

Alkali-thermal gasification and hydrogen generation potential of biomass

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Electronic Supplementary Materials

Table S1: Corrosion Data. The table compares static corrosion rates of nickel alloys in molten caustic soda. This data was used in the material selection process and emphasizes the advantage of alloy 600

Alloy	Corrosion rate (mil/year)			
	400°C	500°C	580°C	680°C
Hastelloy alloy C	NT	100.5	HC	NT
Hastelloy alloy D	0.7	2.2	9.9	HC
Monel alloy 400	1.8	5.1	17.6	NT
Inconel alloy 600	1.1	2.4	5.1	66.4
Duranickel alloy 301	1.7	3.2	10.4	40.7
Nimonic alloy 75	1.1	14.3	20.8	47.6

NT=not tested; HC= Gained weight. Swollen outside surface largely oxide, heavily corroded; 1 milli-inch= 0.0254 mm

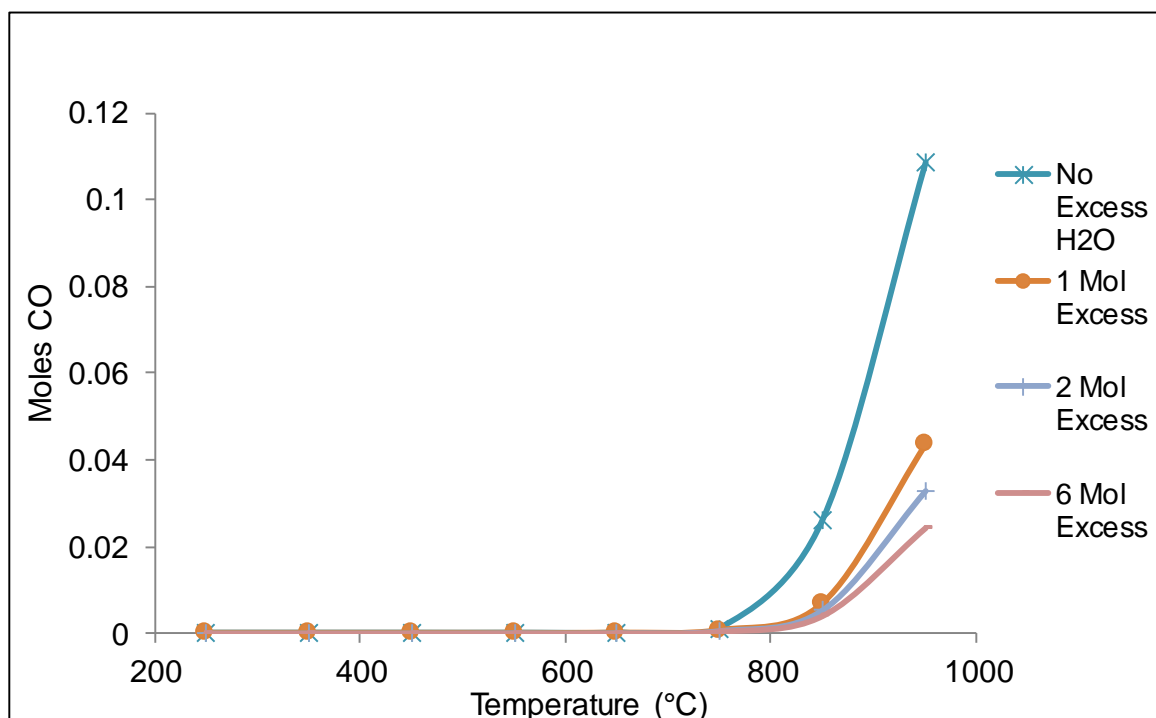


Figure S1: Thermodynamic effect of temperature and excess H₂O on CO-production for glucose gasification with its NaOH-CP value (12 moles NaOH per mole glucose). No excess H₂O corresponds to using water as prescribed by overall Reaction 1 presented.

