Electronic Supplementary Material (ESI) for Green Chemistry.

Surface modification of porous g-C_3N_4 materials by waste product for enhanced photocatalytic performance under visible light

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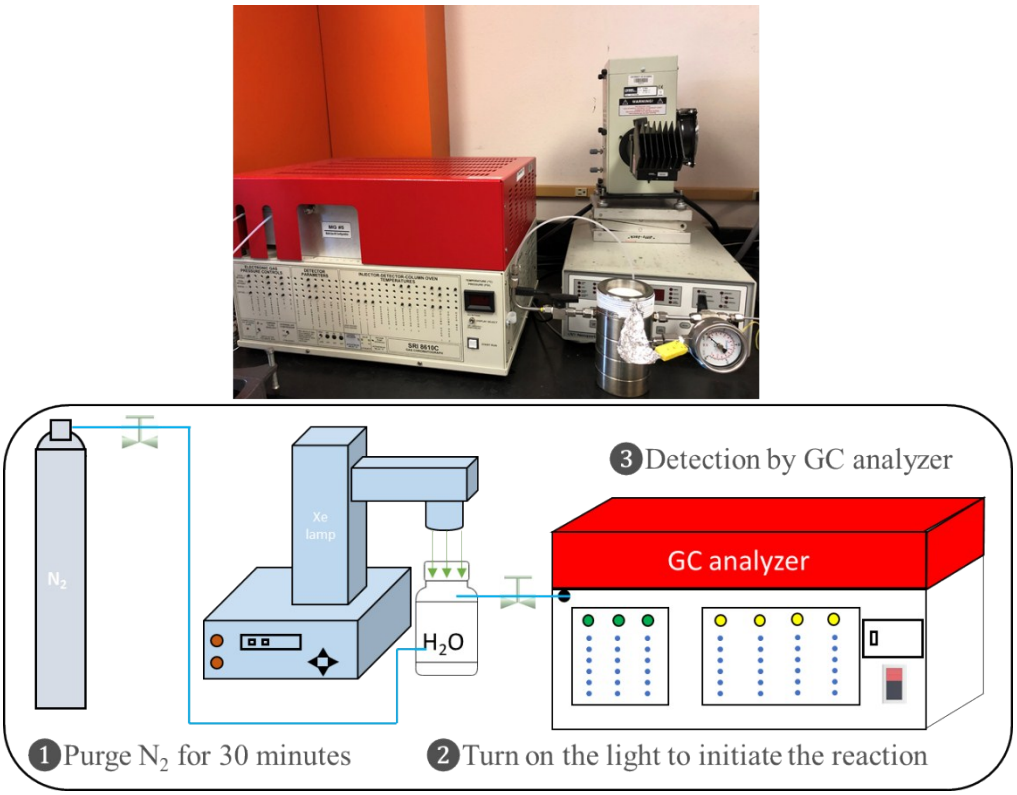


