

Figure S1. The XPS survey spectra for PAF-30-SO₃H/X (X = 2.5, 5, 7.5).

Table S1. Components of the XPS spectra.

Materials	Element content, at. %				
	<i>C</i>	<i>O</i>	<i>P</i>	<i>S</i>	<i>Ru</i>
PAF-30-SO ₃ H/2.5	92.0	6.4	0.6	1.0	-
PAF-30-SO ₃ H/5	87.1	10.1	0.5	2.3	-
PAF-30-SO ₃ H/7.5	80.9	14.6	0.6	3.9	-
Ru-PAF-30-SO ₃ H/2.5-COD	79.8	15.3	0.2	0.6	4.1
Ru-PAF-30-SO ₃ H/5-COD	76.2	17.2	0.3	3.3	3.0
Ru-PAF-30-SO ₃ H/7.5-COD	77.0	17.1	0.2	3.4	2.3
Ru-PAF-30-SO ₃ H/2.5	79.7	15.1	0.3	0.5	4.4
Ru-PAF-30-SO ₃ H/5	71.5	19.2	0.3	2.7	6.3
Ru-PAF-30-SO ₃ H/7.5	76.5	16.9	0.1	3.5	3.0

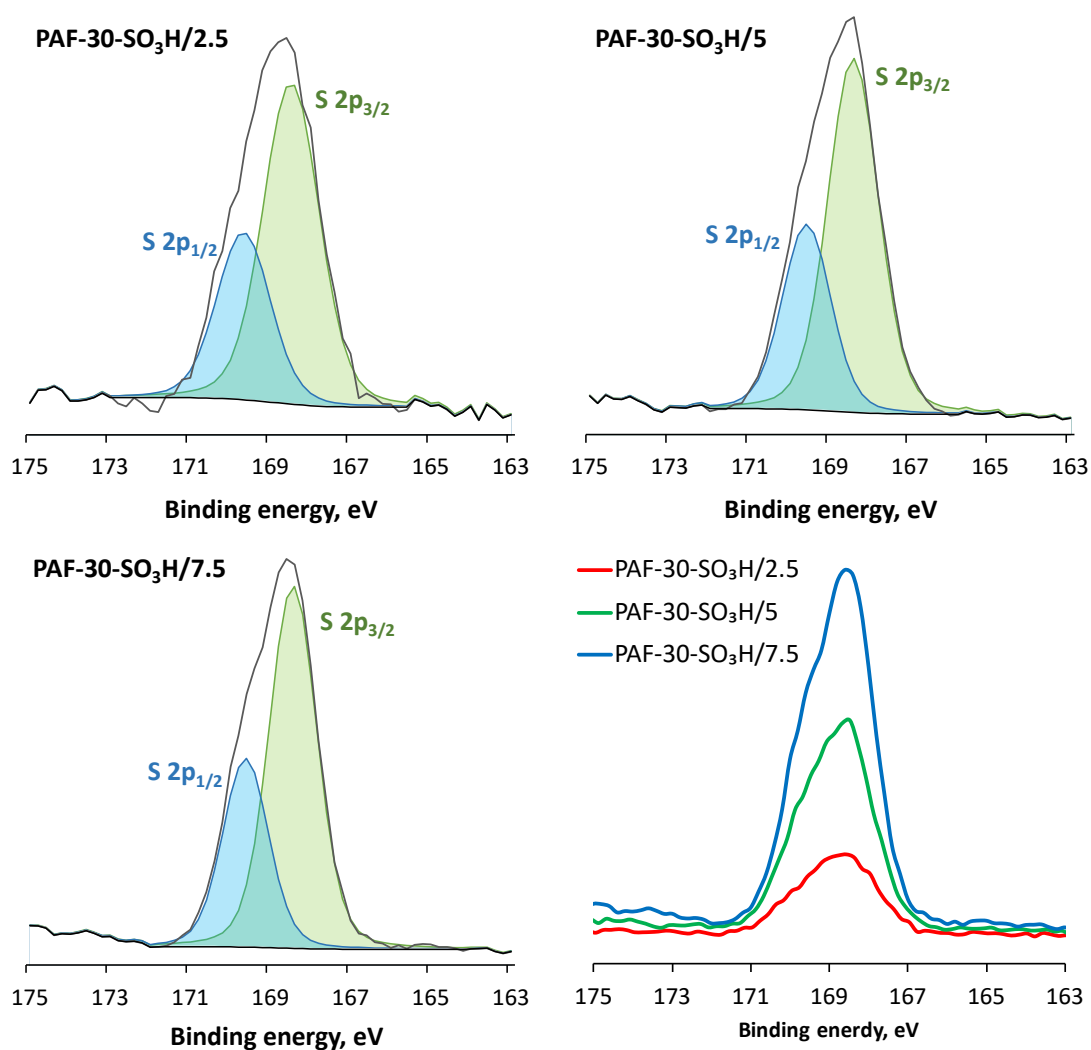


Figure S2. High-resolution XPS spectra of S2p region for PAF-30-SO₃H/X (X = 2.5, 5, 7.5).

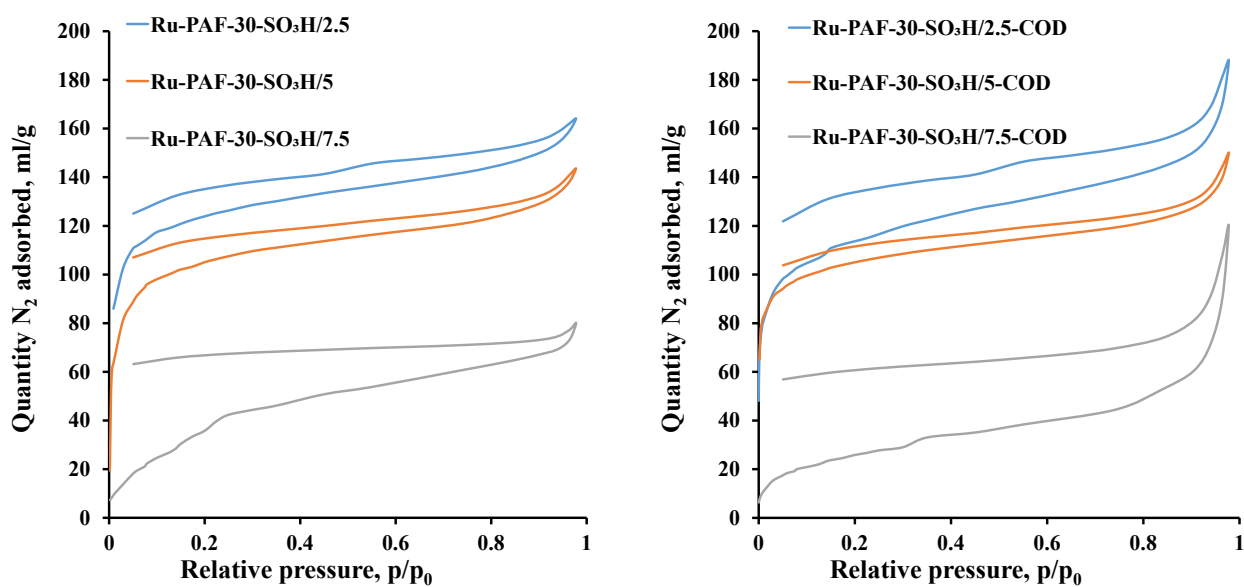


Figure S3. N₂ adsorption isotherms for synthesized catalysts.