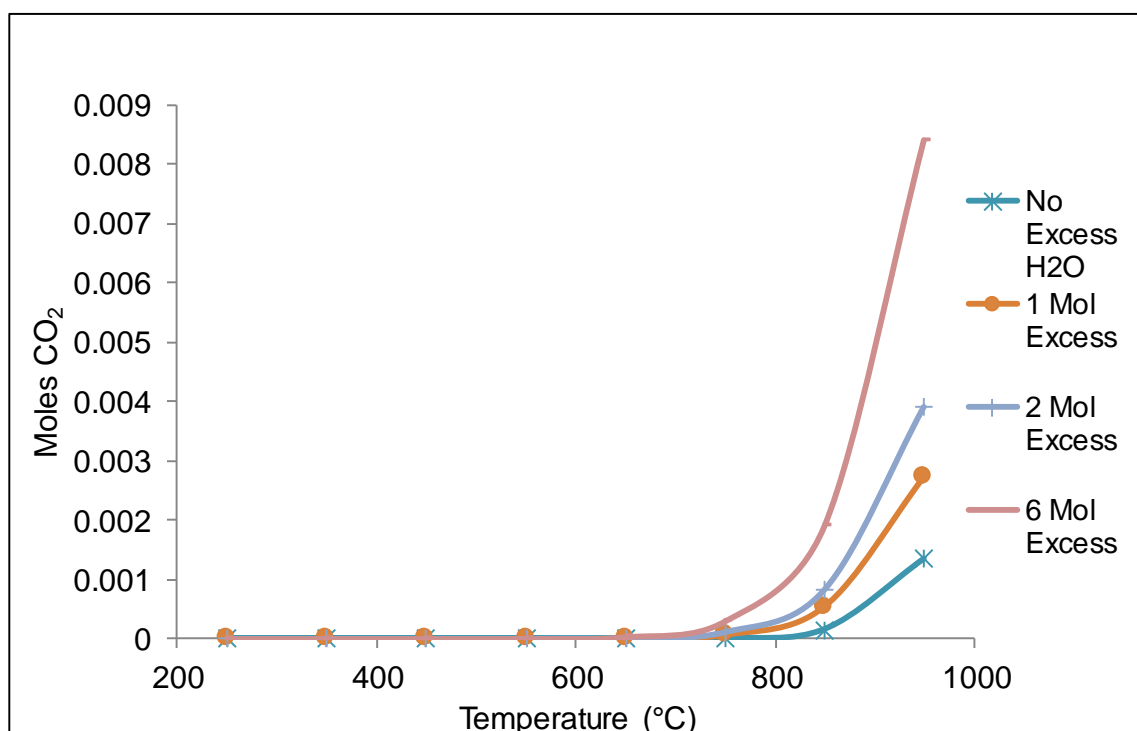


Figure S2: Thermodynamic effect of temperature and excess H₂O on CO₂-production for glucose gasification with its NaOH-CP value (12 moles NaOH per mole glucose). No excess H₂O corresponds to using water as prescribed by overall Reaction 1 presented.

