Supplementary Information

Nickel mediated Palladium free photocatalytic Suzuki-coupling reaction under visible light irradiation

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1.1 Characterization Techniques Used

HR-TEM used to demonstrate the morphology and d-spacing in the materialswith the help of a JEM 2100 (JEOL, Japan) microscope. Bruker D8 Advance diffractometer determined the diffraction patterns, crystallinity, and crystal planes of the materials at 40 kV and 40 mA with Cu $K_\alpha$radiation (λ = 0.15418 nm). FT-IR spectroscopy identified the different vibrational modes on a Perkin–Elmer spectrum RX-1 IR spectrophotometer. Shimadzu UV-VIS-NIR spectrophotometer recorded the electronic spectra of the synthesized materials with a 10-mm quartz cell by using $BaSO_4$ as a reference. N_2 adsorption-desorption analysis calculated the BET surface area, pore-volume, and mean pore diameter by using Micromeritics ASAP 2010. The chemical properties of the hybrid CNO-10 analyzed by XPS analysis using ESCA+ equipment (omicron nanotechnology, Oxford Instrument Germany) equipped with monochromator Aluminum Source (Al ka radiation hv =1486.7 eV). The thermo-gravimetric technique determined the weight loss of the materials from room temperature to 800 °C under nitrogen flow using a thermal analyzer TA-SDT Q-600. ICP-AES estimated the metal content in the CNO-10 hybrid using ICP-AES, DRE, PS-3000UV, Leeman Labs Inc, USA). Nitric acid used to digest the sample and diluted to 10 mL withde-ionized water. GC-FID (Varian CP-3800, Column specification: Varian capillary column, CP Sil 24CB LOW BLEED/MS 30 m, 0.25 μm # CP 5817) at the flow rate 0.5 mL min^{-1}, injector temperature 330 °C, FID detector temperature 350 °C used to find and confirm the conversion and products. ^1H and ^{13}C NMR spectral data of biphenyls collected on a Bruker Advance-II 500 MHz with operating frequency at 500 MHz**.**

2.1. FE-SEM images and EDX pattern of CNO-0 and CNO-10

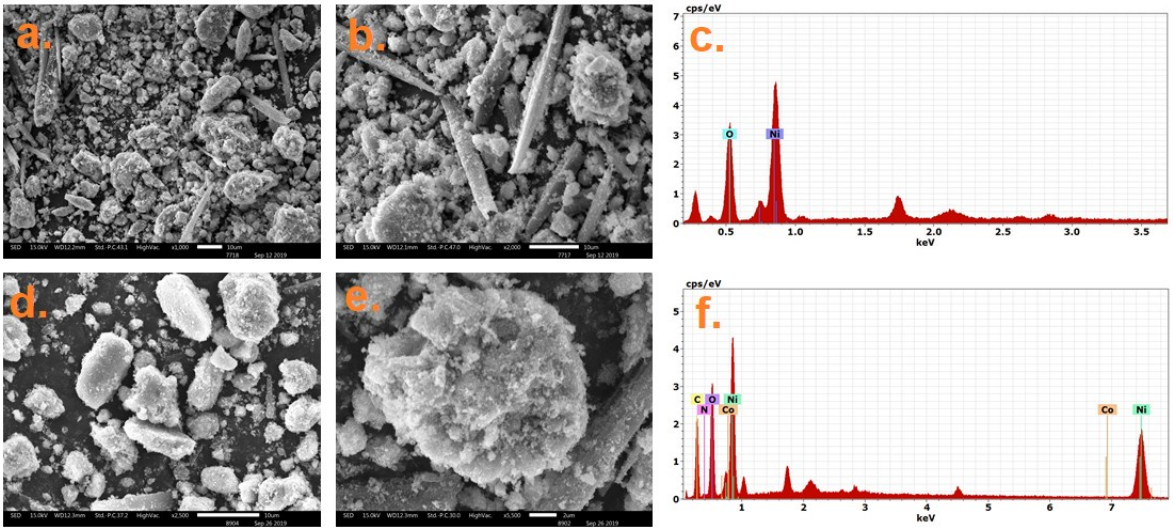


Fig. S2. a), b) and d), e) FE-SEM images of CNO-0 and CNO-10 photocatalyst and, c) and f) EDX patternof CNO-0 and CNO-10 photocatalyst.

