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EvoluChem™ Photoredox Device

Description:

The EvoluChem™ PhotoRedOx Box is designed to facilitate photochemical experiment. This apparatus is a multi-format photo reactor compatible with most vial formats (0.3 ml, 2 ml, 4 ml and 20 ml vials) and flow reactor. Photoredox reagent screening kits are available in 0.3 ml vial format with pre-mixed reagent and catalysts. (Patent Pending)

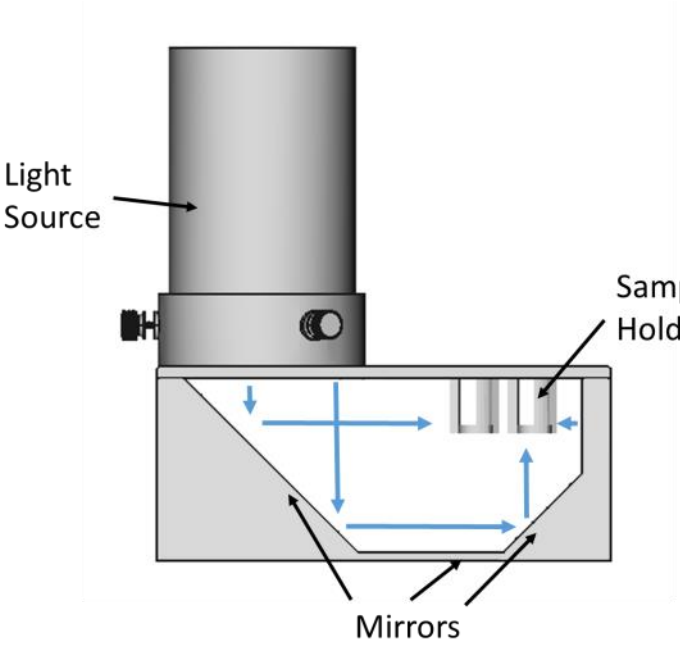
HCK1006-01-016 Device with blue light source

Patent Pending

Features

- Fits many light sources (EvoluChem 18W or Kessil blue 34W)
- Photochemistry chamber to evenly distribute light
- Flexible format vials (from 0.3 ml to 20 ml)
- Flow reactor available
- Magnetic stirring on standard heat/stirring plate
- Cooling by fan to maintain experiment at room temperature
- Pre-designed array of catalysts and reagents available

Unique geometry to focus light on samples



The EvoluChem™ PhotoRedOx Box is equipped with several mirrors that direct and distribute the light toward the samples. The geometry of the box enable parallel reaction with homogenous light exposure.

Better Heat Management

The position of the light source on the side of the samples reduce the amount of heat directed to samples. The embedded fan eliminates any remaining heat.

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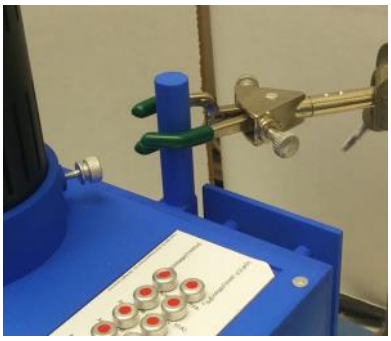
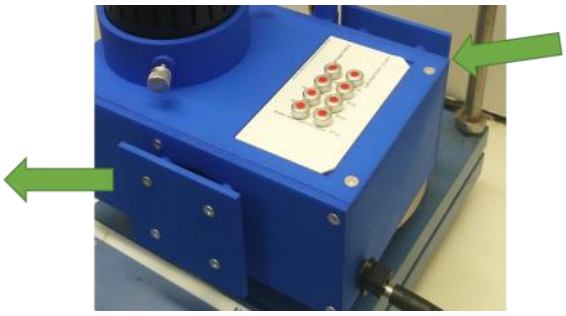
EvoluChem™ Photoredox Device

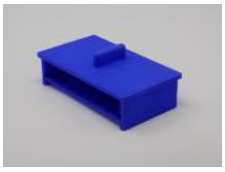
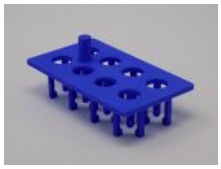
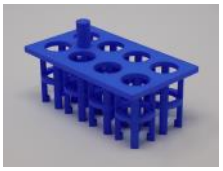
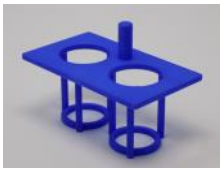
Handle to secure device on a stirring plate