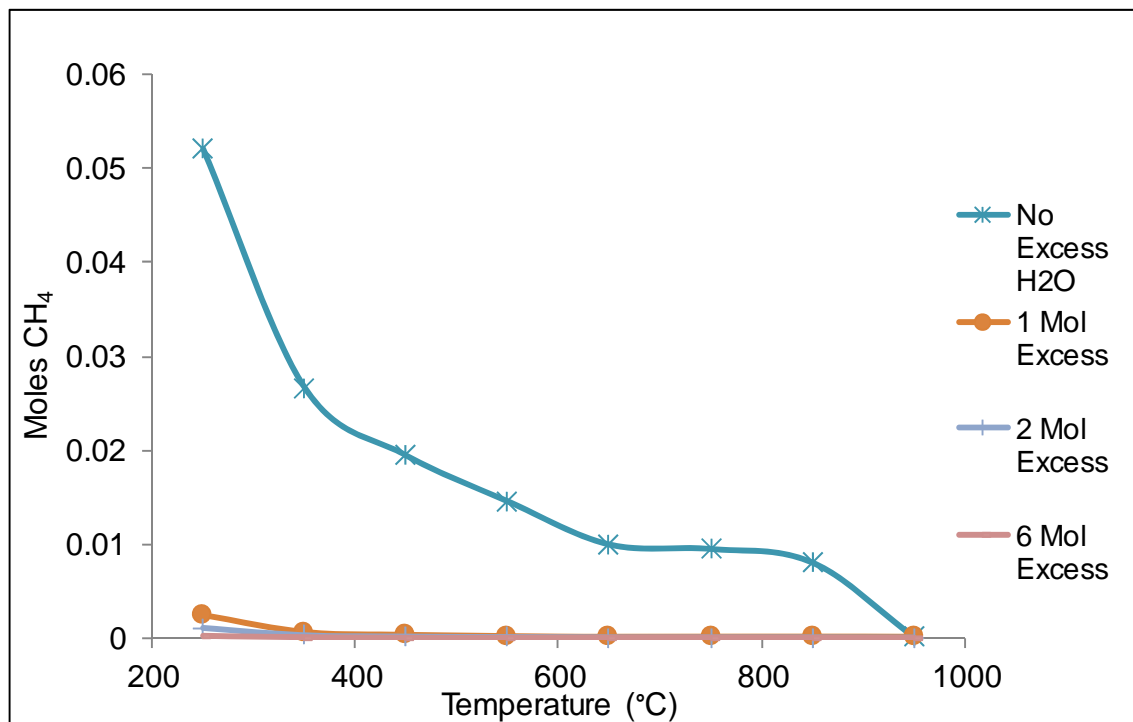


Figure S3: Thermodynamic effect of temperature and excess H₂O on CH₄-production for glucose gasification with its NaOH-CP value (12 moles NaOH per mole glucose). No excess H₂O corresponds to using water as prescribed by overall Reaction 1 presented.

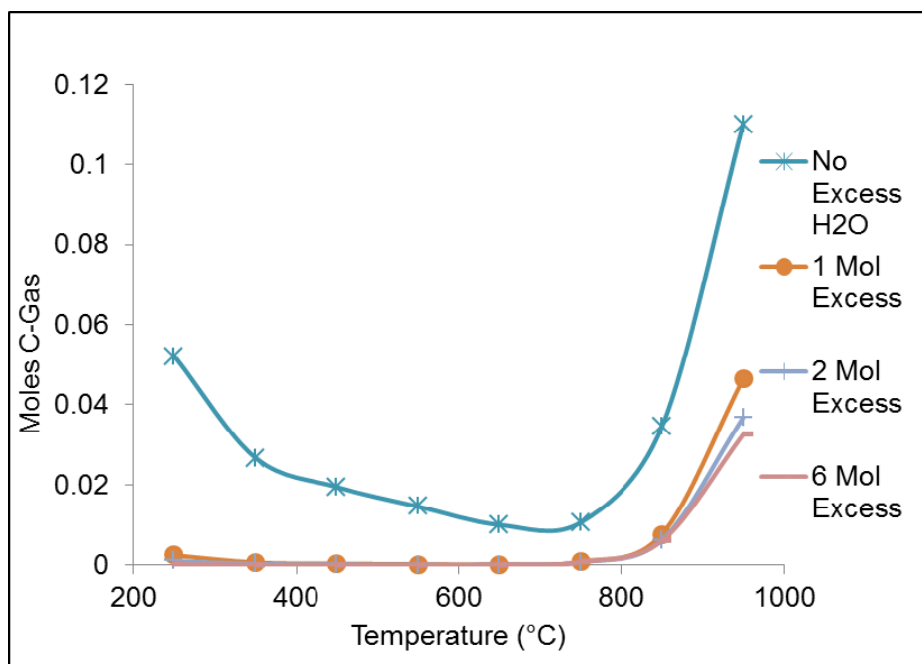


Figure S4: Thermodynamic effect of temperature and excess H₂O on C-gas production, using the NaOH-CP with glucose as the biomass model compound.