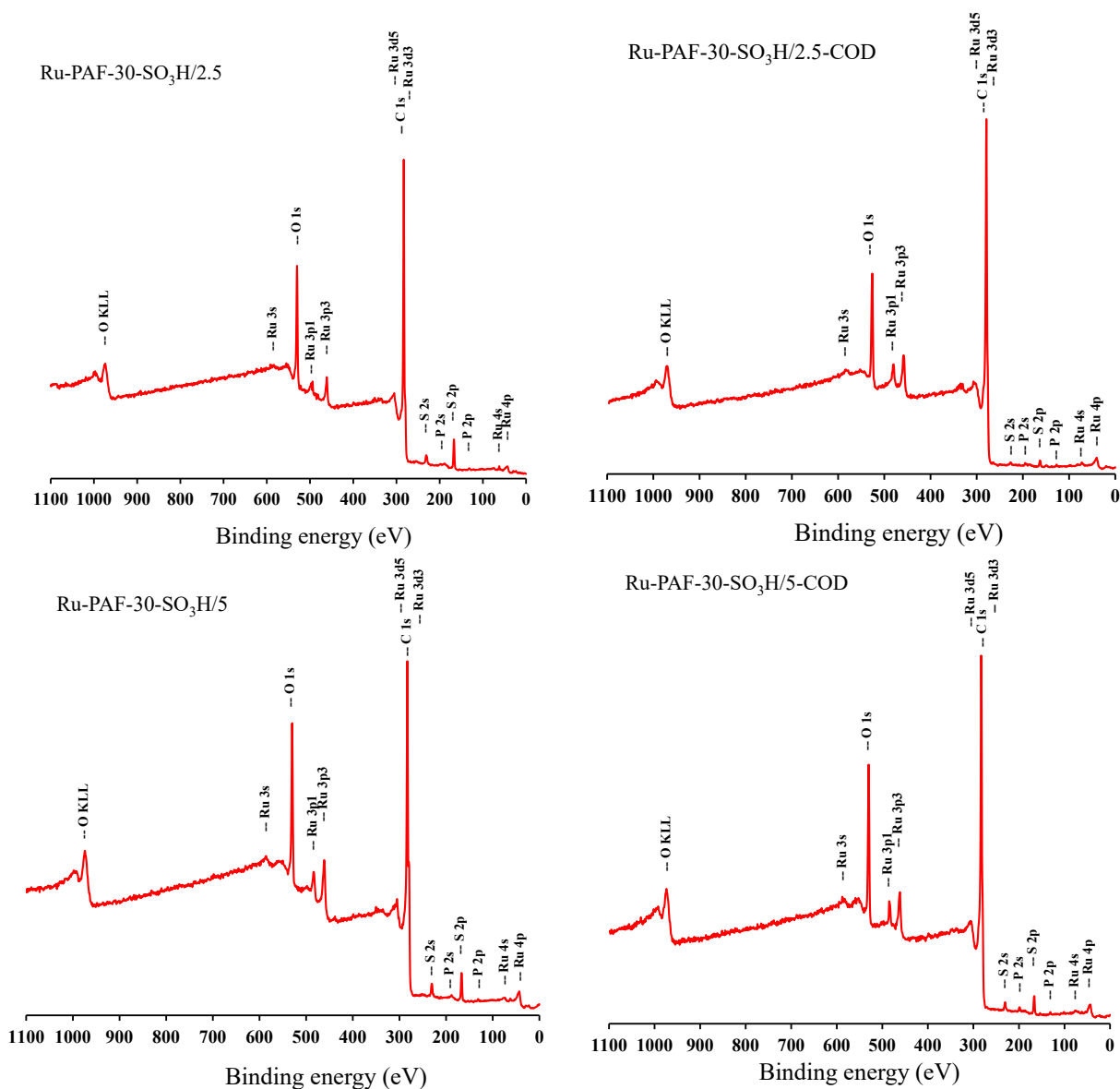


Figure S4. The XPS survey spectra for ruthenium catalysts.