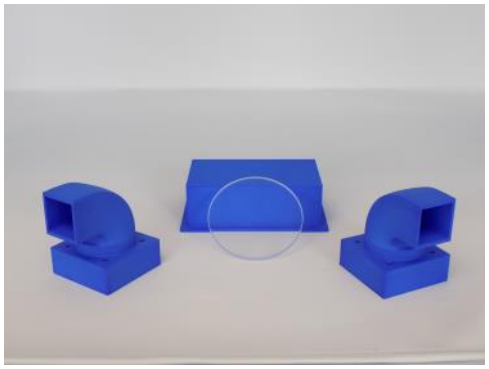
Air flow to maintain samples at room temperature



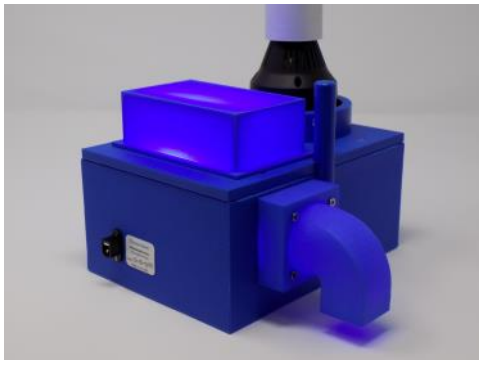
Fit multiple vial sizes

				
32 X 0.3 ml vials	**8 X 2 ml vials**	**8 X 4 ml vials**	**8 X 8 ml vials**	**2 X 20 ml vials**
HCK1006-01-017	HCK1006-01-018	HCK1006-01-019	HCK1006-01-020	HCK1006-01-021

Light Proofing Upgrade (HCK1006-01-026)



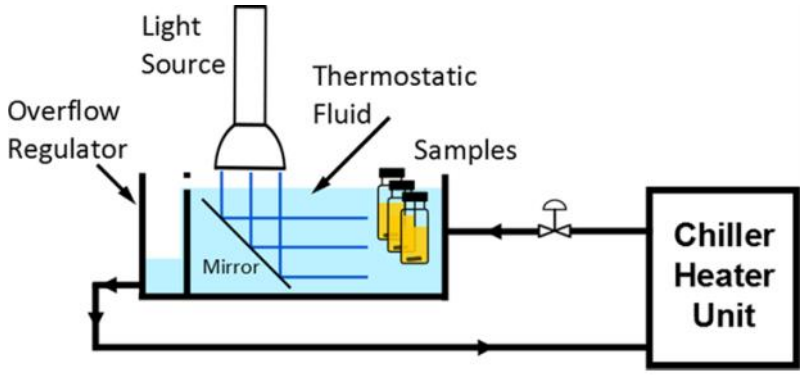
The PhotoRedOx Box has been designed to limit the exposure to light during experiment. However when using light spectrum below 500 nm, repetitive exposure to light should be avoided. In addition to personal protective equipment, we offer upgrade kit to dramatically reduce the light leaking from the device.



PhotoRedOx TC (Temperature Controlled)

Description:

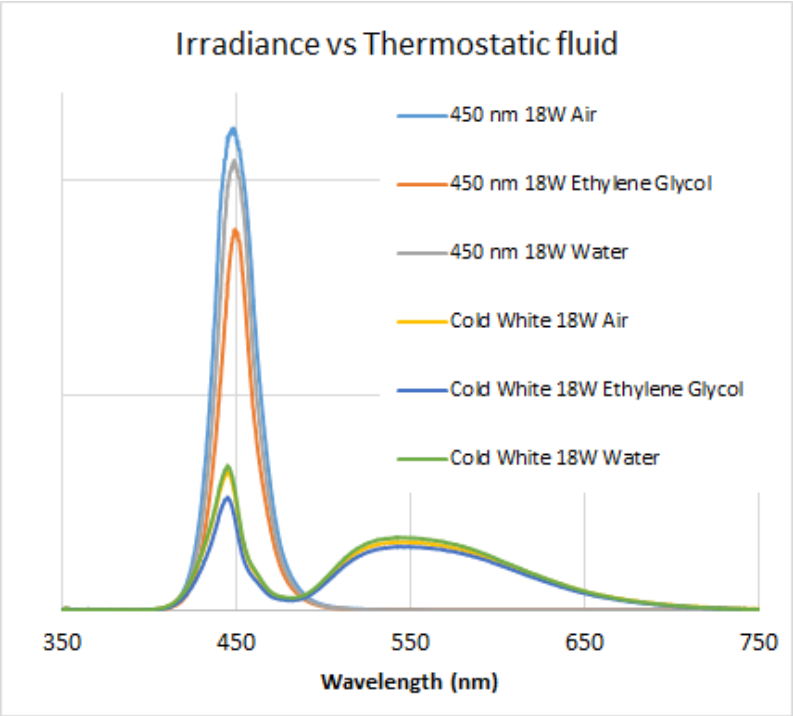
The temperature controlled photoredox device allows to perform photo-catalytic reactions at controlled temperature from 0°C to 80°C. The device uses the same design than our standard photoredox box with mirror that direct the light to samples holders allowing the performance of multiple reaction conditions sim-ultaneously. However it is possible to heat and cool the reaction using a thermostatic fluid such as water that recirculates from a chiller/heater unit.