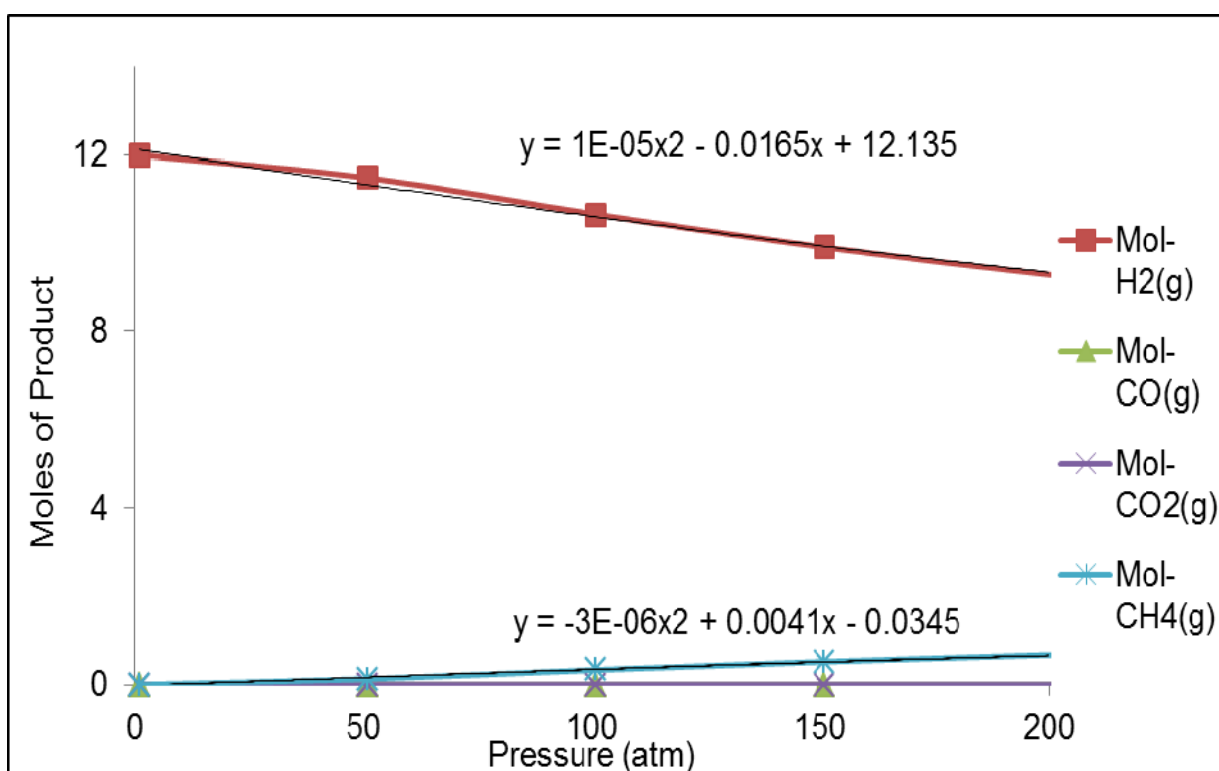


Figure S5: Thermodynamic effect of pressure on the composition of glucose gasification products at 800°C, 1 mole glucose, 12 moles NaOH.

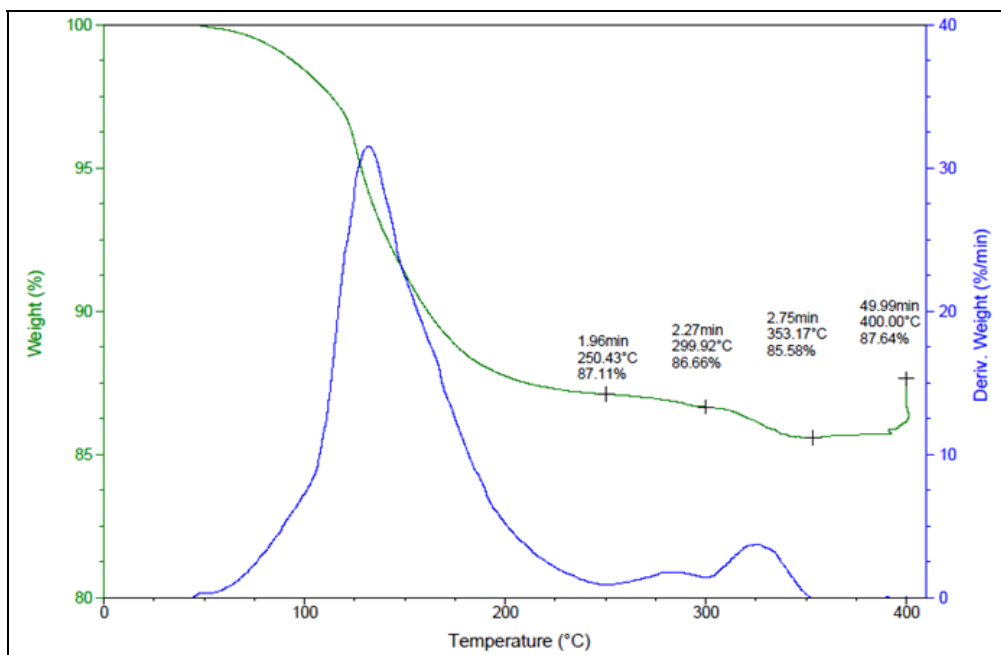


Figure S6: Percent weight loss vs. temperature for a sample containing 0.30g NaOH and 0.10g glucose, heated in hydrated air (at room temperature, 0.4psig), with temperature ramped at 20°C/min and held at 400°C for 50 minutes. Note: some weight gain is observed towards the end of each heating period due to CO₂ entering the apparatus and becoming fixed by residual NaOH.

