>	0.32	1	0.32	3.68	0.0758	
Residual	1.24	14	0.088			
Lack of fit	0.96	10	0.096	1.41	0.3965	

Pure error	0.27	4	0.068
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Cor. total	12.41	28	
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$R^2=0.9004$ ,  $R_{adj}^2=0.8008$ , “\*\*\*” was very significant ( $P<0.01$ ), “\*\*” was significant ( $P<0.05$ ), SS denotes sum of squares; DF denotes degree of freedom; MS denotes mean square.

**Table S5.** Optimum decolorization conditions.

Experimental factors	Activated carbon adsorption		Hydrogen peroxide oxidation	
	Theoretical conditions	Actual conditions	Theoretical conditions	Actual conditions
Amount (%)	0.65	0.65	13.25	13
Adsorption time(min)	40.06	40	211.97	212
Adsorption temperature (°C)	42.83	43	49.24	49
pH value	6.61	7	9.49	9.5