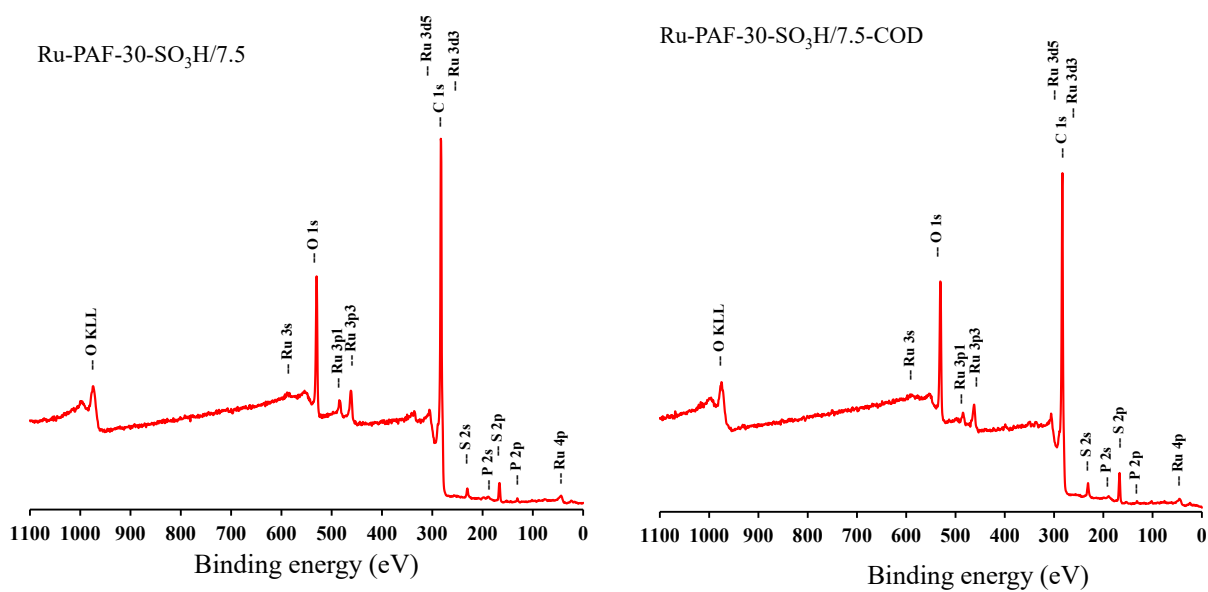


Figure S4. (end) The XPS survey spectra for ruthenium catalysts

Table S2. Peak parameters for XPS spectra of obtained ruthenium catalysts.

Catalyst	Ru ⁰		RuO ₂		RuO ₂ × xH ₂ O		C 1s	π-π 1s
	3d _{5/2}	3d _{3/2}	3d _{5/2}	3d _{3/2}	3d _{5/2}	3d _{3/2}		
<i>Ru</i> -PAF-30-SO ₃ H / 2.5	16.3%		62.0%		21.7%		284.58	290.86
	280.19	284.36	281.10	285.27	282.30	286.47		
<i>Ru</i> -PAF-30-SO ₃ H / 5	27.3%		59.3%		13.4%		284.60	290.80
	280.10	284.27	281.17	285.34	282.46	286.63		
<i>Ru</i> -PAF-30-SO ₃ H / 7.5	—		87.0%		13.0%		284.54	290.98
			281.36	285.53	282.40	286.57		
<i>Ru</i> -PAF-30-SO ₃ H / 2.5-COD	—		66.1%		43.9%		284.52	290.95
			281.37	285.54	282.31	286.48		
<i>Ru</i> -PAF-30-SO ₃ H / 5-COD	—		45.6%		54.4%		284.50	290.80
			281.40	285.57	282.36	286.53		
<i>Ru</i> -PAF-30-SO ₃ H / 7.5-COD	—		67.6%		32.4%		284.54	291.00
			281.39	285.56	282.34	286.51		

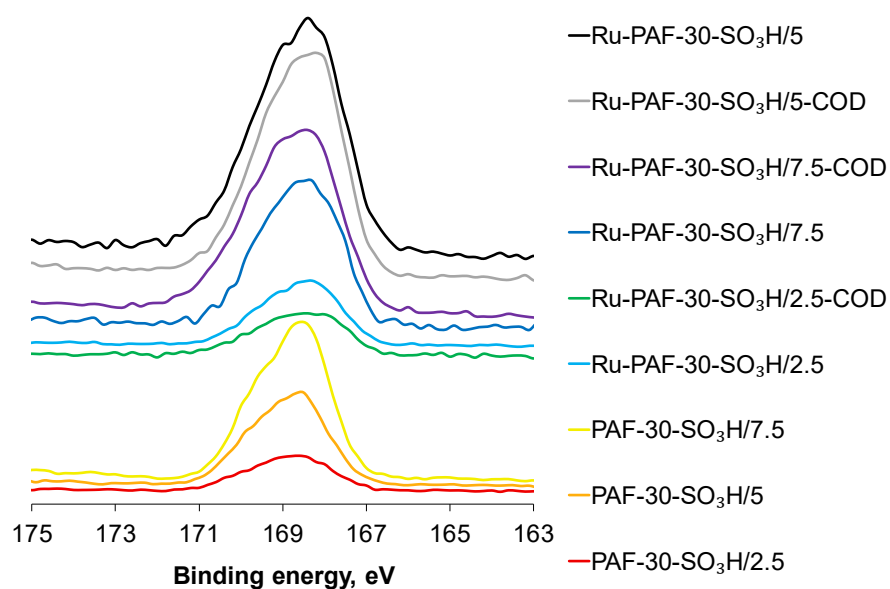


Figure S5. High-resolution XPS spectra of S2p region.