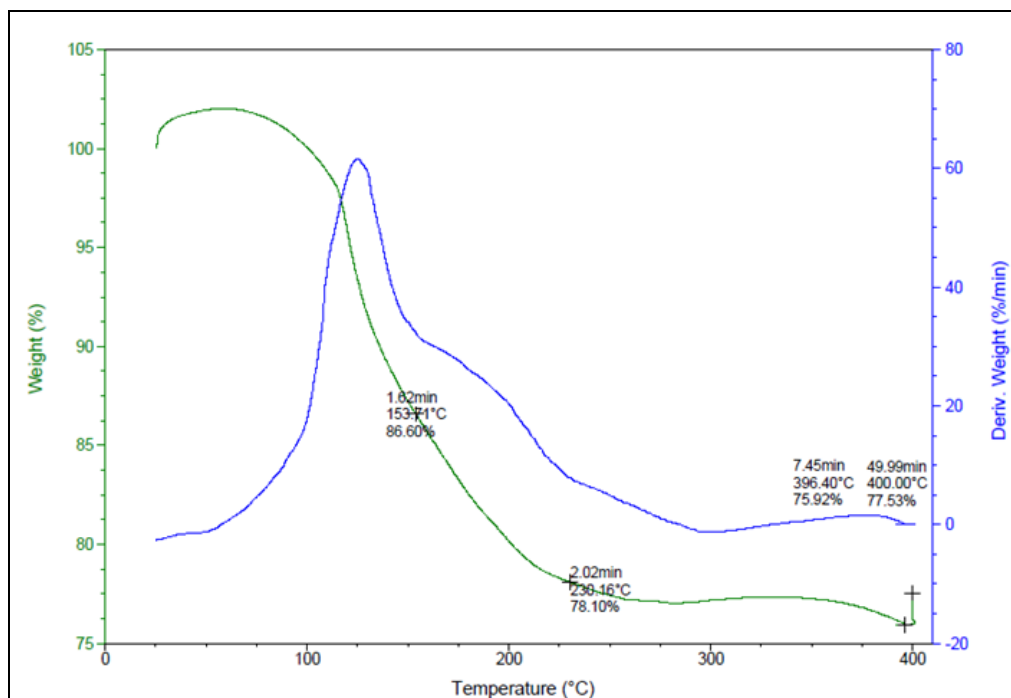


Figure S7: Percent weight loss vs. temperature for a sample containing 0.30g NaOH and 0.10g glucose, heated in hydrated air (at room temperature, 0.4psig), with temperature jumped to 400°C and held for 50 minutes. Note: some weight gain is observed towards the end of each heating period due to CO₂ entering the apparatus and becoming fixed by residual NaOH.

