Synthesis of copper nanoparticles supported on a microporous covalent triazine polymer: an efficient and reusable catalyst for O-arylation reaction

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Characterization data of catalytic products

1-Phenoxybenzene (3a)
$^1$H NMR (400 MHz, CDCl$_3$): $\delta$ (ppm) = 7.38-7.34 (m, 4H), 7.15-7.10 (m, 2H), 7.06-7.03 (m, 4H).
$^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ (ppm) = 157.3, 129.7, 123.2, 118.9.

1-Methyl-4-phenoxybenzene (3b)
$^1$H NMR (400 MHz, CDCl$_3$): $\delta$ (ppm) = 7.34-7.30 (m, 2H), 7.16-7.06 (m, 3H), 7.01-6.98 (dd, 2H), 6.95-6.93 (d, 2H), 2.35 (s, 3H).
$^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ (ppm) = 157.8, 154.6, 132.8, 130.2, 129.6, 122.7, 119.1, 118.3, 20.6.

1-Methoxy-4-phenoxybenzene (3c)
$^1$H NMR (400 MHz, CDCl$_3$): $\delta$ (ppm) = 7.32-7.28 (m, 2H), 7.07-6.88 (m, 7H), 3.80 (s, 3H).
$^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ (ppm) = 158.6, 155.9, 150.2, 129.7, 122.5, 120.9, 117.7, 114.9, 55.7.

1-Nitro-4-phenoxybenzene (3d)
$^1$H NMR (400 MHz, CDCl$_3$): $\delta$ (ppm) = 8.21-8.18 (d, 2H), 7.45-7.41 (t, 2H), 7.27-7.23 (t, 1H), 7.10-7.08 (d, 2H), 7.02-7.00 (d, 2H).
$^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ (ppm) = 163.3, 154.7, 142.6, 130.3, 129.7, 122.5, 120.9, 117.7, 114.9, 117.1.

4-Phenoxybenzonitrile (3e)
$^1$H NMR (400 MHz, CDCl$_3$): $\delta$ (ppm) = 7.61-7.57 (m, 2H), 7.43-7.39 (m, 2H), 7.26-7.21 (m, 1H), 7.08-7.05 (m, 2H), 7.02-6.98 (m, 2H).
$^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ (ppm) = 161.6, 154.7, 134.1, 130.2, 125.1, 120.4, 118.8, 117.9, 105.8.

1-Fluoro-4-phenoxybenzene (3f)
$^1$H NMR (400 MHz, CDCl$_3$): $\delta$ (ppm) = 7.36-7.31 (m, 2H), 7.12-6.97 (m, 7H).
$^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ (ppm) = 160.0, 157.7, 157.6, 152.9, 129.8, 123.1, 120.6, 120.5, 118.2, 116.4, 116.1.
1-Chloro-4-phenoxybenzene (3g)
1H NMR (400 MHz, CDCl$_3$): $\delta$ (ppm) = 7.38-7.32 (m, 2H), 7.31-7.26 (m, 2H), 7.15-7.11 (m, 1H), 7.03-7.00 (m, 2H), 6.96-6.94 (m, 2H).
$^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ (ppm) = 156.8, 155.9, 129.8, 129.7, 128.2, 123.6, 120.0, 118.9.

1-(4-Phenoxyphenyl)ethanone (3h)
1H NMR (400 MHz, CDCl$_3$): $\delta$ (ppm) = 7.96-7.92 (m, 2H), 7.42-7.37 (m, 2H), 7.22-7.18 (m, 1H), 7.09-7.06 (m, 2H), 7.02-6.98 (m, 2H), 2.57 (s, 3H).
$^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ (ppm) = 196.7, 161.9, 155.5, 131.9, 130.6, 130.0, 124.6, 120.2, 117.3, 26.4.

1-Trifluoromethyl-4-phenoxybenzene (3i)
1H NMR (400 MHz, CDCl$_3$): $\delta$ (ppm) = 7.60-7.57 (m, 2H), 7.42-7.38 (m, 2H), 7.22-7.18 (m, 1H), 7.09-7.04 (m, 4H).
$^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ (ppm) = 160.5, 155.7, 130.0, 127.1, 127.0, 124.5, 119.9, 117.8.

1-Methyl-3-phenoxybenzene (3j)
1H NMR (400 MHz, CDCl$_3$): $\delta$ (ppm) = 7.32-7.27 (m, 2H), 7.20-7.16 (m, 1H), 7.08-7.04 (m, 1H), 7.00-6.97 (m, 2H), 6.90-6.87 (m, 1H), 6.82-6.77 (m, 2H), 2.30 (s, 3H).
$^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ (ppm) = 157.3, 157.2, 139.9, 129.7, 129.4, 124.0, 123.0, 119.5, 118.8, 115.9, 21.4.