Fig. S1 Optical photo and schematic diagram of photocatalytic reaction system

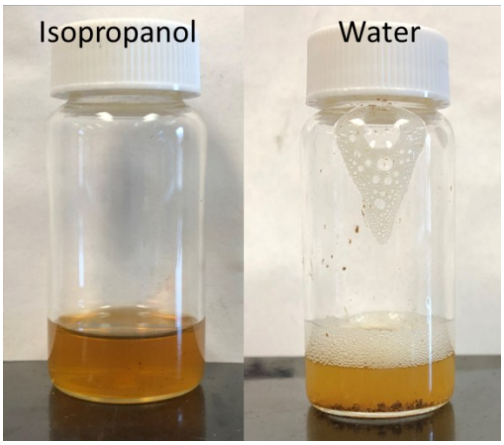


Fig. S2 optical photo of MCN samples

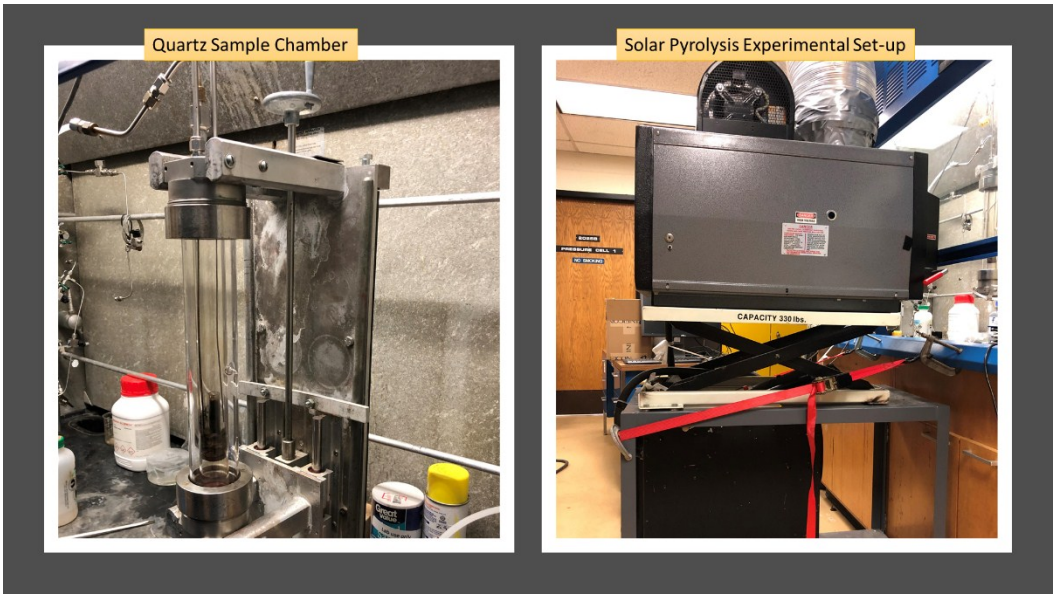


Fig S3 Optical photo of solar pyrolysis experimental set-up and quartz sample chamber

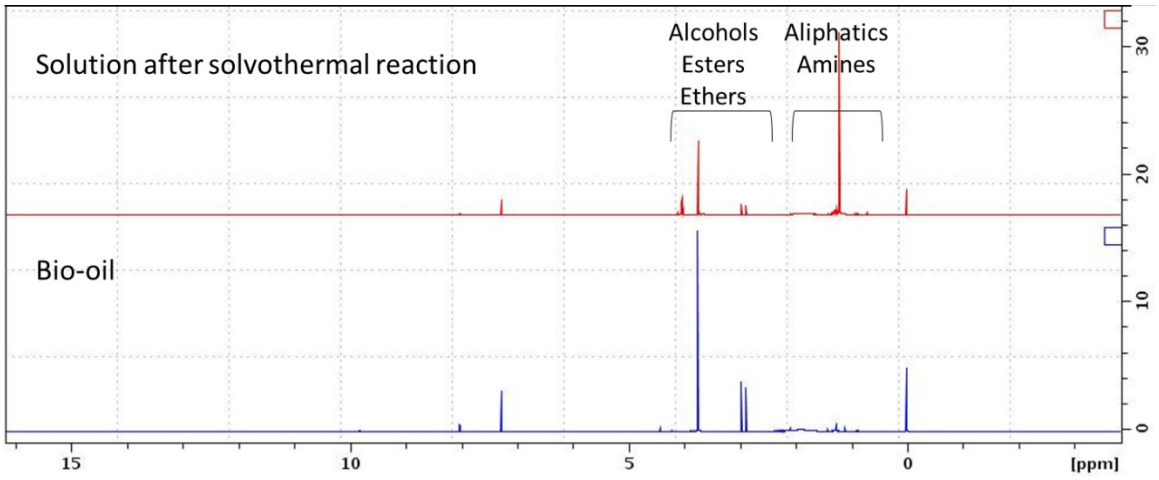


Fig. S4 NMR spectra of the crude bio-oil and the liquid solution after solvothermal reaction

