Electronic Supplementary Material (ESI) for Green Chemistry. This journal is © The Royal Society of Chemistry 2020

Electronic Supplementary Data

Continuous Flow Suzuki-Miyaura Couplings Under Aqueous Micellar Conditions in a CSTR Cascade Catalyzed by Fe/ppm Pd Nanoparticles

Alex B. Wood,^{*a} Kakasaheb Y. Nandiwale,^{*b} Yiming Mo,^b Bo Jin,^a Alexander Pomberger,^b Victor L.

Schultz,^b Fabrice Gallou,^c Klavs F. Jensen,^{*b} and Bruce H. Lipshutz^{*a}

^a Department of Chemistry and Biochemistry, University of California, Santa Barbara, CA 93106 USA. <u>*bhlipshutz@ucsb.edu</u>

^b Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139 USA. <u>*kfjensen@mit.edu</u>

^c Novartis Pharma, Basel, Switzerland

Table of Contents

Components of CSTR	S2
Applications of CSTR to Suzuki-Miyaura biaryl couplings	S3
Batch reaction procedures	S7
Analytical Data	S9
NMR Spectra	S12

Components of CSTR

The cylinder-shaped inner chambers on the reactor block have a diameter of 13 mm and a depth of 9 mm (Figure S1). The connecting tubes between the chambers have an inner diameter of 2.5 mm. An O-ring gap (Kalrez 4079 O-Ring) surrounds the chamber. An aluminum window has dimensions of 90 mm × 25 mm × 4.8 mm. Both aluminum covers (112 mm × 46 mm × 4.8 mm) were fabricated using water jet machining (OMAX MicroMAX JetMachining Center). The PTFE reactor chamber and aluminum housing were designed with SolidWorks and manufactured by Protolabs.



Figure S1: Images of the individual reactor components.

The aluminum housing has two holes at each side to fit cartridge heaters (8376T26, McMaster-Carr Supply Company). All connection ports have 1/4-28 threads, which can be directly connected using common IDEX fittings (IDEX Health & Science LLC.) without additional adapters. All other materials for the reactor were purchased from McMaster-Carr Supply Company.



Figure S2: Miniaturized CSTR cascade showing the reactor components



Figure S3: System schematic of CSTR platform showing the various components necessary to run a reaction containing solids



Figure 54: Photograph of the CSTR setup showing the various components necessary to run a reaction containing solids

Components with model number (Figure S4): Oscillator (Model No. 306-10H, Precision Microdrives), positive displacement pump (VICI, Model M6 pump), back-pressure regulator (Model No. BPR-10, Zaiput Flow Technologies), pressure controller (Model No. PCD-500PSIG-D, Alicat Scientific).

Applications of CSTR to Suzuki-Miyaura biaryl couplings

Reaction 1. A model biaryl coupling in a CSTR platform.

Under flow conditions: **1** (1.25 mL, 10.0 mmol), **2** (1460 mg, 12.0 mmol, 1.2 equiv.), Fe/ppm Pd NPs (718 mg, 800 ppm Pd), TPGS-750-M (800 mg, 2 wt %), and $K_3PO_4 \cdot H_2O$ (3450 mg, 15.0 mmol, 1.5 equiv.) with total volume of ~40 mL (34.8 mL H₂O + 3.95 mL THFA) were distributed among three streams, as discussed below (Scheme S1).



Scheme S1. Conditions for synthesis of 3 in a CSTR platform.

Syringe 1. In glass vial containing a PTFE coated magnetic stir bar, TPGS-750-M (800 mg, 2 wt.%) was added and sealed with a rubber septum. The vial was then inerted and degassed H₂O (17.4 mL) was added under argon flow *via* syringe and stirred at rt for 2 h. In a separate second vial containing a PTFE coated magnetic stir bar, Fe/ppm Pd NPs (718 mg, 800 ppm Pd) were added, sealed with a rubber septum, and inerted with argon. A solution of TPGS-750-M/H₂O (17.4 mL) from the first vial was then added to the second vail *via* inerted syringe under an argon flow. The mixture was then stirred at rt for 1 h. This catalyst slurry was then transferred to an inerted stainless steel syringe containing a PTFE coated magnetic stir bar and attached to syringe pump 1.