2.2. Elemental mapping of CBO-0 and CNO-10

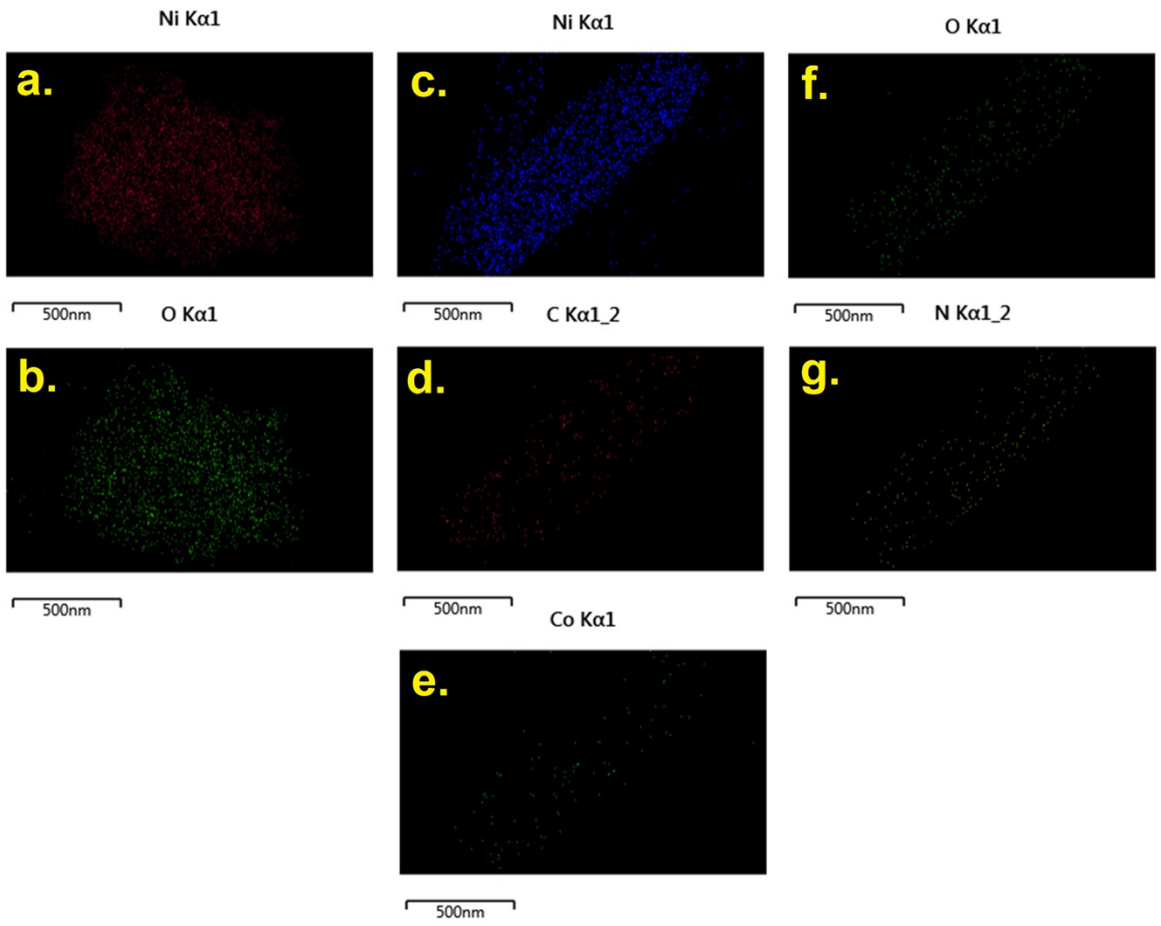
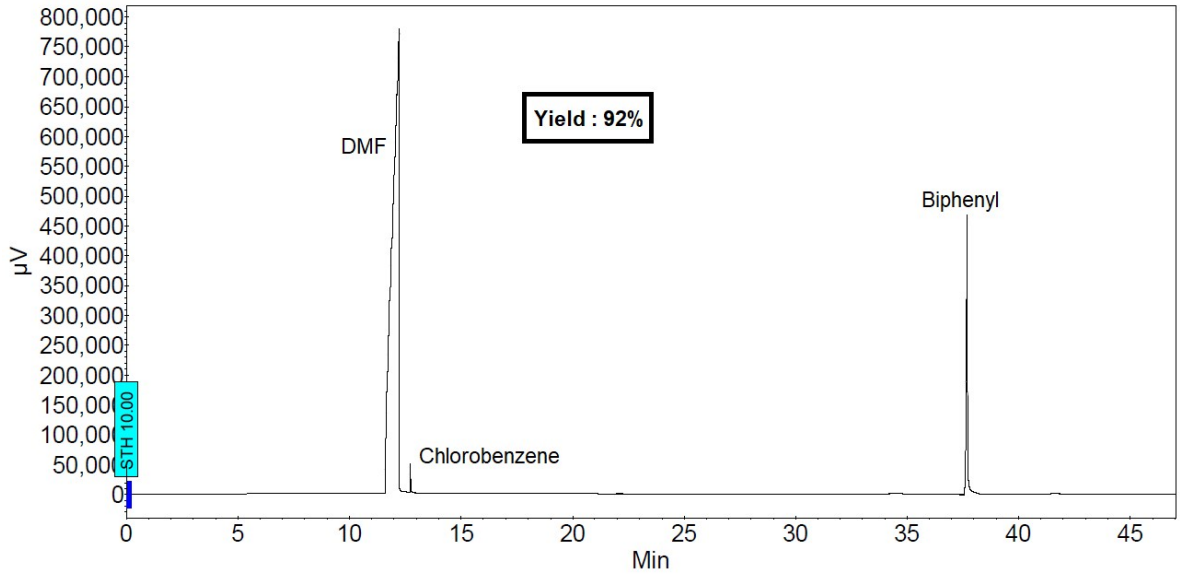
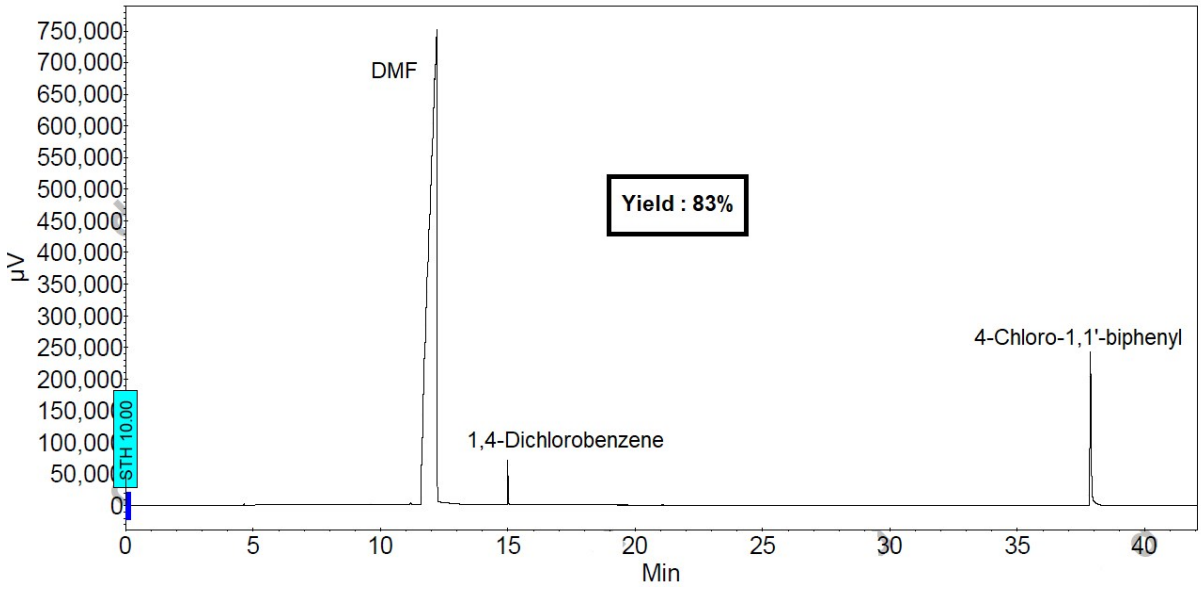