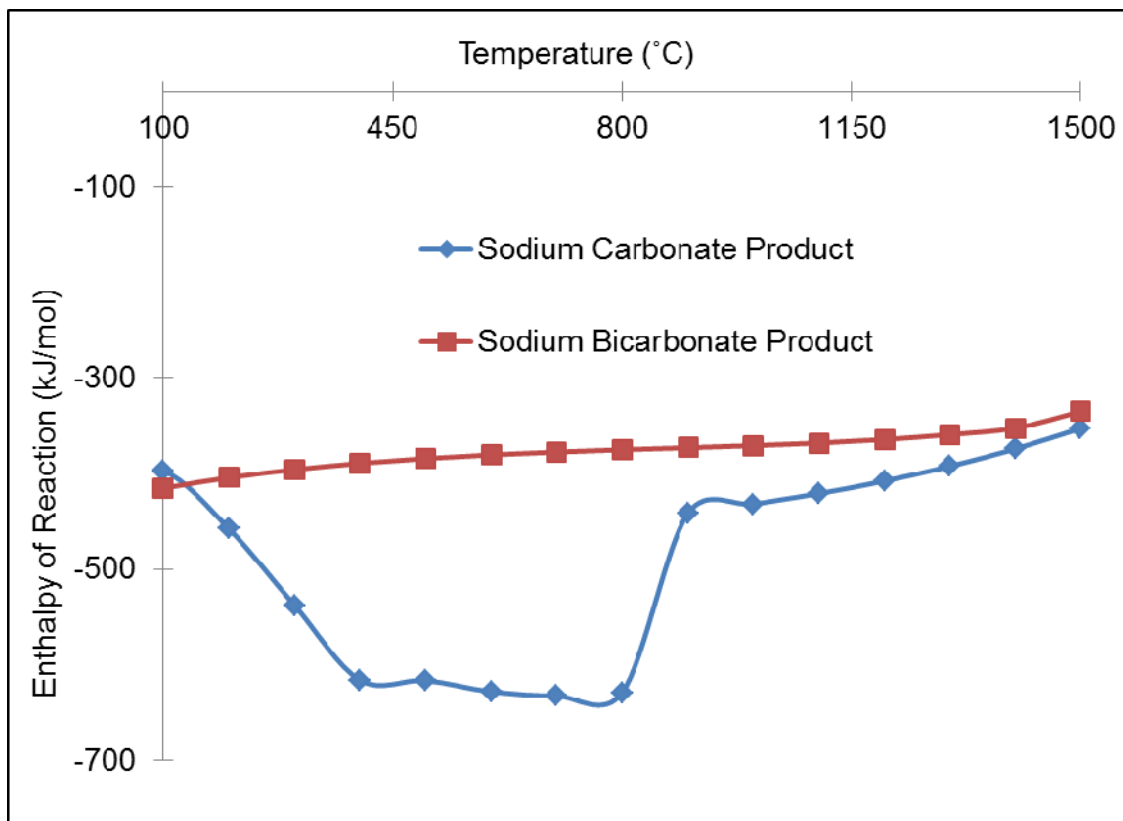


Figure S8: A comparison between the net energy release for glucose gasification considering Na₂CO₃ and NaHCO₃ as final products. The former is more energetically favorable over a temperature range of around 200-1500°C.

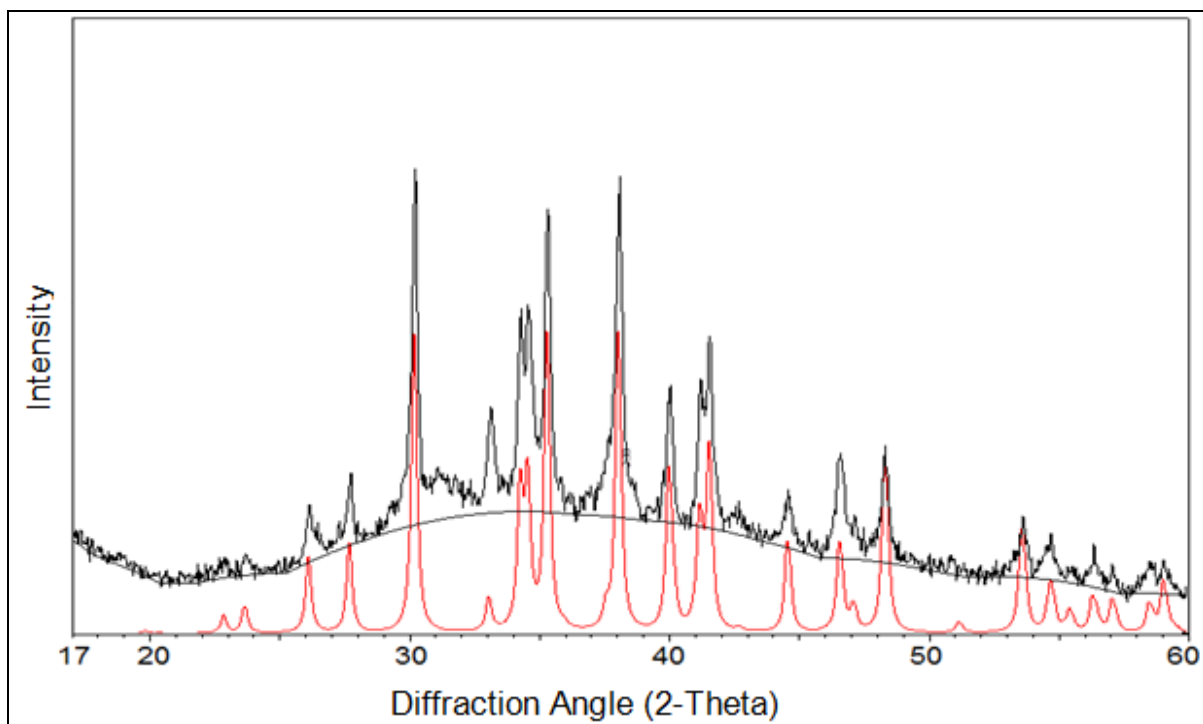


Figure S9: X-ray Diffraction pattern of solid residue from alkali-thermal gasification of glucose shown above the calculated pattern for Na₂CO₃.