Syringe 2. In a glass vial containing a PTFE coated magnetic stir bar, **1** (1.25 mL, 10.0 mmol, 1 equiv.), and **2** (1460 mg, 12.0 mmol, 1.2 equiv.) were added, sealed with a rubber septum, and inerted with argon. Degassed THFA (3.95 mL) was added to the vial under argon flow *via* inerted syringe and stirred at rt for 1 h. This solution of substrates was then transferred to inerted stainless steel syringe and attached to syringe pump 2.

Syringe 3. In a glass vial containing a PTFE coated magnetic stir bar, $K_3PO_4 \bullet H_2O$ (3450 mg, 15.0 mmol, 1.5 equiv.) was added and sealed with a rubber septum. The vial was evacuated and backfilled with argon three times. Degassed H_2O (17.4 mL) was added to the vial under argon flow *via* inerted syringe and stirred at rt for 1 h. This solution was then transferred to an inerted stainless-steel syringe and attached to syringe pump 3.

After achieving steady state (~3 residence times, 60 min), the sample was collected for 50 min and used to calculate the isolated yield of product. In 50 min, 3.3 mmol of substrate had been introduced into the reactor. The organic layer was concentrated *in vacuo* and then purified by flash column chromatography (Et₂O/hexane = 10/90) to afford 493 mg (2.67 mmol, ~81%) of product **3**.

Reaction 2: Continuous synthesis of biaryl precursor to the sartans in flow.

Under flow conditions. **8** (1370 mg, 7.5 mmol, 1 equiv.), **9** (1220 mg, 9.0 mmol, 1.2 equiv.), Fe/ppm Pd NPs (538 mg, 800 ppm Pd), TPGS-750-M (600 mg, 2 wt %), and $K_3PO_4 \bullet H_2O$ (2.590 g, 11.3 mmol, 1.5 equiv.) with the total volume of 30 mL (H_2O) distributed among two streams, as discussed below (Scheme S2). The flow rates of two streams were adjusted to achieve desired concentration of reagents, catalyst and the surfactant in the CSTR.



Scheme S2. Conditions for synthesis of biaryl precursor 7 to the sartans in a CSTR platform.

Syringe 1: In a glass vial containing a PTFE coated magnetic stir bar, TPGS-750-M (600 mg, 2 wt %) was added and sealed with a rubber septum. The vial was evacuated and backfilled with argon three times. Degassed H₂O (20 mL) was added to the vial under argon flow *via* inerted syringe and stirred at rt for 2 h. In a separate second vial containing a PTFE coated magnetic stir bar, Fe/ppm Pd NPs (538 mg, 800 ppm Pd), **8** (1370 mg, 7.5 mmol, 1 equiv.), and **9** (1.220 g, 9.0 mmol, 1.2 equiv.) were added, sealed with a rubber septum, and inerted with argon. A solution of TPGS-750-M/H₂O (20 mL) from the first vial was then added to second vail *via* inerted syringe under argon flow. The mixture was then stirred at rt for 1 h. This reaction slurry was then transferred to inerted stainless steel syringe containing a PTFE coated magnetic stir bar and attached to syringe pump 1.

Syringe 2: In a glass vial containing a PTFE coated magnetic stir bar, $K_3PO_4 \bullet H_2O$ (2.590 g, 11.3 mmol, 1.5 equiv.) was added, sealed with a rubber septum, and inerted with argon. Degassed H_2O (10 mL) was added to the vial under argon flow *via* inerted syringe and stirred at rt for 1 h. This solution was then transferred to an inerted stainless-steel syringe and attached to syringe pump 2.

After achieving steady state (~3 residence times, 60 min), the sample was collected for 20 min and used to calculate isolated yield of product. In 20 min, 1.32 mmol of substrate is introduced in the reactor. The organic layer of sample was concentrated *in vacuo* and then purified by flash column chromatography (Et_2O /hexane = 10/90) to afford 243 mg (1.26 mmol, 95%) of product **7**.

Reaction 3. Continuous synthesis of a biaryl precursor to Jakafi in flow.

Under flow conditions. **13** (1830 mg, 7.5 mmol, 1 equiv.), and pinacol ester **14** (2.500 g, 9.0 mmol, 1.2 equiv.), Fe/ppm Pd NPs (538 mg, 800 ppm Pd), TPGS-750-M (600 mg, 2 wt %), Et₃N (1.57 mL, 11.3 mmol, 1.5 equiv.) with the total volume of 30 mL (28.43 mL H₂O + 1.57 mL Et₃N) were distributed among two streams as discussed below (Scheme S3).