Fig. S1. Elemental mapping a) Ni and b) O for NiO semiconductor.Elemental mapping c) Ni,d) C,e) Co, f) O, and g) N for CNO-10 photocatalyst.

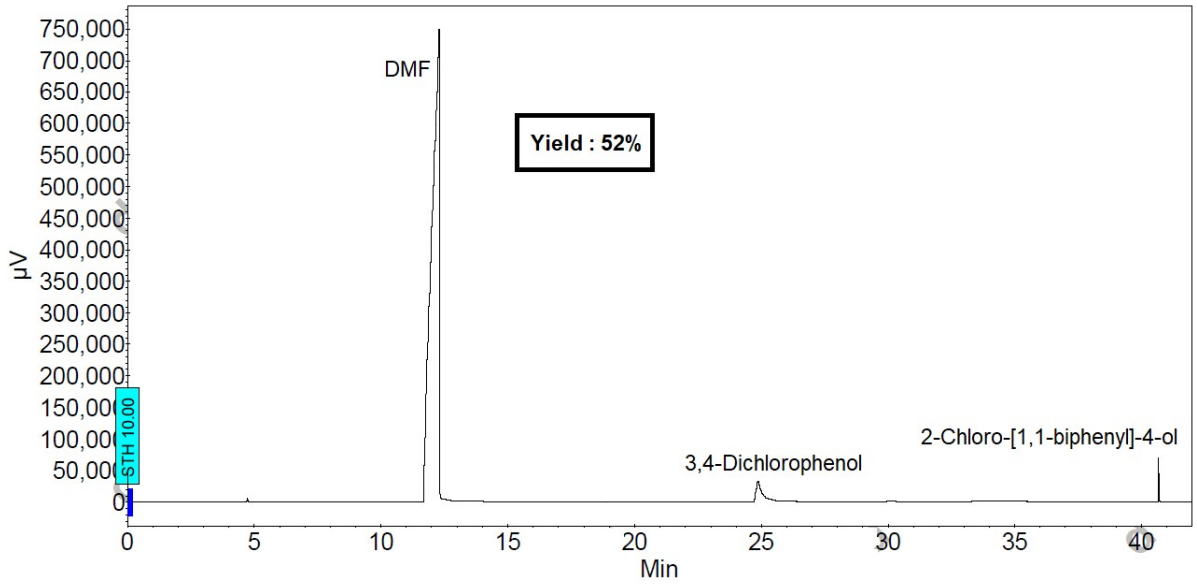
3.1. Gas Chromatogram of Biphenyl



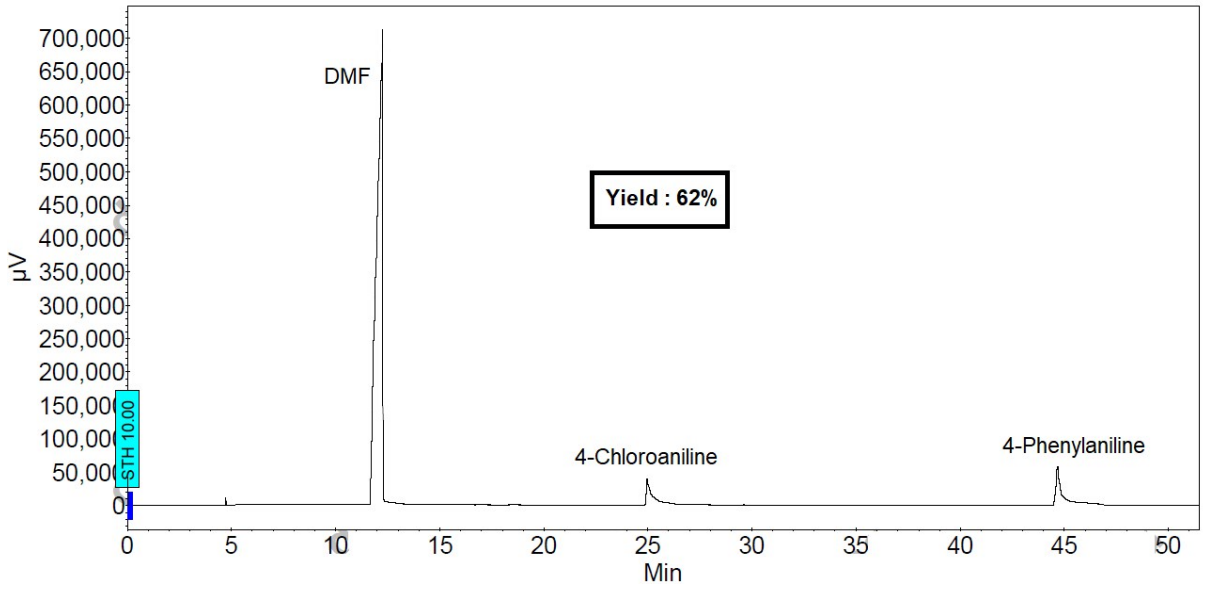
3.2. Gas Chromatogram of 4-Chloro-1,1’-biphenyl



