Electronic supplementary Information (ESI)

Fast and selective recognizes polysaccharide by surface molecularly imprinted film coated onto aldehyde-modified magnetic nanoparticles

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1. Optimized the process of Starch-MMIPs

In our study, the functional monomer was selected by UV-visible spectra method by way of measure the absorbance value of functional monomer and template molecules in the mixture.[1-3]. In the pre-experiment, we choose 3-amino benzene boric acid (APBA), 4-vinyl benzene boric acid (VPBA), acrylic acid (AA) and acrylamide (AM) as functional monomer, respectively, the result show in table 1.

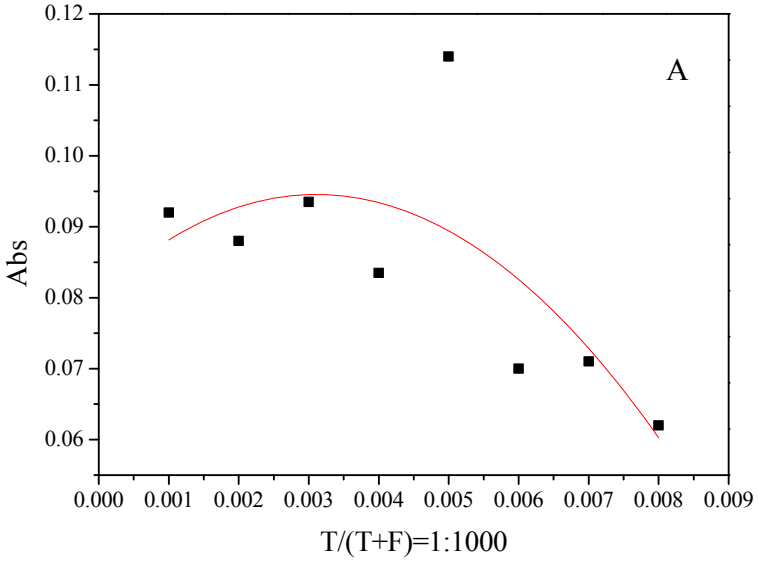
Table S-1 UV-vis spectra for template complication with different functional monomers

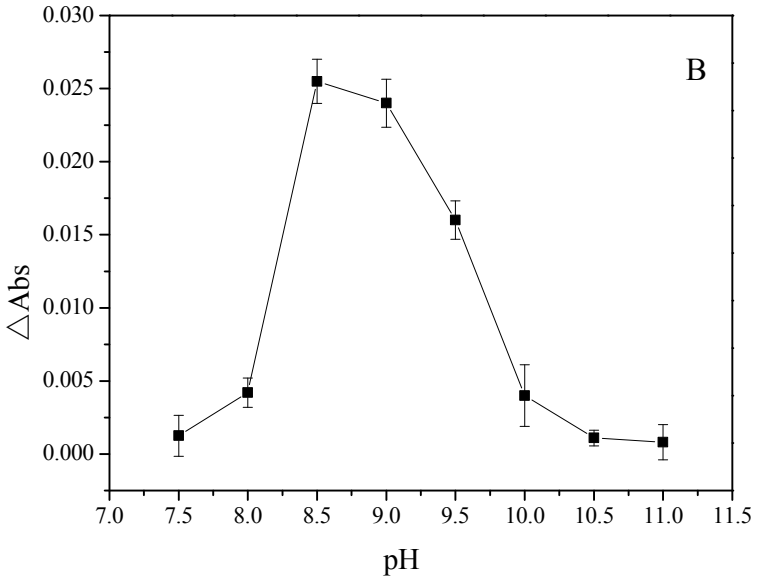
Functional monomer(F)	F/T (mol/mol)	Absorbance value of functional monomer (Abs F_{max})	Absorbance value of mixture Solution (Abs F_nT_{max})	ΔAbs (Abs F_nT_{max} - Abs F_{max})
APBA	1:100	0.772	0.796	0.024
VPBA	1:100	0.554	0.517	0.037
AA	1:100	0.483	0.491	0.008
AM	1:100	0.509	0.525	0.016
APBA	1:1000	0.772	0.791	0.019
VPBA	1:1000	0.554	0.535	0.019
AA	1:1000	0.483	0.492	0.009
AM	1:1000	0.509	0.531	0.015
APBA	1:10000	0.772	0.799	0.028
VPBA	1:10000	0.554	0.533	0.021
AA	1:10000	0.483	0.501	0.018
AM	1:10000	0.509	0.531	0.022

Concentration of functional monomers 0.02 mol L^{-1}; concentration of starch 0.2、0.02、0.002 μmol L^{-1}, respectively

Table S-1 illustrated that the four different types of functional monomers, APBA and VPBA show high binding affinity for the template, the functional monomers of AA and AM show low binding of the template, obviously because of the absence of significant interaction between these functional monomers and the template molecule. This manuscript we choose APBA as the functional monomer, and the other students will choose VPBA as the functional monomer.