HCK1006-01-025

Features

- Fits many light sources (EvoluChem 18W or Kessil blue 34W)
- Photochemistry chamber to evenly distribute light
- Flexible format vials (from 0.3 ml to 20 ml)
- Flow reactor available
- Stirring on magnetic stirring plate
- External recirculator needed to heat or chill reaction vessel



Fluids such as water or ethylene glycol do not affect light trans-

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PhotoChem Light Sources

Description:

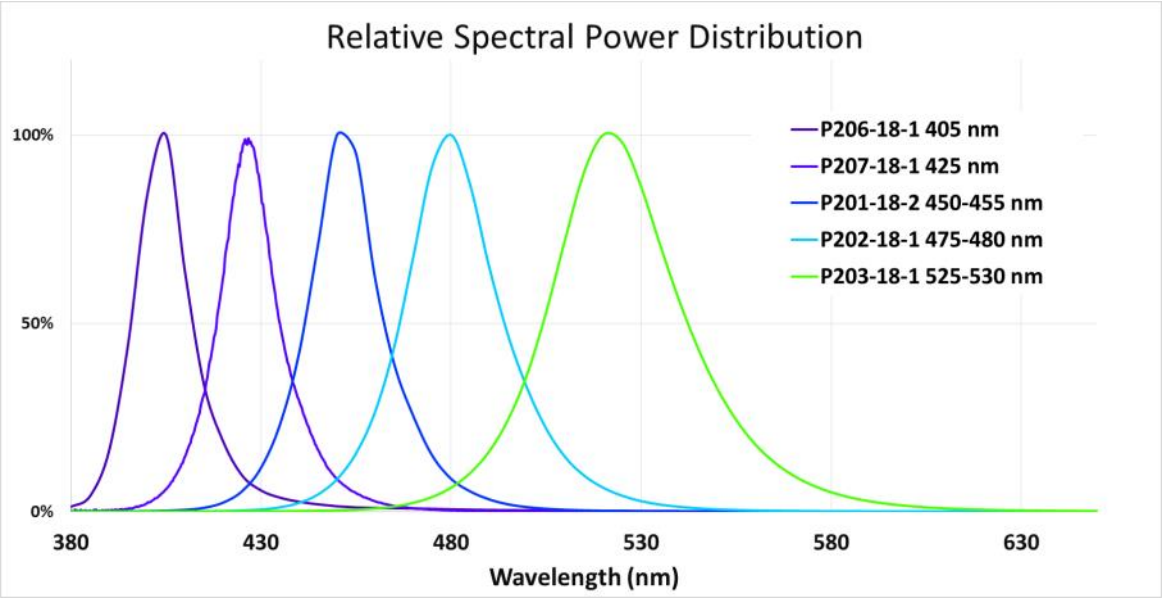
The EvoluChem™ LED spotlights are designed specifically for photo-catalytic chemistry applications. They fit the photoredox box and they are designed to irradiate all samples with maximum efficiency. The LED chips are selected for specific wavelengths 365 nm, 405 nm, 425 nm, 455 nm, 475 nm, 525 nm, 6200K white.