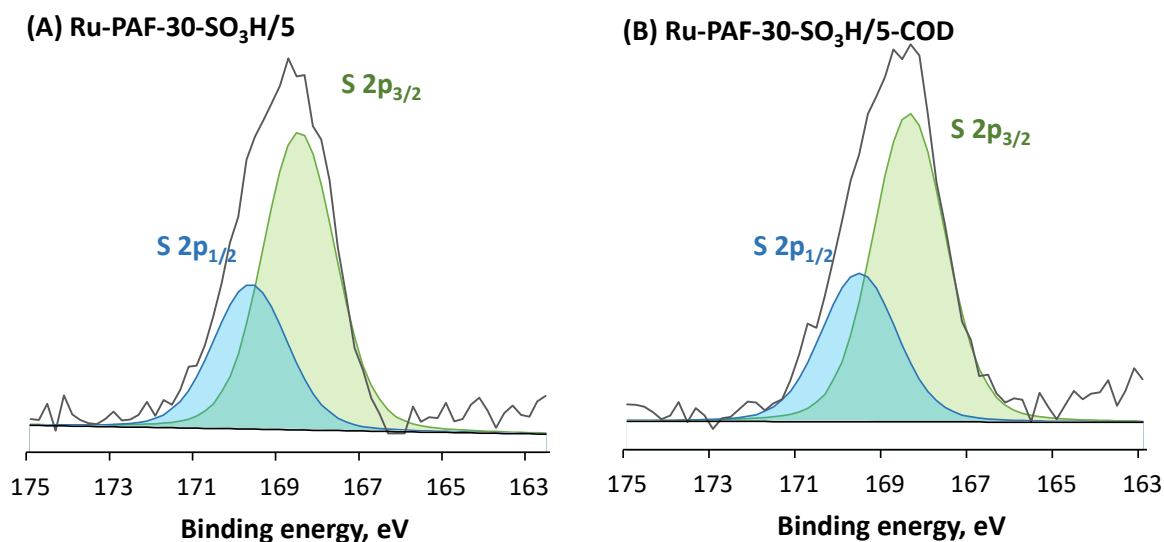


Figure S6. High-resolution XPS spectra of S2p region for Ru-PAF-30-SO₃H/5 (A) and Ru-PAF-30-SO₃H/5 (B) catalysts after the 3rd catalytic run.

Table S3. Guaiacol HDO over different catalysts.

Catalyst	Sub/Me	Conv., %	Products	Yield, %	Ref.
Ru-PAF-30-SO ₃ H/2.5-COD (Ru = 0.79 wt.%) 3 MPa H ₂ ; 250 °C; 500 µL H ₂ O; 0.38 mmol guaiacol; 5 mg of catalyst; 2 h;	972	89	2-methoxy-cyclohexanol Cyclohexanol Cyclohexane	33 40 16	This work
Ru NPs@SILP-1.00 (Ru = 0.32 wt.%) 12 MPa H ₂ ; 175 °C; 1 mL decalin; 2.4 mmol guaiacol; 75 mg of catalyst; 16 h	1000	>99%	2-methoxy-cyclohexanol Methoxycyclohexane Cyclohexanol Cyclohexane	14 4 1 81	[1]
Ru-MWCNT (Ru = 5 wt.%) 4 MPa H ₂ , 270 °C; 29 mL H ₂ O, 8,96 mmol guaiacol; 20 mg of catalyst; 1h	906	98.1 %	Cyclohexane Methoxycyclohexane Cyclohexanol Cyclohexanone Cyclopentanemethanol 2-methoxy-cyclohexanol 1,2-Cyclohexanediol Catechol	34.9 0.2 2.2 0.1 2.6 13.6 0.3 0.1	[2]
Ru-AC (Ru = 5 wt.%) 4 MPa H ₂ , 270 °C; 29 mL H ₂ O, 8,96 mmol guaiacol; 20 mg of catalyst; 1h	906	96.1 %	Cyclopentane Cyclohexane Methylcyclohexane Methoxycyclohexane Cyclohexanol Cyclohexanone Cyclopentanemethanol Anisole Phenol 2-methoxy-cyclohexanol 1,2-Cyclohexanediol Catechol	0.2 24.7 0.3 0.4 10.2 0.8 1.6 0.2 0.3 22.7 1.0 0.1	[2]
Ru-CARF (Ru = 5 wt.%) 4 MPa H ₂ , 270 °C; 29 mL H ₂ O, 8,96 mmol guaiacol; 20 mg of catalyst; 1h	906	81.6 %	Cyclohexane Methylcyclohexane Methoxycyclohexane Cyclohexanol Cyclohexanone Cyclopentanemethanol Anisole Phenol 2-methoxy-cyclohexanol 1,2-Cyclohexanediol Catechol	5.7 1.1 0.1 24.5 1.9 0.7 0.3 4.2 17.3 0.5 0.1	[2]