Scheme S3. Conditions for synthesis of a biaryl precursor 15 to JAK inhibitors in a CSTR platform.

Syringe 1: In a glass vial containing a PTFE coated magnetic stir bar, TPGS-750-M (600 mg, 2 wt.%) was added and sealed with a rubber septum. The vial was evacuated and backfilled with argon three times. Degassed H₂O (28.43 mL) was added to the vial under argon flow *via* syringe and stirred at rt for 2 h. In a separate second vial containing a PTFE coated magnetic stir bar, Fe/ppm Pd NPs (538 mg, 800 ppm Pd), **13** (1.830 g, 7.5 mmol, 1 equiv.), and **14** (2500 mg, 9.0 mmol, 1.2 equiv.) were added and sealed with a rubber septum. The vial was evacuated and backfilled with argon three times. A solution of TPGS-750-M/H₂O (28.43 mL) from the first vial was then added to second vail *via* syringe under argon flow. The reaction mixture was then stirred at rt for 1 h. This reaction slurry was then transferred to 50 mL stainless steel syringe containing a PTFE coated magnetic stir bar and attached to syringe pump 1.

Syringe 2: Second stainless-steel syringe was filled with degassed Et₃N (1.57 mL, 11.3 mmol, 1.5 equiv.) and attached to syringe pump 2.

After achieving steady state (~3 residence times, 60 min), the sample was collected for 15 min and used to calculate the isolated yield of product. In 15 min, 0.99 mmol of substrate is introduced in the reactor. The organic layer was concentrated *in vacuo* and then purified by flash column chromatography (EtOAc/hexane = 50/50) to afford 291 mg (0.81 mmol, ~82%) of product **15**.

Reaction 4. Continuous synthesis of a biaryl precursor to Zelboraf in flow.

Under flow conditions. **19** (1080 mg, 3.75 mmol, 1.0 equiv.) and **20** (704 mg, 4.5 mmol, 1.2 equiv.), Fe/ppm Pd NPs (538 mg, 800 ppm Pd), TPGS-750-M (600 mg, 2 wt %), and Et₃N (1.57 mL, 11.3 mmol, 3.0 equiv.) with total volume of ~30 mL (28.44 mL H₂O + 1.57 mL Et₃N) were distributed among three streams as discussed below. The flowrates of three streams were adjusted to achieve desired concentration of reagents, nanoparticles, and the surfactant in the CSTR (Scheme S4).



Scheme S4. Conditions for synthesis of biaryl precursor 21 to Zelboraf[®] in a CSTR platform.

Syringe 1: In a glass vial containing a PTFE coated magnetic stir bar, TPGS-750-M (600 mg, 2 wt.%) was added and sealed with a rubber septum. The vial was evacuated and backfilled with argon three times. Degassed H₂O (14.22 mL) was added to the vial under argon flow *via* syringe and stirred at rt for 2 h. In a separate second vial containing a PTFE coated magnetic stir bar, Fe/ppm Pd NPs (538 mg, 800 ppm Pd) was added and sealed with a rubber septum. The vial was evacuated and backfilled with argon three times. A solution of TPGS-750-M/H₂O (14.22 mL) from the first vial was then added to second vial *via* syringe under argon flow. The mixture was then stirred at rt for 1 h. This mixture slurry of catalyst was then transferred to stainless steel syringe containing a PTFE coated magnetic stir bar and attached to syringe pump-1.

Syringe 2: In a glass vial containing a PTFE coated magnetic stir bar, 1-benzyl-5-bromo-1H-pyrrolo[2,3-b] pyridine **19 (**1080 mg, 3.75 mmol, 1.0 equiv.) and (4-chlorophenyl) boronic acid **20** (704 mg, 4.5 mmol, 1.2 equiv.) and sealed with a rubber septum. The vial was evacuated and backfilled with argon three times. Degassed H_2O (14.22 mL) was added to the vial under argon flow *via* syringe and stirred at rt for 2 h. This slurry of substrates was then transferred to a stainless-steel syringe containing a PTFE coated magnetic stir bar and attached to syringe pump-2.

