

1. Formulae:

$$\text{Cellulose conversion (\%)} = \frac{m_{\text{initial}} - m_{\text{left}}}{m_{\text{initial}}} \times 100\%$$

Where, m_{initial} denotes the weight of cellulose before reaction, m_{left} denotes the weight of cellulose after reaction.

$$\text{Yield (\%)} = \frac{n_{\text{product}}}{n_{\text{initial}}} \times 100\%$$

Where, n_{initial} denotes the carbon moles of cellulose before reaction, n_{product} denotes the carbon moles of the product.

$$\text{Selectivity (\%)} = \frac{Y_{\text{product}}}{\text{Cellulose conversion}} \times 100\%$$

Where Y_{product} denotes the yield of the product.

2. Figures and table

An 883 Basic IC (ion chromatograph) worked with a Metrisep A Supp4-250/4.0 column was used to detect the presence of PO_4^{3-} and H_3BO_3 . The mobile phase was a mixed solution of 1.7 mM NaHCO_3 and 1.8 mM Na_2CO_3 and the flow rate was $1.0 \text{ mL} \cdot \text{min}^{-1}$. A S4800 instrument was used to record the SEM images, which was operated at 10 KV. An XPert Pro MPD (Philip) instrument with $\text{Cu K}\alpha$ ($\lambda=0.15406 \text{ nm}$) was used to measure the X-ray powder diffraction (XRD) patterns of the BP. An ASIQUACIV200-2 automatic physical/chemical adsorption analyzer was used to conduct ammonia temperature programmed desorption tests of additives.

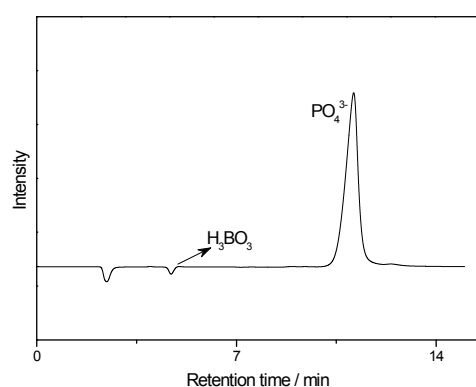


Fig. S1 The ion chromatography of the diluted hydrolysis solution of boron phosphate.

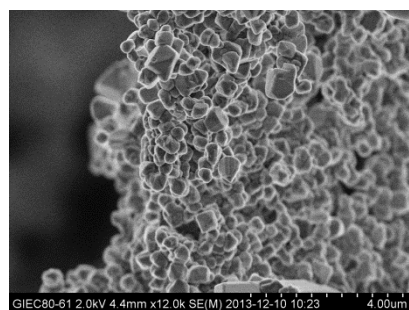


Fig. S2 SEM micrographs of boron phosphate.

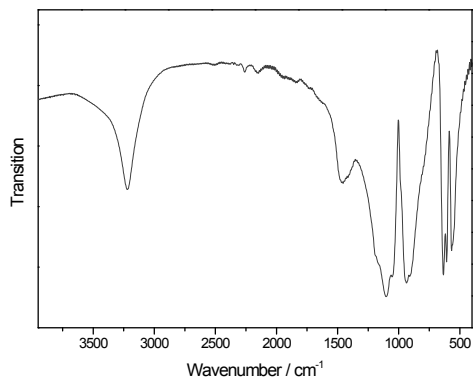


Fig. S3 FT-IR spectrum of boron phosphate.

The FT-IR spectrum was assigned as follows.¹⁻³ The band at 3221 cm^{-1} belongs to the stretching modes of O-H groups of strongly adsorbed water. The peak of 1455 cm^{-1} belongs to the free boric acid stretching. Stretching bands of $\nu(\text{BO}_4)$ and $\nu(\text{PO}_4)$ appear at 1103 cm^{-1} and 936 cm^{-1} , respectively. The deformation band of O-B-O appears at 620 cm^{-1} . But the high calcination temperature resulted in that the peak split into two bands at 634 cm^{-1} and 607 cm^{-1} . The peak at 567 cm^{-1} ascribes to the deformation band of O-P-O.