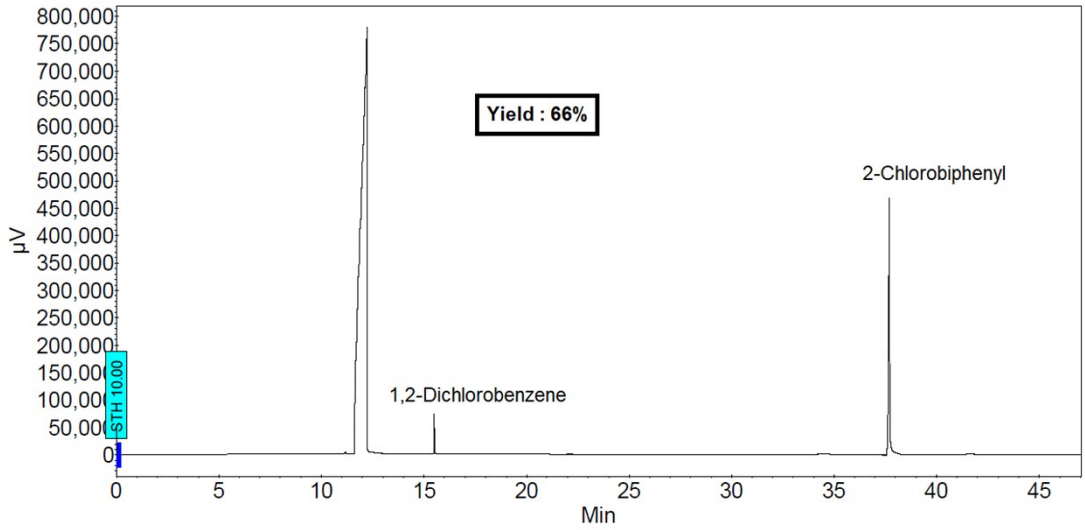
3.3. Gas Chromatogram of 2-Chloro-[1,1'-biphenyl]-4-ol



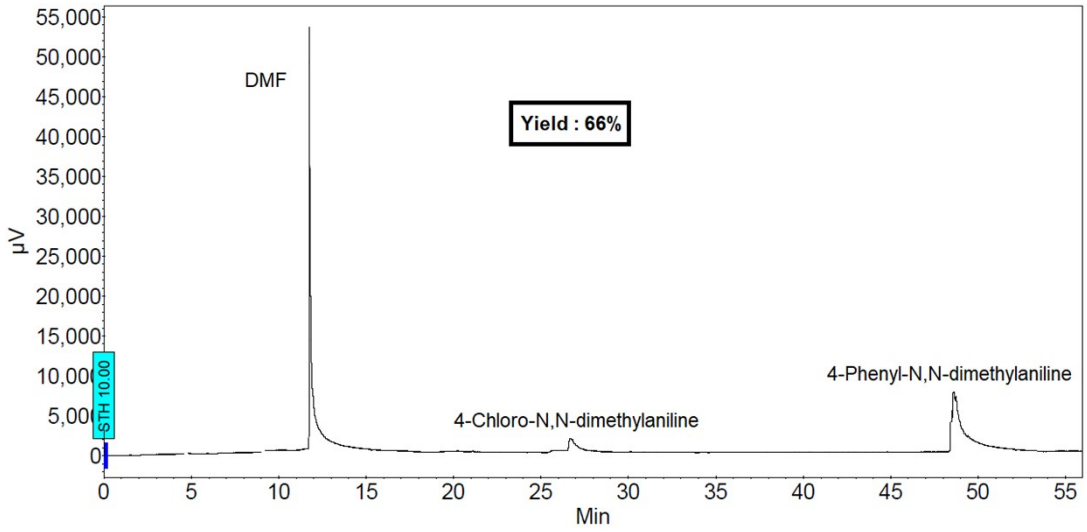
3.4. Gas Chromatogram of 4-Phenylaniline



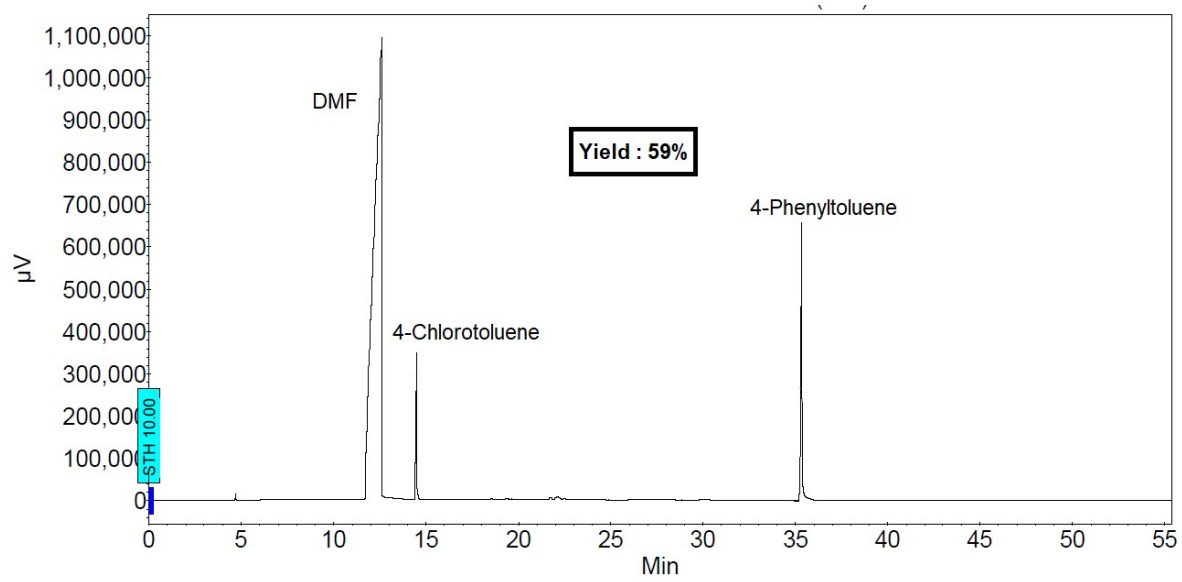
3.5. Gas Chromatogram of 2-Chlorobiphenyl