Syringe 3: Third stainless-steel syringe was filled with degassed Et₃N (1.57 mL, 11.3 mmol, 3.0 equiv.) and attached to syringe pump-3.

After achieving steady state (~3 residence times, 60 min), the sample was collected for 15 min and used to calculate the isolated yield of product. In 15 min, 0.49 mmol of substrate had been introduced in the reactor. The organic layer was concentrated *in vacuo* and then purified by flash column chromatography (DCM/hexane = 10/90) to afford 147 mg (0.46 mmol, ~94%) of product **21**.

Batch reaction procedures

Reaction 1. Batch synthesis of PFR model reaction

To a 5 mL microwave vial equipped with a PTFE coated magnetic spin vein was added 20 mg of Fe/ppm Pd NPs (800 ppm Pd), 4bromoanisole **1** (93.52 mg, 0.5 mmol, 1.0 equiv), phenylboronic acid **2**(76.2 mg, 0.625 mmol, 1.25 equiv.), and potassium phosphate tribasic monohydrate (351 mg, 1.525 mmol, 3 equiv.). A 2 wt % solution of TPGS-750-M (0.8 mL) was added to the vial followed by tetrahydrofurfuryl alcohol (0.2 mL) and the vial was sealed using an aluminum crimp cap fitted with a PTFE septum. The contents of the vial were then allowed to stir at rt until a semi-homogeneous mixture had formed, and was then transferred to a microwave reactor. The contents of the vial were heated to 95 °C and stirred vigorously for 10 min. The resulting homogeneous mixture was then extracted with EtOAc (0.5 mL x 3). The organics were then evaporated under reduced pressure resulting in a crude oil, which was then taken up into 200 ml of cold water and allowed to sit cold for 30 min. The precipitate was then filtered, washed with water, and taken up in EtOAc. The crude organic mixture was then passed through a plug of silica gel to afford 89.1 mg (97%) of 4-methoxy-1,1'-biphenyl **3** as an off-white solid.

Reaction 2. Batch synthesis of the biaryl precursor to the sartans.

To a 4 mL reaction vial containing a PTFE coated magnetic stir bar, 19.8 mg of FePdNPs (800 ppm Pd) was added in a glove box. The reaction vial was sealed with a rubber septum. 2-bromobenzonitrile **8** (91 mg, 0.5 mmol, 1.0 equiv.), *p*-tolylboronic acid **9** (81.6 mg, 0.6 mmol, 1.2 equiv.) and potassium phosphate tribasic monohydrate (173 mg, 0.75 mmol, 1.5 equiv.) were added to the reaction vial under argon flow. The reaction vial was then evacuated and backfilled with dry argon three times. A solution of 2 wt % TPGS-750-M (1.0 mL) was added via syringe. The reaction vial was sealed with PTFE tape over rubber septum and then stirred vigorously at 90 °C for 20 minutes. The reaction vial was then allowed to cool to rt and the reaction mixture was extracted with EtOAc (1.0 mL X 5). The combined organic layer was dried over anhydrous Na₂SO₄ and solvent was removed *in vacuo*. Crude product was purified by flash chromatography over silica gel to afford 95.9 mg (99 %) of 2-cyano-4'- methylbiphenyl **7** as a white solid (Et₂O/hexane = 6/94).

Reaction 3. Batch synthesis of the biaryl precursor to Jakafi.

To a 4 mL reaction vial containing a PTFE coated magnetic stir bar, 19.8 mg of FePdNPs (800 ppm Pd) was added in a glove box. The reaction vial was sealed with a rubber septum. 7-Benzyl-4-chloro-7H-pyrrolo[2,3-d]pyrimidine **13** (121.5 mg, 0.5 mmol, 1.0 equiv.) and 1-(2-tetrahydropyranyl)-1H-pyrazole-4-boronic acid, pinacol ester **14** (167 mg, 0.6 mmol, 1.2 equiv) were added to the reaction vial under argon flow. The reaction vial was then evacuated and backfilled with dry argon three times. A solution of 2 wt % TPGS-750-M (1.0 mL) and Et₃N (105 μ L, 0.75 mmol, 1.5 equiv.) were added via syringe. The reaction vial was sealed with PTFE tape over rubber septum and then stirred vigorously at 95 °C for 20 minutes. The reaction vial was then allowed to cool to rt and the reaction mixture was extracted with EtOAc (1.0 mL X 5). The combined organic layer was dried over anhydrous Na₂SO₄ and solvent was removed *in vacuo*. Crude product was purified by flash chromatography over silica gel to afford 160.2 mg (89 %) of 7-benzyl-4-(1-(tetrahydro-2H-pyran-2-yl)-1H-pyrazol-4-yl)-7H-pyrrolo[2,3-d]pyrimidine **15** as a white solid (EtOAc/hexane = 1/1).