General Specifications

Power Consumption	18W or 30W Max
Input Voltage	100-240 VAC
Beam Angle	25°
Wavelength Options	365 nm, 405 nm, 425 nm 455 nm, 475 nm, 525 nm, 6200K white
LED chip	Cree, EPILED and LG

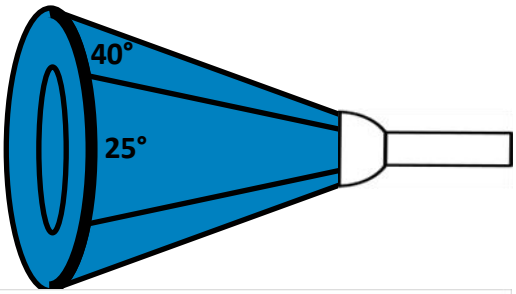
EvoluChem™ LED

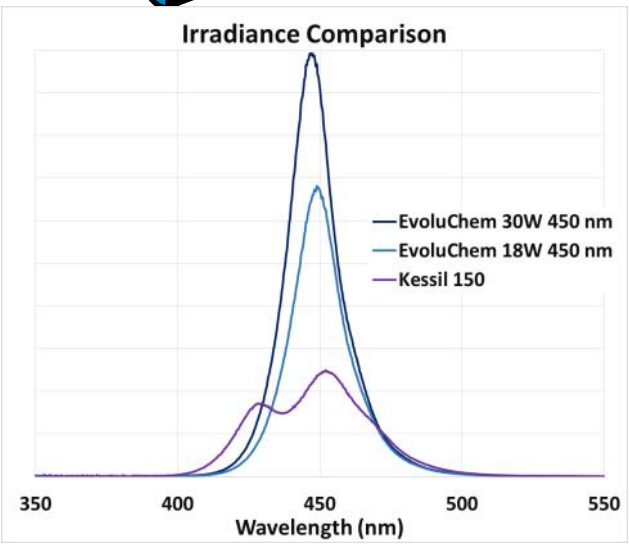
EvoluChem LED 18W



PhotoChem Light Sources

Advantage of Focused Light Beam





Light Power vs Irradiance

Although the total power of LED light is important, it is essential to estimate the amount of light that actually goes on the sample. If the light is spread over a large area the density of light (irradiance) on sample will be little. Therefore we designed the EvoluChem™ LEDs to focus the light toward the samples. They have light beam angle of 25° which allows to obtain better light efficiency than the Kessil light (40°).

With a more focused beam the EvoluChem™ LED 18W average irradiance is 50% higher than a 34W Kessil light.

Light Sources	Electric Power (W)	Total Irradiance* (mW/cm^2)
Kessil 150N	34W	22
P201-18-2 450-455 nm	18W	30
P303-30-1 450-455 nm	30W	50

* The irradiance was measured on a PhotoRedOx box

Light Sources	Wavelength	LED	Part Number
P205-18-1 365 nm	365 nm	LG	HCK1012-01-011
P206-18-1 405 nm	405 nm	LG	HCK1012-01-010
P207-18-1 425 nm	425 nm	EPILED	HCK1012-01-012
P201-18-2 450-455 nm	450 nm	CREE XPE	HCK1012-01-002
P202-18-1 475-480 nm	475 nm	CREE XPE	HCK1012-01-003
P203-18-1 525-530 nm	525 nm	CREE XPE	HCK1012-01-004
P204-18-1 6200K	Cold White 6200K	CREE XTE	HCK1012-01-005
P303-30-1 450 nm	450 nm	CREE XPE	HCK1012-01-008
Kessil 34W royal blue 150	430 nm 450 nm	Dicon	HCK1006-01-005