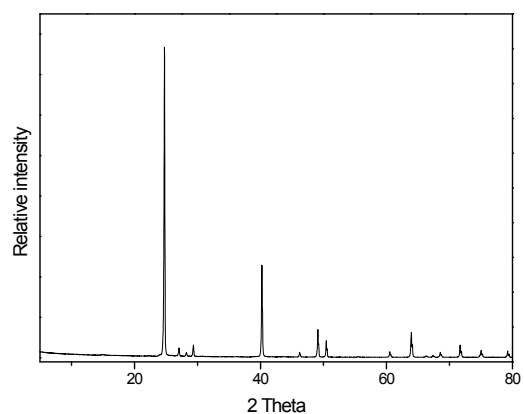


Fig. S4 The X-Ray Powder diffraction pattern of boron phosphate.

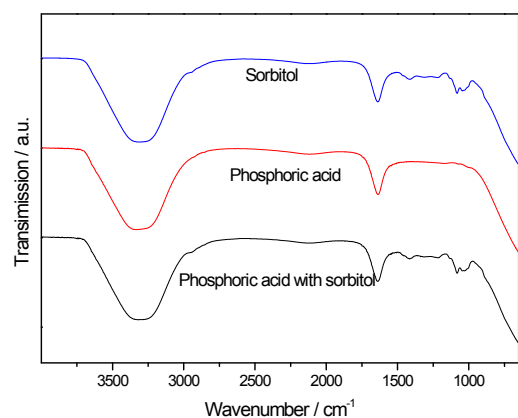


Fig. S5 FT-IR spectra of 25 wt% sorbitol aqueous solution, 5 wt% H_3PO_4 aqueous solution, and 5 wt% H_3PO_4 -25 wt % sorbitol aqueous solution.

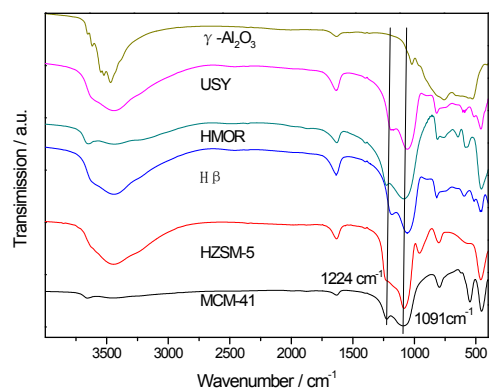


Fig. S6 FT-IR spectra of silica-alumina materials.

Table S1 Physicochemical property of the catalysts

Co-catalyst	BET surface area / m ² ·g ⁻¹	Average pore diameter / nm	Acidity density / mmol·g ⁻¹
MCM-41	309.8	2.5	0.04
HZSM-5	392.8	3.5	1.19
γ-Al ₂ O ₃	200.6	1.4	1.85
Hβ	583.1	0.5	1.24
HMOR	431.4	0.6	1.15
USY	651.1	3.1	0.83
BP	16.6	42.4	1.45

Table S2 Conversion of cellulose over Ru/C and/or different additives.^a

Entry	Additive	Cellulose conversion/%	Product yield/%		
			C ₆ alditols	Others in aqueous ^b	In gas ^c
1	-	6.3	1.4	0.1	4.7
2	MCM-41	17.7	12.9	3.9	0.4
3	HZSM-5	16.8	12.2	4.3	0.2
4	Hβ	14.5	10.9	3.1	0.2
5	HMOR	15.1	11.3	3.0	0.6
6	USY	12.8	9.3	2.5	0.4
7	γ-Al ₂ O ₃	13.9	10.5	2.9	0.5

^aReaction conditions: 0.8 g cellulose, 0.1 g Ru/C, 0.2 g additive, 40 mL H₂O, 5 MPa H₂ (RT), 463 K, 1 h. ^bOthers in aqueous include isosorbide, cellobiose, and small polyols. ^cIn gas: methane, ethane, and propane.

References

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2. Mitichen.Mg, Alshenav.Km and A. A. Kubasov, *J Appl Chem-Ussr+*, 1972, **45**, 455-&.
3. J. B. Moffat and J. F. Neeleman, *J Catal*, 1974, **34**, 376-389.