Reaction 4. Batch synthesis of the biaryl precursor to Zelboraf.

To a 4 mL reaction vial containing a PTFE coated magnetic stir bar, 19.8 mg of FePdNPs (800 ppm Pd) was added in a glove box. The reaction vial was sealed with a rubber septum. 1-Benzyl-5-bromo-1H-pyrrolo[2,3-b]pyridine **19** (143.5 mg, 0.5 mmol, 1.0 equiv) and 4-chlorophenylboronic acid **20** (93.6 mg, 0.6 mmol, 1.2 equiv.) were added to the reaction vial under argon flow. The reaction vial was then evacuated and backfilled with dry argon three times. A solution of 2 wt % TPGS-750-M (1.0 mL) and Et₃N (105 μ L, 0.75 mmol, 1.5 equiv) were added via syringe. The reaction vial was sealed with PTFE tape over rubber septum and then stirred vigorously at 95 °C for 20 minutes. The reaction vial was then allowed to cool to rt and the reaction mixture was extracted with EtOAc (1.0 mL X 5). The combined organic layer was dried over anhydrous Na₂SO₄ and solvent was removed *in* *vacuo*. Crude product was purified by flash chromatography over silica gel to afford 153.4 mg (96 %) of 1-benzyl-5-(4-chlorophenyl)-1H-pyrrolo[2,3-b]pyridine **21** as a white solid (DCM/hexane = 1/9).

Analytical Data

4-Methoxylbiphenyl CAS: 613-37-6



¹**H NMR** (500 MHz, CDCl₃) δ 7.61 – 7.50 (m, 4H), 7.42 (t, *J* = 7.8 Hz, 2H), 7.31 (td, *J* = 7.3, 1.2 Hz, 1H), 7.03 – 6.94 (m, 2H), 3.86 (s, 3H).^[1]

 $^{13}\textbf{C}\,\textbf{NMR}\,(126\,\text{MHz},\,\text{CDCl}_3)\,\delta\,159.31,\,140.99,\,133.95,\,128.86,\,128.30,\,126.89,\,126.80,\,114.36,\,55.50.\,^{[1]}$

2-Cyano-4'-methylbiphenyl CAS: 114772-53-1



7

¹**H NMR** (500 MHz, CDCl₃) δ 7.75 (dd, J = 7.7, 1.4 Hz, 1H), 7.63 (td, J = 7.7, 1.4 Hz, 1H), 7.51 (dd, J = 8.0, 1.3 Hz, 1H), 7.49 – 7.45 (m, 2H), 7.42 (td, J = 7.6, 1.2 Hz, 1H), 7.34 – 7.28 (m, 2H), 2.43 (s, 3H).^[2]

 $^{13}\textbf{C}\,\textbf{NMR}\,(126\,\text{MHz},\text{CDCl}_3)\,\delta\,145.65,\,138.81,\,135.39,\,133.83,\,132.88,\,130.09,\,129.56,\,128.73,\,127.39,\,118.99,\,111.32,\,21.37.^{[2]}$

7-Benzyl-4-chloro-7H-pyrrolo[2,3-d]pyrimidine CAS: 16019-34-4



 $^{1}\text{H}\text{ NMR} (500 \text{ MHz}, \text{CDCl}_{3}) \\ \delta 8.67 (s, 1\text{H}), \\ 7.35 - 7.27 (m, 3\text{H}), \\ 7.21 (dd, \text{J} = 6.0, 2.7 \text{ Hz}, 3\text{H}), \\ 6.61 (d, \text{J} = 3.5 \text{ Hz}, 1\text{H}), \\ 5.45 (s, 2\text{H}). \\ \delta 8.67 (s, 2\text{H}), \\ \delta 8$

¹³C NMR (126 MHz, CDCl₃) δ 152.33, 151.29, 151.00, 136.37, 129.18, 129.07, 128.32, 127.74, 117.60, 100.10, 48.59.