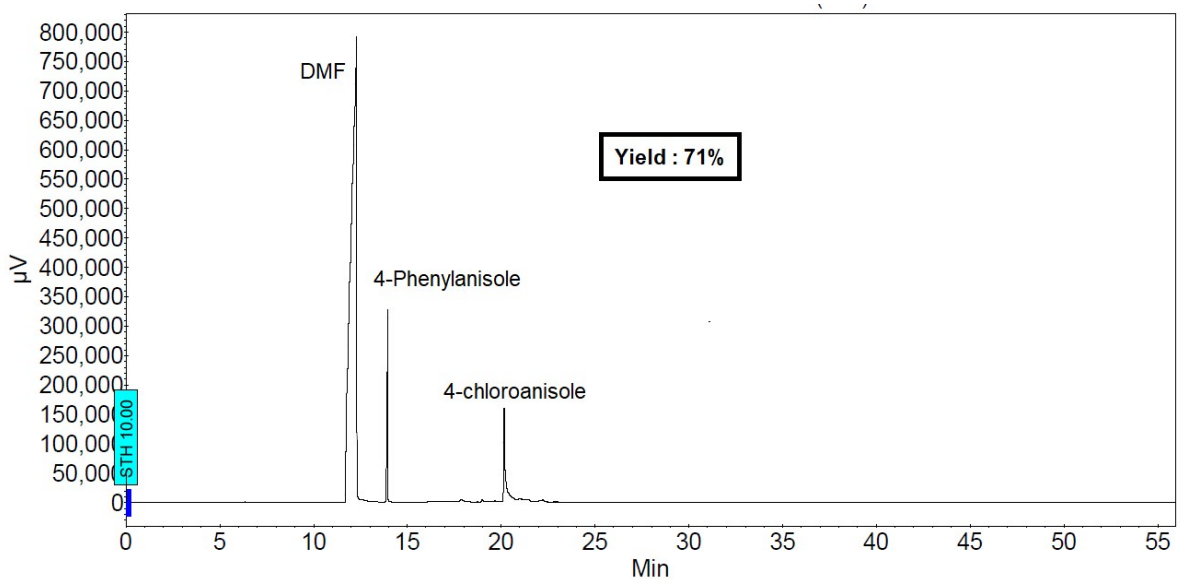
3.6. Gas Chromatogram of 4-Phenyl-*N*,*N*-dimethylaniline



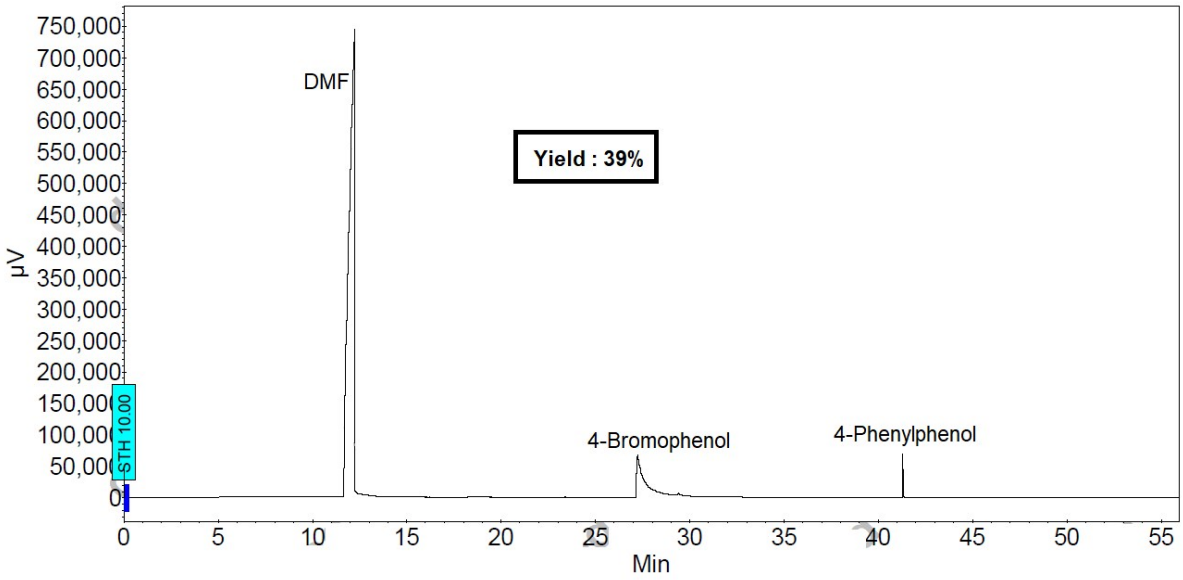
3.7. Gas Chromatogram of 4-Phenyltoluene



