**Supplementary data**

Tables：

Table S1 Factors and levels of the response surface design

|  |  |  |  |
| --- | --- | --- | --- |
| Factors | Levels | | |
| -1 | 0 | 1 |
| Ultrasonic power (W) | 200 | 250 | 300 |
| Extraction time (min) | 20 | 30 | 40 |
| Temperature (℃) | 70 | 80 | 90 |

Table S2. The Box-Behnken experimental and response values for the yields of polysaccharide

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Run | A (℃) | B (W) | C (min) | *Y* (Extraction rate %) |
| 1 | 80.00 | 200.00 | 20.00 | 18.6 |
| 2 | 80.00 | 250.00 | 30.00 | 21.8 |
| 3 | 80.00 | 250.00 | 30.00 | 21.1 |
| 4 | 90.00 | 200.00 | 30.00 | 20.7 |
| 5 | 70.00 | 300.00 | 30.00 | 18.7 |
| 6 | 80.00 | 250.00 | 30.00 | 21.9 |
| 7 | 80.00 | 250.00 | 30.00 | 21.7 |
| 8 | 80.00 | 200.00 | 40.00 | 17.9 |
| 9 | 70.00 | 250.00 | 40.00 | 17.5 |
| 10 | 80.00 | 250.00 | 30.00 | 20.5 |
| 11 | 90.00 | 250.00 | 40.00 | 21.1 |
| 12 | 90.00 | 250.00 | 20.00 | 20.9 |
| 13 | 80.00 | 300.00 | 20.00 | 22.2 |
| 14 | 70.00 | 250.00 | 20.00 | 16.3 |
| 15 | 90.00 | 300.00 | 30.00 | 22.8 |
| 16 | 70.00 | 200.00 | 30.00 | 17.1 |
| 17 | 80.00 | 300.00 | 40.00 | 22.9 |

Table S3 ANOVA for response surface quadratic model analysis of variance table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source | Sum of Squares | DF | Mean Square | F-Value | P-value  Prob>F |  |
| Model | 65.73 | 9 | 7.30 | 10.93 | 0.0003 | significant |
| A | 31.60 | 1 | 31.60 | 47.29 | 0.0002 |  |
| B | 18.91 | 1 | 18.91 | 28.30 | 0.0011 |  |
| C | 0.24 | 1 | 0.24 | 0.37 | 0.5639 |  |
| AB | 0.062 | 1 | 0.062 | 0.094 | 0.7686 |  |
| AC | 0.25 | 1 | 0.25 | 0.37 | 0.5601 |  |
| BC | 0.49 | 1 | 0.49 | 0.73 | 0.4202 |  |
| A2 | 9.63 | 1 | 9.63 | 14.41 | 0.0067 |  |
| B2 | 0.016 | 1 | 0.016 | 0.025 | 0.8798 |  |
| C2 | 3.70 | 1 | 3.70 | 5.54 | 0.0508 |  |
| Residual | 4.68 | 7 | 0.67 |  |  |  |
| Lack of Fit | 3.28 | 3 | 1.09 | 3.12 | 0.1501 | not significant |
| Pure Error | 1.40 | 4 | 0.35 |  |  |  |
| Cor Total | 70.40 | 16 |  |  |  |  |

Table S4 1H-NMR and 13CNMR chemical shifts of DP40 in D2O at 27 °C

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Glycosyl residues | Chemical shifts (ppm) | | | | | |
| H1/C1 | H2/C2 | H3/C3 | H4/C4 | H5/C5 | H6a,b/C6 |
| (1→6)-α-D-Glcp | 4.913 | 3.931 | 3.786 | 3.660 | 3.931 | 3.786 |
| 100.10 | 73.88 | 75.25 | 73.88 | 75.25 | 69.91 |
| α-D-Glcp(1→ | 4.913 | 3.931 | 4.025 | 3.786 | 3.660 | 3.660 |
| 100.00 | 71.40 | 74.65 | 70.20 | 72.82 | 60.59 |
| α-D-Galp(1→ | 5.103 | 3.821 | 3.821 | 4.025 | 4.098 | 3.786 |
| 100.00 | 69.91 | 70.01 | 70.07 | 71.40 | 60.53 |
| α-D-Manp(1→ | 5.103 | 4.098 | 3.821 | 3.786 | 3.786 | 4.025 |
| 102 | 70.01 | 71.40 | 69.91 | 73.85 | 60.59 |

Table S5 1H-NMR and 13CNMR chemical shifts of DP40-plasma in D2O at 27 °C

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Glycosyl residues | Chemical shifts(ppm) | | | | | |
| H1/C1 | H2/C2 | H3/C3 | H4/C4 | H5/C5 | H6a,b/C6 |
| →4)-α-D-Glcp(1→ | 4.69 | 3.51 | 4.02 | 3.72 | 3.83 | 3.72 |
| 102.45 | 76.30 | 74.95 | 71.55 | 71.30 | 60.57 |
| α-D-Glcp(1→ | 4.87 | 3.83 | 4.02 | 3.72 | 3.51 | 3.72 |
| 102 | 73 | 76.56 | 70.01 | 75.17 | 69.82 |
| β-1,3-D-Glcp(1→ | 4.69 | 3.26 | 3.72 | 3.32 | 3.51 | 3.83/3.68 |
| 102.79 | 73.01 | 83.50 | 69.82 | 74.95 | 60.57 |
| α-D-Galp(1→ | 5.13 | 3.72 | 3.83 | 4.02 | 4.12 | 3.72 |
| 99.87 | 69.82 | 69.97 | 69.94 | 70.09 | 60.57 |
| α-D-Manp(1→ | 5.13 | 4.12 | 3.83 | 3.71 | 3.72 | 4.02 |
| 102.57 | 70.01 | 71.30 | 69.82 | 73.37 | 60.57 |