7-Benzyl-4-(1-(tetrahydro-2H-pyran-2-yl)-1H-pyrazol-4-yl)-7H-pyrrolo[2,3-d]pyrimidine



15

¹H NMR (500 MHz, CDCl₃) δ 8.86 (s, 1H), 8.42 (s, 1H), 8.29 (s, 1H), 7.31 (tt, J = 7.0, 6.1 Hz, 3H), 7.25 – 7.21 (m, 2H), 7.20 (d, J = 3.6 Hz, 1H), 6.76 (d, J = 3.6 Hz, 1H), 5.48 (s, 3H), 4.13 – 4.06 (m, 1H), 3.80 – 3.71 (m, 1H), 2.17 (dt, J = 6.2, 1.8 Hz, 2H), 2.10 – 2.01 (m, 1H), 1.78 – 1.57 (m, 4H).

¹³**C NMR** (126 MHz, CDCl₃) δ 151.85, 151.68, 151.18, 139.56, 136.99, 129.00, 128.60, 128.47, 128.09, 127.70, 122.12, 114.32, 100.34, 88.01, 67.88, 48.04, 30.71, 25.07, 22.32.

HRMS: (ESI, [C₂₁H₂₁N₅O + H]) calcd, 360.1824; found *m/z*: 360.1825.

1-Benzyl-5-bromo-1H-pyrrolo[2,3-b]pyridine



19

¹**H NMR** (500 MHz, CDCl₃) δ 8.37 (d, *J* = 2.2 Hz, 1H), 8.04 (d, *J* = 2.2 Hz, 1H), 7.30 (dddd, *J* = 12.3, 7.0, 4.6, 2.3 Hz, 3H), 7.23 – 7.15 (m, 3H), 6.43 (d, *J* = 3.5 Hz, 1H), 5.46 (s, 2H).^[3]

 $^{13}\textbf{C}\,\textbf{NMR}\,(126\,\text{MHz},\,\text{CDCl}_3)\,\delta\,146.20,\,143.66,\,137.46,\,130.91,\,129.47,\,128.88,\,127.89,\,127.57,\,122.12,\,111.86,\,99.80,\,48.16.^{[3]}$

Benzyl-5-(4-chlorophenyl)-1H-pyrrolo[2,3-b]pyridine



¹**H NMR** (500 MHz, CDCl₃) δ 8.55 (d, *J* = 2.1 Hz, 1H), 8.07 (d, *J* = 2.2 Hz, 1H), 7.55 (d, *J* = 8.5 Hz, 2H), 7.44 (d, *J* = 8.5 Hz, 2H), 7.35 – 7.27 (m, 3H), 7.24 (dd, *J* = 7.5, 2.4 Hz, 3H), 6.54 (d, *J* = 3.5 Hz, 1H), 5.53 (s, 2H).

¹³**C NMR** (126 MHz, CDCl₃) δ 147.52, 142.33, 138.33, 137.76, 133.19, 129.17, 129.02, 128.87, 128.72, 128.61, 127.80, 127.57, 127.24, 120.56, 100.54, 48.11.

HRMS: (ESI, [C₂₀H₁₅CIN₂ + H]) calcd, 319.1002; found *m/z*: 319.1003.

4-Methoxylbiphenyl (CAS:613-37-6)





7-Benzyl-4-chloro-7H-pyrrolo[2,3-d]pyrimidine (CAS:16019-34-4)





7-Benzyl-4-(1-(tetrahydro-2H-pyran-2-yl)-1H-pyrazol-4-yl)-7H-pyrrolo[2,3-d]pyrimidine

1-Benzyl-5-bromo-1H-pyrrolo[2,3-b]pyridine





1-Benzyl-5-(4-chlorophenyl)-1H-pyrrolo[2,3-b]pyridine

References

- [1] W. J. Guo, Z. X. Wang, J. Org. Chem. **2013**, 78, 1054-1061.
- [2] Q. Liang, P. Xing, Z. Huang, J. Dong, K. B. Sharpless, X. Li, B. Jiang, Org. Lett. 2015, 17, 1942-1945.
- [3] J. K. Laha, R. A. Bhimpuria, D. V. Prajapati, N. Dayal, S. Sharma, *Chem. Commun.* **2016**, *52*, 4329-4332.

Author Contributions

*These authors contributed equally to this work.