1-Methoxy-3-phenoxybenzene (3k)
1H NMR (400 MHz, CDCl$_3$): $\delta$ (ppm) = 7.36-7.32 (m, 2H), 7.26-7.20 (m, 1H), 7.13-7.11 (m, 1H), 7.04-7.01 (m, 2H), 6.67-6.64 (m, 1H), 6.61-6.58 (m, 2H), 3.78 (s, 3H).
$^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ (ppm) = 160.9, 158.5, 156.9, 130.1, 129.7, 123.3, 119.1, 110.9, 108.8, 104.8, 55.3.

1-Nitro-2-phenoxybenzene (3l)
1H NMR (400 MHz, CDCl$_3$): $\delta$ (ppm) = 7.96-7.94 (m, 1H), 7.52-7.48 (m, 1H), 7.40-7.36 (m, 2H), 7.22-7.17 (m, 2H), 7.07-7.00 (m, 3H).
$^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ (ppm) = 155.7, 150.7, 134.1, 130.0, 125.7, 124.6, 123.1, 120.4, 119.2.

1-(p-Tolyloxy)-4-methylbenzene (3m)
1H NMR (400 MHz, CDCl$_3$): $\delta$ (ppm) = 7.13-7.11 (d, 4H), 6.91-6.89 (d, 4H), 2.33 (s, 6H).
$^{13}$C NMR (100 MHz, CDCl$_3$): $\delta$ (ppm) = 155.3, 132.4, 130.1, 118.6, 20.6.
1-\((\rho\text{-Tolyloxy})\)-3-methylbenzene (3n)
\(^1\)H NMR (400 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 7.23-7.14 (m, 3H), 6.94-6.89 (m, 3H), 6.83-6.79 (m, 2H), 2.35 (s, 3H), 2.34 (s, 3H).
\(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 157.8, 154.8, 139.8, 132.7, 130.2, 129.3, 123.6, 119.1, 119.0, 115.4, 21.4, 20.7.

1-(4-(4-Methoxyphenoxy)phenyl)ethanone (3o)
\(^1\)H NMR (400 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 7.92-7.90 (d, 2H), 7.02-7.00 (d, 2H), 6.95-6.91 (m, 4H), 3.82 (s, 3H), 2.56 (s, 3H).
\(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 196.8, 163.0, 156.8, 148.6, 131.5, 130.6, 121.8, 116.4, 115.2, 55.7, 26.5.

1-(4-Nitrophenoxy)-4-nitrobenzene (3p)
\(^1\)H NMR (400 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 8.32-8.27 (m, 4H), 7.19-7.15 (m, 4H).
\(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 160.6, 144.2, 126.2, 119.6.

1-(4-(4-Nitrophenoxy)phenyl)ethanone (3q)
\(^1\)H NMR (400 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 8.26-8.24 (d, 2H), 8.04-8.02 (d, 2H), 7.15-7.08 (m, 4H), 2.61 (s, 3H).
\(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 196.7, 161.8, 159.2, 143.6, 133.9, 130.9, 126.2, 119.6, 118.5, 26.6.

1-(4-Fluorophenoxy)-4-fluorobenzene (3r)
\(^1\)H NMR (400 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 7.05-6.99 (m, 4H), 6.97-6.92 (m, 4H).
\(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 159.9, 157.5, 153.4, 119.9, 119.8, 116.4, 116.2.

4-(4-Fluorophenoxy)benzonitrile (3s)
\(^1\)H NMR (400 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 7.62-7.58 (m, 2H), 7.14-7.08 (m, 2H), 7.06-7.02 (m, 2H), 6.99-6.96 (m, 2H).
\(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 161.7, 160.9, 158.6, 150.5, 134.2, 122.0, 121.9, 118.7, 117.5, 116.9, 116.8, 105.9.

4-Phenoxy pyridine (3t)
\(^1\)H NMR (400 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 8.46-8.44 (m, 2H), 7.44-7.40 (m, 2H), 7.26-7.22 (m, 1H), 7.10-7.08 (m, 2H), 6.83-6.81 (m, 2H).
\(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 164.7, 151.4, 149.6, 130.2, 125.4, 120.8, 112.1.