Ru-Vulcan (Ru = 5 wt.%) 4 MPa H ₂ , 270 °C; 29 mL H ₂ O, 8,96 mmol guaiacol; 20 mg of catalyst; 1h	906	77.0 %	Cyclohexane	11.9	[2]
			Methylcyclohexane	1.2	
			Methoxycyclohexane	0.1	
			Cyclohexanol	12.7	
			Cyclohexanone	1.1	
			Cyclopentanemethanol	0.6	
			Anisole	2.2	
			Phenol	12.3	
			2-methoxy-cyclohexanol	8.8	
			1,2-Cyclohexanediol	0.7	
Ru-PAF-30-SO ₃ H/5-COD (Ru = 0.76 wt.%) 3 MPa H ₂ ; 250 °C; 500 µL H ₂ O; 0.38 mmol guaiacol; 5 mg of catalyst; 2 h;	1010	83%	Catechol	0.1	This work
			Cyclohexanone	44	
			Cyclopentanemethanol	11	
			Cyclopentanecarbaldehyde	8	
			Cyclohexane	1	
Ru/HY (Ru = 5 wt.%) 4 MPa H ₂ ; 250 °C; 30 mL H ₂ O; 0.81 mmol guaiacol; 100 mg of catalyst; 2 h;	16	91	Alkylation products	19	[3]
			Cyclohexanone	27.5	
			Cyclohexane	18.5	
			Cyclohexanol	18.1	
			Gases	10.0	
			Ring-open products	8.2	
			Cyclopentylmethanol	7.9	
			Dimers	6.3	
Ru-PAF-30-SO ₃ H/5 (Ru = 4.68 wt.%) 3 MPa H ₂ ; 250 °C; 500 µL H ₂ O; 0.38 mmol guaiacol; 5 mg of catalyst; 2 h;	164	100	Others	3.5	This work
			2-methoxy-cyclohexanol	35	
			Anisole	2	
			Cyclohexanol	8	
			Cyclohexane	55	
NSMP-Ru (Ru = 3.6 wt.%) 5 MPa H ₂ , 200 °C; 1 mL H ₂ O, 0.4 mmol guaiacol; 5 mg of catalyst, 2h	225	>99 %			[4]
			Methoxycyclohexanol	86	
			Cyclohexanol	13	
5%Ru/AMWCNTs (Ru = 5 wt.%) 2MPa H ₂ , 200 °C; 5.4 mL decalin, 10 mmol guaiacol; 100 mg of catalyst, 200 min	202	49.32 %	Methylcyclohexanol	<1	[5]
			Cyclohexanol	33.2	
			1,2-Cyclohexanediol	5.2	
			Cyclohexane	1.4	
			Cyclohexanone	1.7	
			Phenol	1.2	
			Benzene	1.8	
			Others	4.9	
Ru/HNT-t (3) (Ru = 2 wt.%) 3 MPa H ₂ ; 180 °C; 2.7 mL H ₂ O; 2.42 mmol guaiacol; 61 mg of catalyst; 3 h;	200	100%			[6]
			Cyclohexanol	35.4	
			2-methoxycyclohexanol	25.4	
			4-methylcyclohexanol	24.1	
			Cyclohexane	12.6	
			Phenol	2.0	
			p-cresol	0.4	
			Cyclohexanone	0.1	

Ru/TiO ₂ –Al ₂ O ₃ (Ru = 1.04 wt.%) 1 MPa H ₂ ; 240 °C; 20 mL octane; 0.81 mmol guaiacol; 50 mg of catalyst; 4 h;			157	91.4 %	Cyclohexane Cyclohexanol 2-methoxycyclohexanol	89.4 9.0 1.6	[7]
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