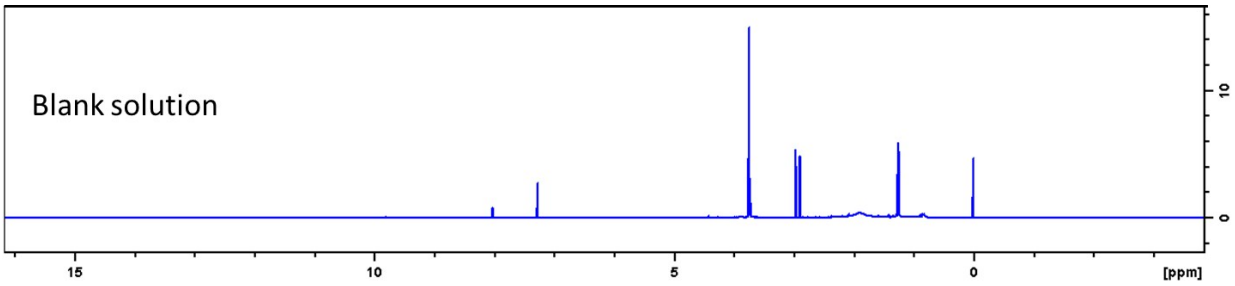


Fig. S5 NMR spectra of the residual solution after solvothermal reaction without GCN material

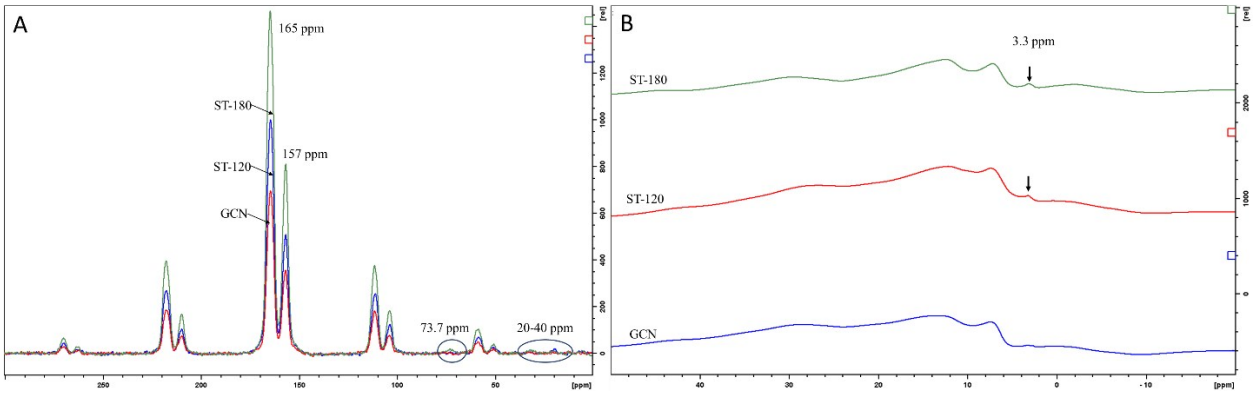


Fig. S6 Solid state ^{13}C and ^{1}H NMR spectra of GCN and MCN samples.