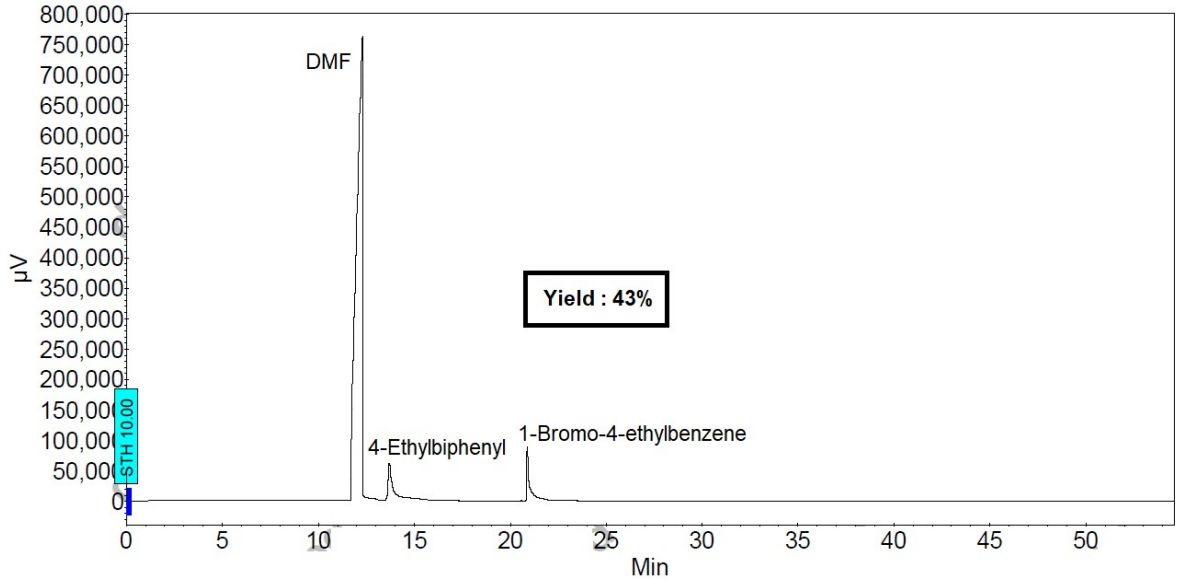
3.8. Gas Chromatogram of 4-Chloroanisole



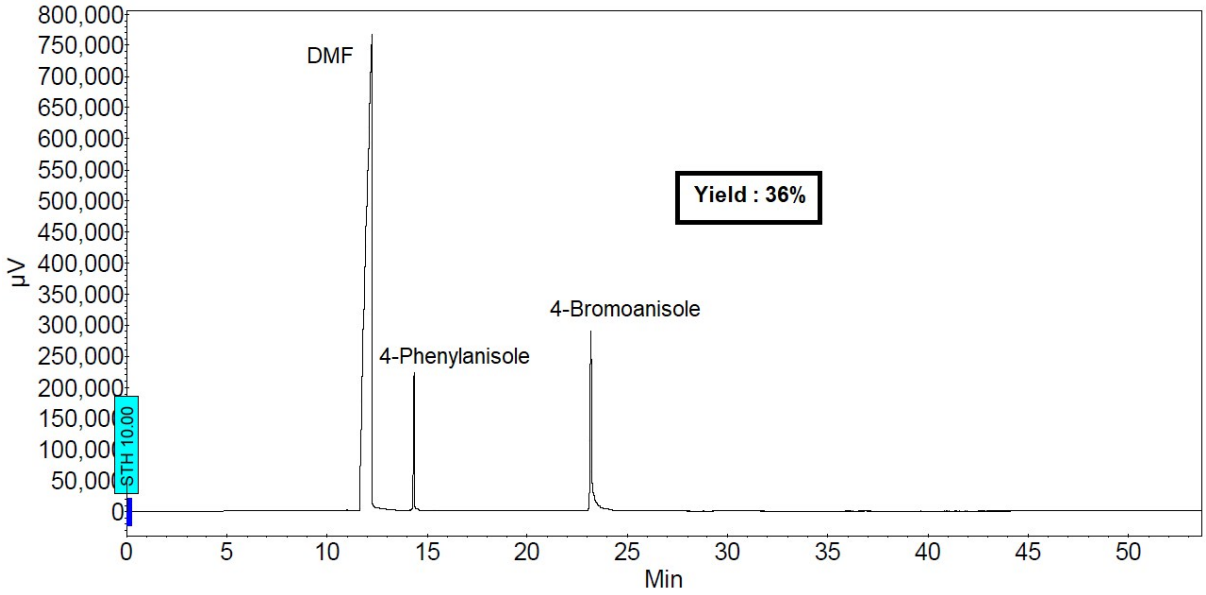
3.9. Gas Chromatogram of 4-Phenylphenol



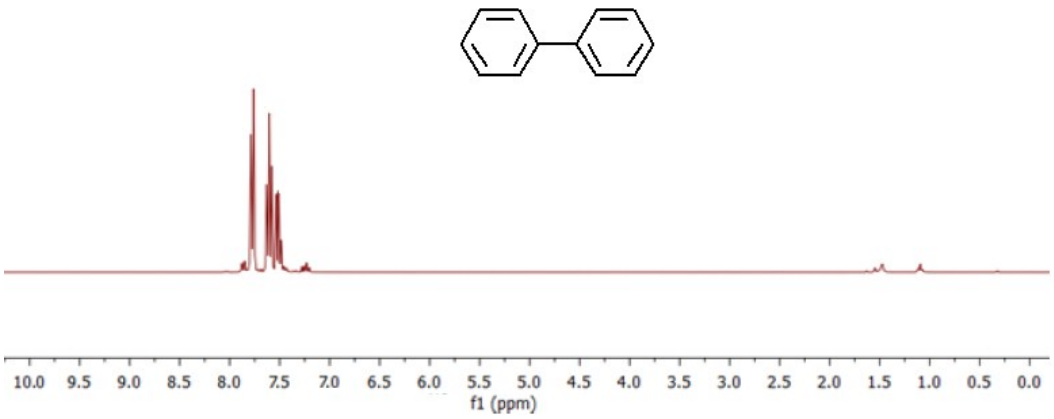
3.10. Gas Chromatogram of 4-Ethylbiphenyl