In this study, we further investigate the synthesis of starch-imprinted nanoparticles using different ratios of template/functional monomer, value of phosphate buffer solution and different reaction temperature, the result show in Fig. S-1.





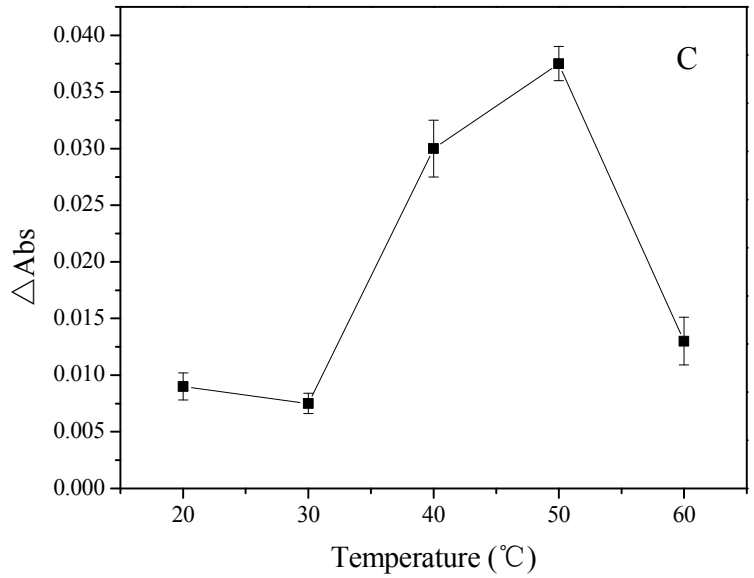


Fig. S-1 The absorbance value under different condition of preparation mixture; A) different ratios of template/functional monomer, B) different value of phosphate buffer solution, C) different reaction temperature

The result indicates (Fig. S-1) that the APBA/Starch ratio in the prepolymerization mixture is 3:1000, value of phosphate buffer solution is 8.5, reaction temperature is 50℃. Through orthogonal experiment optimization results show (Table S-2) that the influencing factors order is value of phosphate buffer solution (pH 9.0) > ratios of template/functional monomer (3:1000) > reaction temperature (40℃), so the condition of process of preparation of Starch-MMIPs is 60 nmol L^{-1} (0.768 mg) starch, 20 μmol L^{-1} APBA (3.099 mg) were dissolved in 5 mL sodium phosphate buffer (0.02 M L^{-1}, pH 9.0). and the mixture was incubated at room temperature for 1 h.

Table S-2 Orthogonal results for functional monomer of APBA

No.	A	B	C	ΔAbs
1	1(3:1000)	1(pH 8)	1(40℃)	0.0160±0.0021
2	1	2(pH 8.5)	2(50℃)	0.0115±0.0013
3	1	3(pH 9)	3(60℃)	0.0330±0.0008
4	2(4:1000)	1	2	0.0095±0.0015
5	2	2	3	0.0010±0.0008
6	2	3	1	0.0275±0.0024
7	3(5:1000)	1	3	0.0050±0.0009
8	3	2	1	0.0140±0.0017
9	3	3	2	0.0340±0.0021
k1	0.020	0.010	0.019	
k2	0.013	0.009	0.018	
k3	0.018	0.032	0.013	
R	0.007	0.023	0.006	

2. Molecular Weight Determination

The crude polysaccharides from pine cones of *Pinus koraiensis* (PKP) were isolated by hot-water extraction and ethanol precipitation, and then purified by trichloroacetic acid and activated carbon according to the method by Renbo Xu.[4, 5] The molecular weight determination by gel-permeation chromatography (GPC, Agilent Technologies, Santa Clara, CA, USA), using Agilent 1100 instrument (Agilent Technologies, Santa Clara, CA, USA) equipped with Agilent Technologies PL aquagel-OH Mixed column (Agilent Technologies, Santa Clara, CA, USA) and Agilent G1362A Refractive index Detector (RID). The linear regression was calibrated with Dextrans 106, 194, 620, 1470, 4120, 11840, 25820, 58400, 124700, 460000, 965000 and 1250450 Da. 50 μL samples were injected by Agilent G1313A Autosampler into the gel column, then eluted with ultrapure water at 25℃ and a flow rate of 1.0 mL/min. The molecular weight (Mw) was obtained from the calibration curve. All samples were filtrated through a 0.45 μm pore diameter membrane prior to analysis.