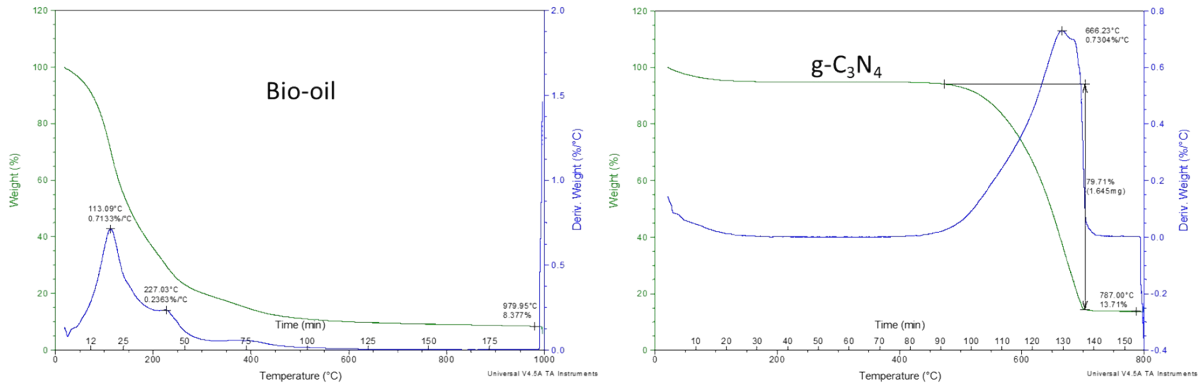


Fig. S7 TG analysis of bio-oil liquids and g-C_3N_4 sample

Fig. S8 Optical photo of MCN samples

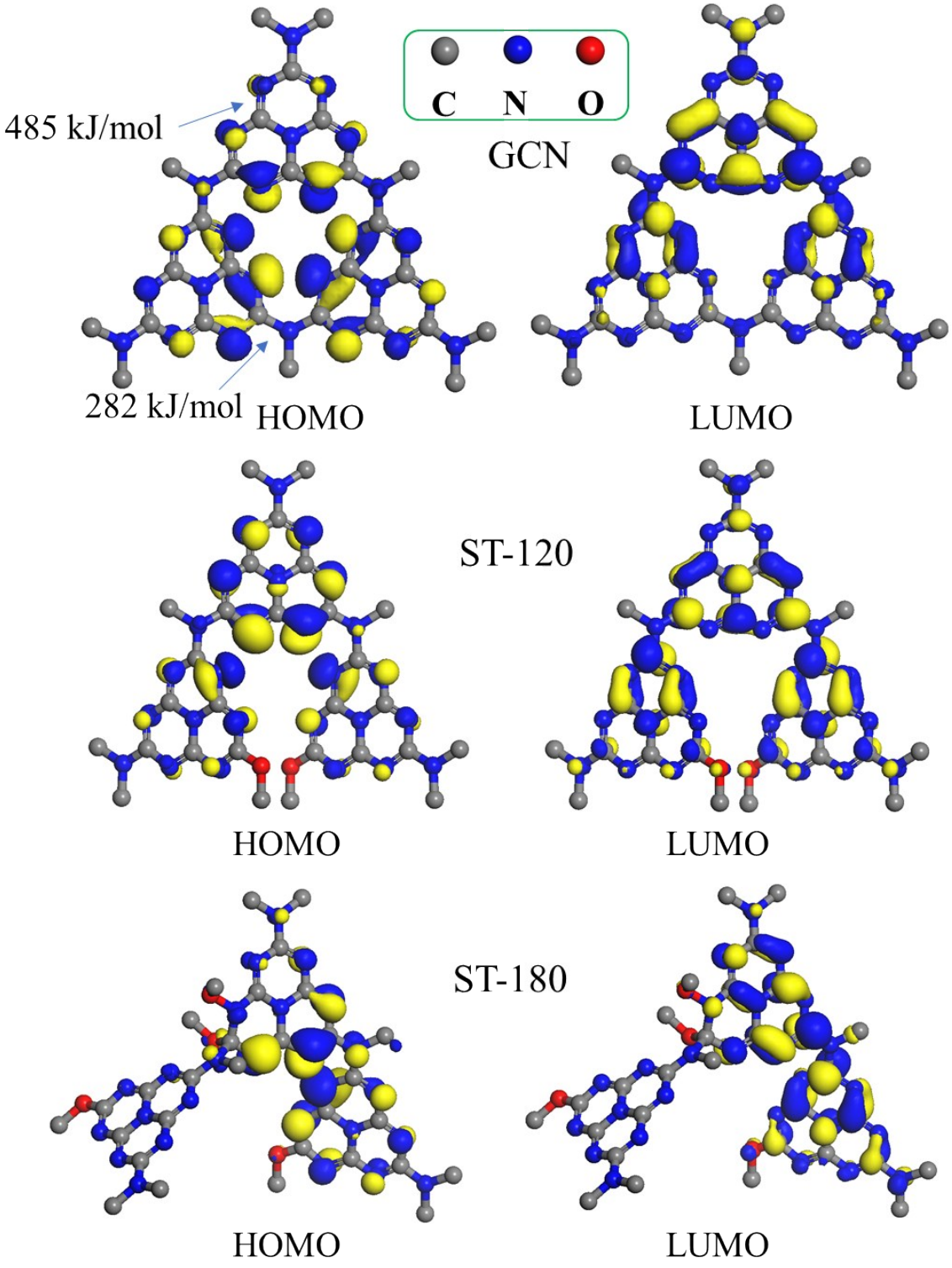


Fig. S9 HOMO and LUMO distribution of GCN and MCN samples

Table S1 Major compounds in bio-oil identified from NIST library

Retention time (min)	Compound	Formula
2.40	1,2-Ethanediol	$C_2H_6O_2$
3.06	1,3-Dioxolane	$C_3H_6O_2$
3.69	2-Pentanone, 4-hydroxy-4-methyl-	$C_6H_{12}O_2$
3.78	Ethanol, 2-(1-methylethoxy)-	$C_5H_{12}O_2$
5.23	Hydroperoxide, heptyl	$C_7H_{16}O_2$
7.73	1,2-Cyclopentanedione, 3-methyl-	$C_6H_8O_2$
8.21	Phloroglucitol	$C_6H_{12}O_3$
9.84	Cyclopropyl carbinol	C_4H_8O
18.15	1,2,3,4-Cyclopentanetetrol, (1α,2β,3β,4α)-	$C_5H_{10}O_4$
20.83	D-Allose	$C_6H_{12}O_6$
26.35	Coniferyl aldehyde	$C_{10}H_{10}O_3$
30.77	Cyclopenta[c]furo[3',2':4,5]furo[2,3-h][1]benzopyran-11(1H)-one, 2,3,6a,9a-tetrahydro-1,3-dihydroxy-4-methoxy-	$C_{17}H_{14}O_7$
