

## Supplementary file

**Table S1.** Comparison of hydrogen production performance from biomass-derived bio-oil steam reforming using Ni-based catalysts (recent literature)

Feedstock / Model compound	Catalyst system	Support	Temp. (°C)	H <sub>2</sub> yield / performance*	Coke formation	Key limitations	Ref.
Acetic acid (model)	Ni/ZrO <sub>2</sub>	ZrO <sub>2</sub>	700–800	H <sub>2</sub> yield ≈ 40–45%	Moderate	Model compound; limited representativeness	Li et al., 2012
Ethanol (model)	Ni–Cu/MgAl	Mixed oxide	650–750	H <sub>2</sub> selectivity ↑ (Cu-promoted WGS)	Reduced vs Ni	Not real bio-oil; alcohol only	Yu et al., 2019
Phenol (model)	Ni/CeO <sub>2</sub>	CeO <sub>2</sub>	700	Stable H <sub>2</sub> , good conversion	Moderate	Catalyst cost; oxide sintering	Silva et al., 2022
Bio-oil model mixture	Ni/Al <sub>2</sub> O <sub>3</sub> –MgO	Al <sub>2</sub> O <sub>3</sub>	800	H <sub>2</sub> ≈ 45–50%	High without Mg	Coke still significant	Jin et al., 2021
Real pine bio-oil	Ni/CeMnO <sub>2</sub>	Mixed oxide	750–800	H <sub>2</sub> ≈ 48%	Moderate	Short time-on-stream	Sohrabi et al., 2021
Biomass oxygenates	Ni/C (biochar)	Carbon	750	H <sub>2</sub> -rich syngas	Lower than oxide	Monometallic Ni deactivation	Gai et al., 2019
Corn stover bio-oil (whole)	Ni–Cu/char (8:2)	Char	800	H <sub>2</sub> yield ≈ 52–53%	Low (≈4 mmol g <sup>-1</sup> )	—	This work