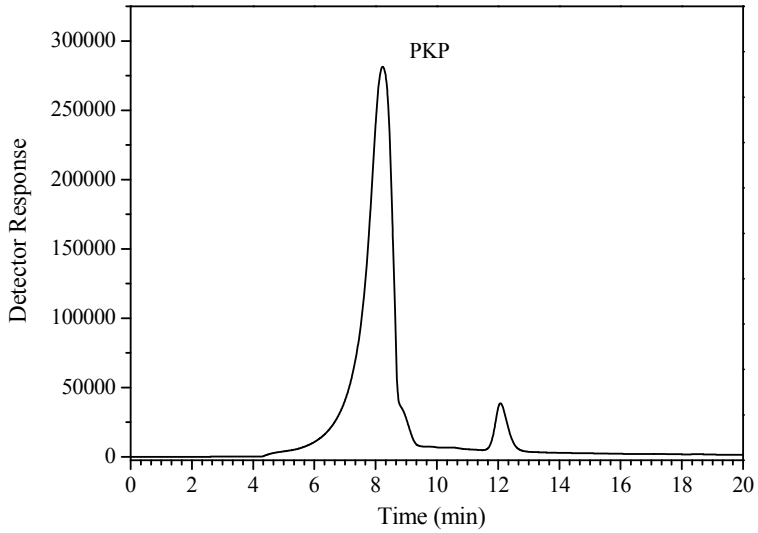
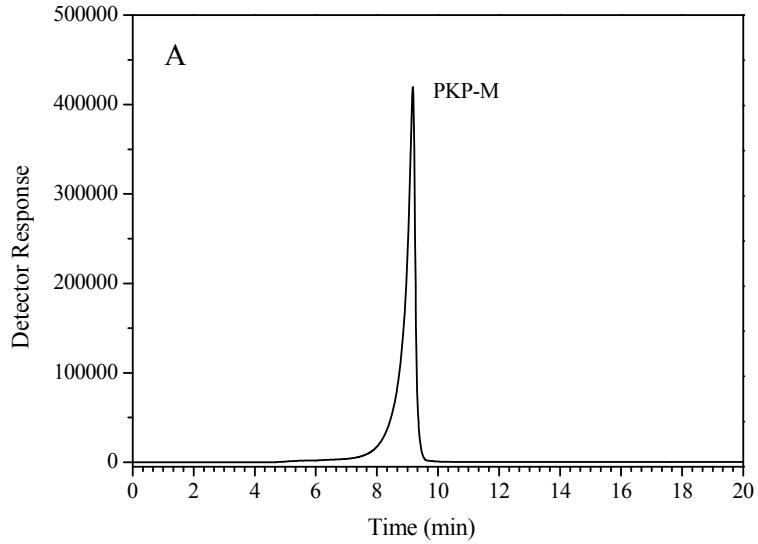


Fig. S-2 HPLC spectra of PKP

By calculating, the molecular weight of PKP was 106.7 kDa.



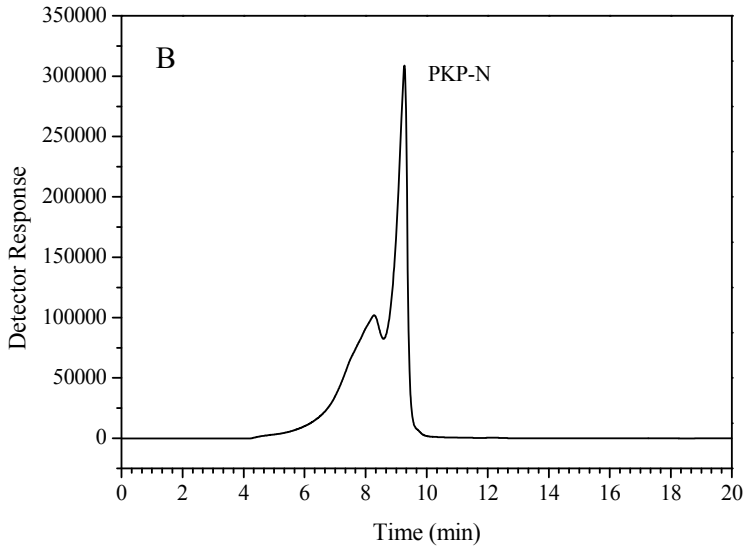


Fig. S-3 HPLC spectra of purified PKP . (A) The crude polysaccharide of PKP purified by Starch-MMIPs; (B) The crude polysaccharide of PKP purified by Starch-MNIPs

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