1,4-Diphenoxy benzene (3u)
\(^1\)H NMR (400 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 7.36-7.31 (m, 4H), 7.11-7.07 (m, 2H), 7.03-6.99 (m, 8H).
\(^{13}\)C NMR (100 MHz, CDCl\(_3\)): \(\delta\) (ppm) = 157.8, 152.7, 129.7, 122.9, 120.4, 118.3.
Figure S1. $^1$H NMR spectrum of 1-phenoxybenzene (3a)
Figure S2. $^{13}$C NMR spectrum of 1-phenoxybenzene (3a)

Figure S3. $^1$H NMR spectrum of 1-methyl-4-phenoxybenzene (3b)

Figure S4. $^{13}$C NMR spectrum of 1-methyl-4-phenoxybenzene (3b)
Figure S5. $^1$H NMR spectrum of 1-methoxy-4-phenoxybenzene (3c)

Figure S6. $^{13}$C NMR spectrum of 1-methoxy-4-phenoxybenzene (3c)
Figure S7. $^1$H NMR spectrum of 1-nitro-4-phenoxybenzene (3d)

Figure S8. $^{13}$C NMR spectrum of 1-nitro-4-phenoxybenzene (3d)
Figure S9. $^1$H NMR spectrum of 4-phenoxybenzonitrile (3e)

Figure S10. $^{13}$C NMR spectrum of 4-phenoxybenzonitrile (3e)
Figure S11. $^1$H NMR spectrum of 1-fluoro-4-phenoxybenzene (3f)

Figure S12. $^{13}$C NMR spectrum of 1-fluoro-4-phenoxybenzene (3f)
Figure S13. $^1$H NMR spectrum of 1-chloro-4-phenoxybenzene (3g)

Figure S14. $^{13}$C NMR spectrum of 1-chloro-4-phenoxybenzene (3g)
Figure S15. $^1$H NMR spectrum of 1-(4-phenoxyphenyl)ethanone (3h)

Figure S16. $^{13}$C NMR spectrum of 1-(4-phenoxyphenyl)ethanone (3h)
Figure S17. $^1$H NMR spectrum of 1-trifluoromethyl-4-phenoxybenzene (3i)

Figure S18. $^{13}$C NMR spectrum of 1-trifluoromethyl-4-phenoxybenzene (3i)
Figure S19. $^1$H NMR spectrum of 1-methyl-3-phenoxybenzene (3j)

Figure S20. $^{13}$C NMR spectrum of 1-methyl-3-phenoxybenzene (3j)
Figure S21. $^1$H NMR spectrum of 1-methoxy-3-phenoxybenzene (3k)

Figure S22. $^{13}$C NMR spectrum of 1-methoxy-3-phenoxybenzene (3k)
Figure S23. $^1$H NMR spectrum of 1-nitro-2-phenoxybenzene (3l)

Figure S24. $^{13}$C NMR spectrum of 1-nitro-2-phenoxybenzene (3l)
Figure S25. $^1$H NMR spectrum of 1-(p-tolyloxy)-4-methylbenzene (3m)

Figure S26. $^{13}$C NMR spectrum of 1-(p-tolyloxy)-4-methylbenzene (3m)
Figure S27. $^1$H NMR spectrum of 1-(p-tolyloxy)-3-methylbenzene (3n)

Figure S28. $^{13}$C NMR spectrum of 1-(p-tolyloxy)-3-methylbenzene (3n)
Figure S29. $^1$H NMR spectrum of 1-(4-(4-methoxyphenoxy)phenyl)ethanone (3o)

Figure S30. $^{13}$C NMR spectrum of 1-(4-(4-methoxyphenoxy)phenyl)ethanone (3o)
Figure S31. $^1$H NMR spectrum of 1-(4-nitrophenoxy)-4-nitrobenzene (3p)

Figure S32. $^{13}$C NMR spectrum of 1-(4-nitrophenoxy)-4-nitrobenzene (3p)
Figure S33. $^1$H NMR spectrum of 1-(4-(4-nitrophenoxy)phenyl)ethanone (3q)

Figure S34. $^{13}$C NMR spectrum of 1-(4-(4-nitrophenoxy)phenyl)ethanone (3q)
Figure S35. $^1$H NMR spectrum of 1-(4-fluorophenoxy)-4-fluorobenzene (3r)

Figure S36. $^{13}$C NMR spectrum of 1-(4-fluorophenoxy)-4-fluorobenzene (3r)
Figure S37. $^1$H NMR spectrum of 4-(4-fluorophenoxy)benzonitrile (3s)

Figure S38. $^{13}$C NMR spectrum of 4-(4-fluorophenoxy)benzonitrile (3s)
Figure S39. $^1$H NMR spectrum of 4-phenoxypyridine (3t)

Figure S40. $^{13}$C NMR spectrum of 4-phenoxypyridine (3t)
Figure S41. $^1$H NMR spectrum of 1,4-diphenoxybenzene (3u)

Figure S42. $^{13}$C NMR spectrum of 1,4-diphenoxybenzene (3u)