34.55	n-Capric acid isopropyl ester	$C_{13}H_{26}O_2$
37.35	2-Furanmethanol, 5-ethenyltetrahydro-α,α,5-trimethyl-, cis-	$C_{10}H_{18}O_2$
38.65	Dehydroabietic acid	$C_{20}H_{28}O_2$
40.63	1-Octanol, 2-butyl-	$C_{12}H_{26}O$
45.79	Benzenepropanol, 4-hydroxy-3-methoxy-	$C_{10}H_{14}O_3$

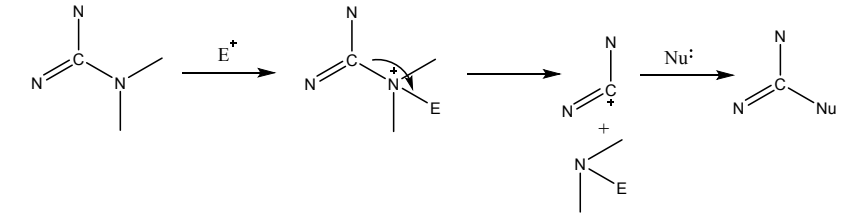
Table S2 Hydrogen evolution rate data

Sample	$C(H_2)$/μmol g^{-1} h^{-1}			
	1	2	3	Average
GCN	515	443	491	483
ST-120	1366	1350	1164	1293
ST-180	1538	1896	1529	1654

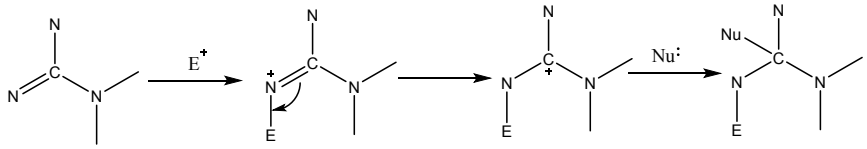
Table S3 Control experiments for hydrogen evolution reaction

$C(H_2)$/μmol g^{-1} h^{-1}	Conditions		
	Catalyst sample	Light source	Pd co-catalyst
28	🏳	🏴	🏴
35	🏴	🏳	🏴
67	🏴	🏴	🏳

120 °C and 180 °C



180 °C



Note:
E = electrophilic group (H^+, anhydrides, *etc.*)
Nu = nucleophilic group (alcohols, alkoxide anions, carboxylate anions, *etc.*)

Scheme S1 Possible reactions between the active species in the bio-oil and GCN material