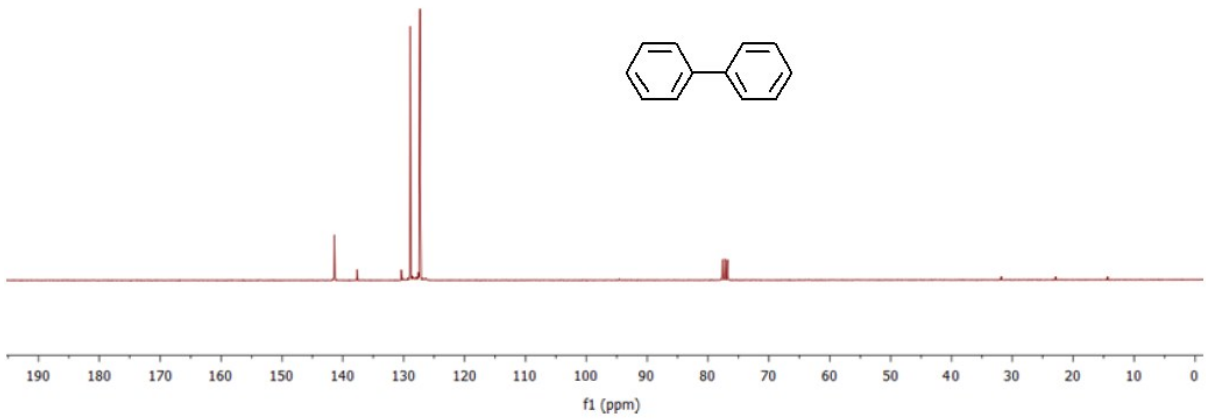
3.11. Gas Chromatogram of 4-Phenylanisole



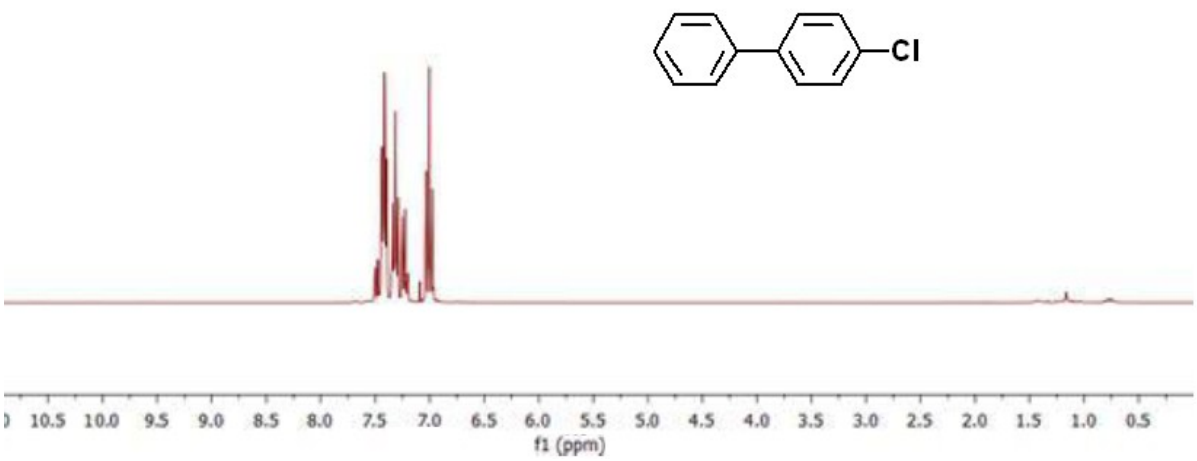
4.1.1. ^{1}H NMR of biphenyl



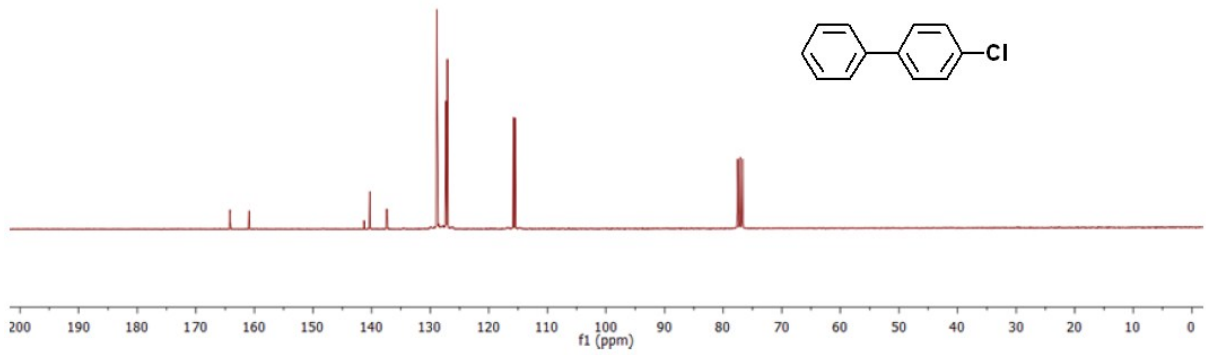
4.1.2. ^{13}C NMR of biphenyl



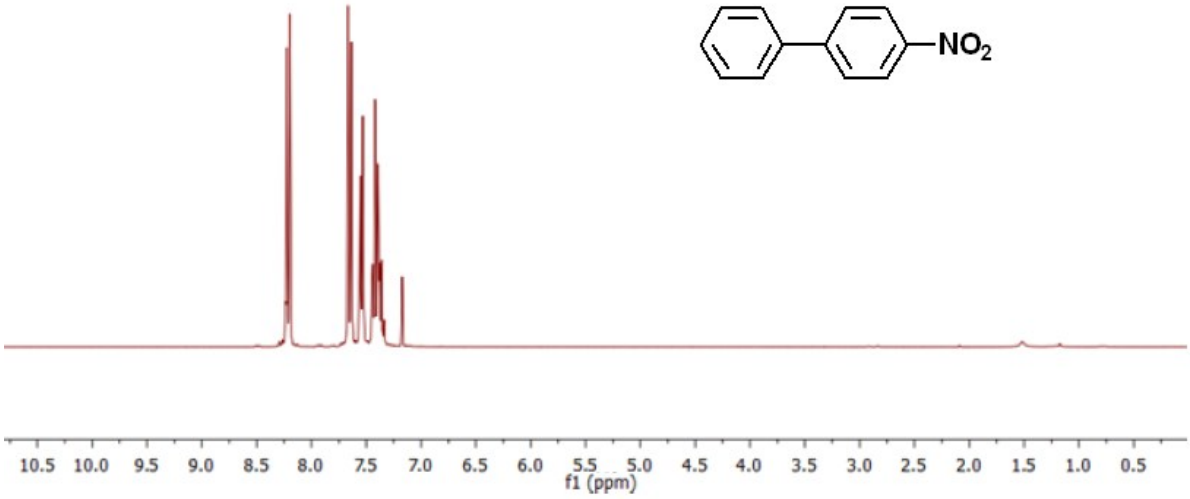
4.2.1. ^{1}H NMR of 4-chlorobiphenyl



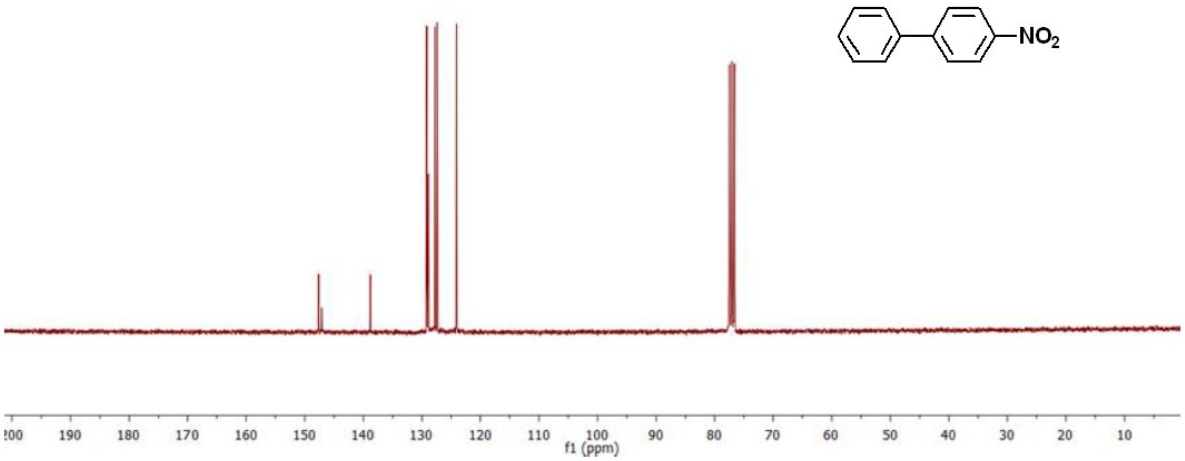
4.2.2. ^{13}C NMR of 4-chlorobiphenyl



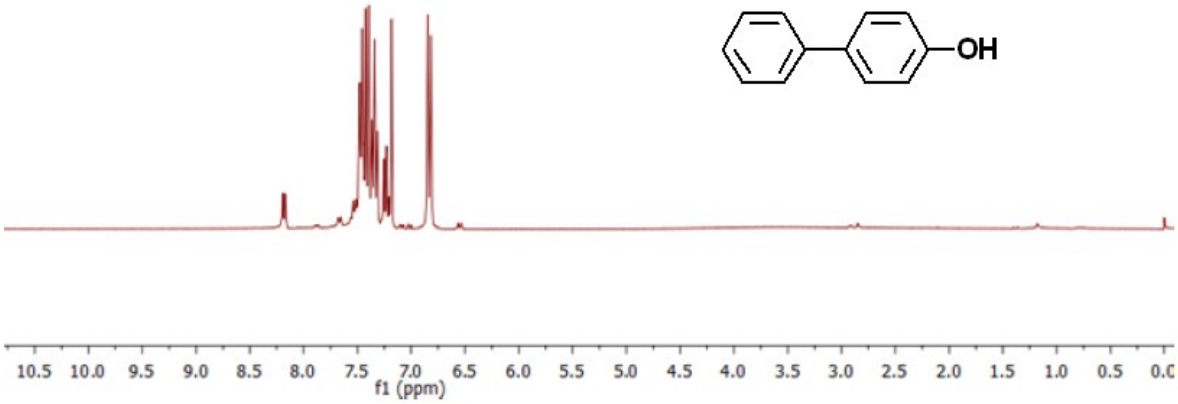
4.3.1. ^{1}H NMR of 4-nitrobiphenyl



4.3.2. ^{13}C NMR of 4-nitrobiphenyl



4.4.1. ^{1}H NMR of 4-phenylphenol



4.4.2. ^{13}C NMR of 4-phenylphenol