EvoluChem LED 30W
HCK1012-01-008

Kessil Blue 34W
HCK1006-01-005

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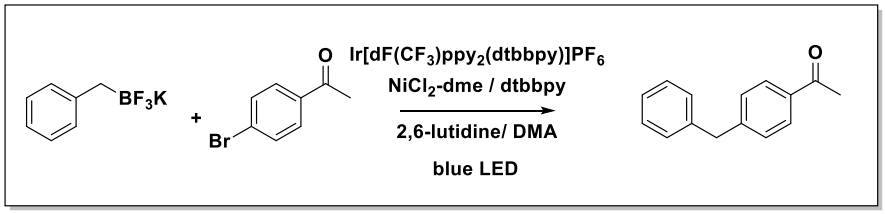
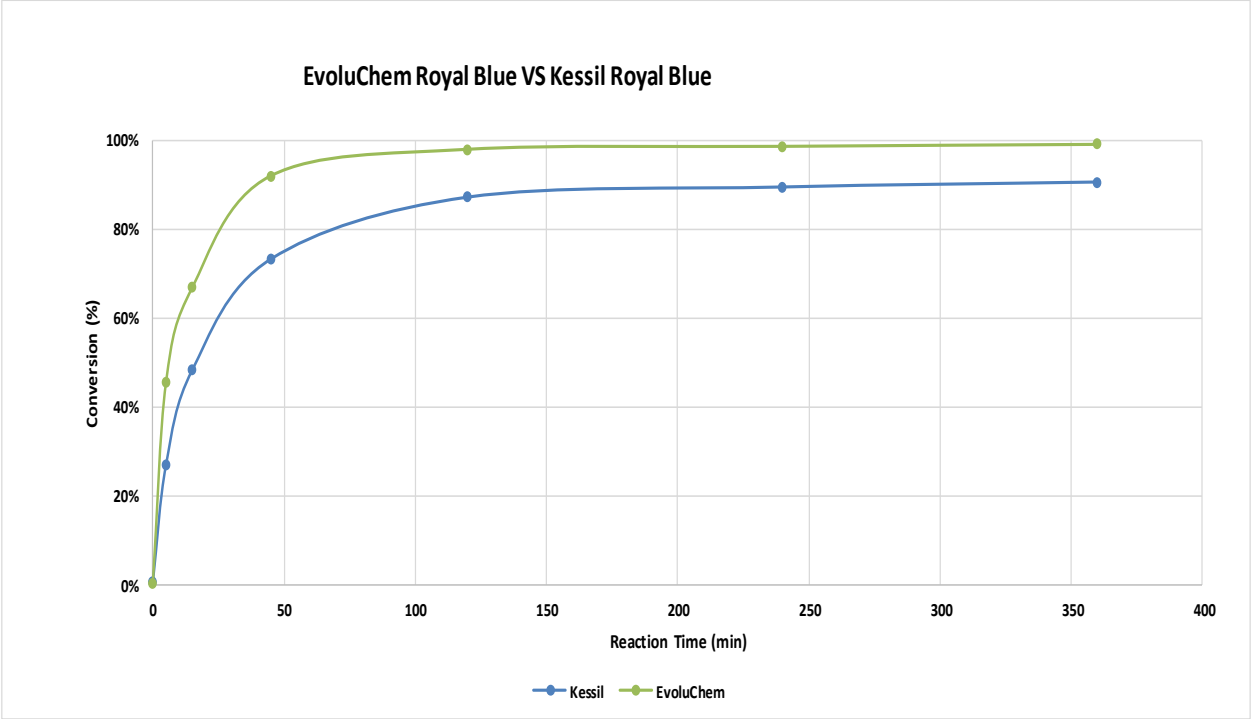
EvoluChem™ 18W vs Kessil 34W



Experimental Details:

In duplicate in a 4-ml vial equipped with a teflon septa and 2x7 mm stir bar, were weighed 4-bromoacetophenone (4.95 mg, 25 µmol) and potassium benzyltrifluoroborate (4.50 mg, 25 µmol, 1 equiv.). To this vial was added a 1.0 ml solution in DMA containing $NiCl_2$-dme (1.1 mg, 5 µmol, 20 mol %), dtbbpy (1.3 mg, 5 µmol, 20 mol %) and Ir(dF-CF3-ppy)$_2$(dtbpy) (1.12 mg, 1 µmol, 4 mol %) followed by addition of 2,6-lutidine (17.5 µl, 150 µmol, 6 equiv.) . The solution was sparged with nitrogen via submerged needle for 5 minutes and vial was placed in EvoluChem photoreactor with blue Kessil 34W LED or with a EvoluChem Royal Blue LED 18W. Reaction time course was monitored at 0, 5, 15, 45, 120, 240, and 360 minutes.



EvoluChem™ PhotoRedOx Duo

The EvoluChem™ PhotoRedOx Duo is using the same unique design as the PhotoRedOx Box. PhotoRedOx Duo increases the reaction vials capacity to 16 vials (2, 4 or 8 ml) using 2 of the same vial holders as the PhotoRedOx box. Using the 2 blue LED setup allows to increase reaction rate of difficult reaction conditions.

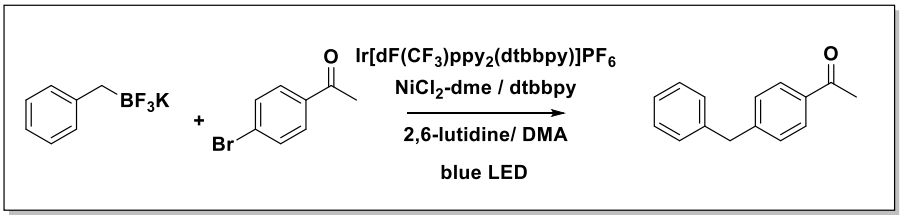
PhotoRedOx Duo

PhotoRedOx Duo 2 Holders

2X Vials

2X Light power

Test Reaction

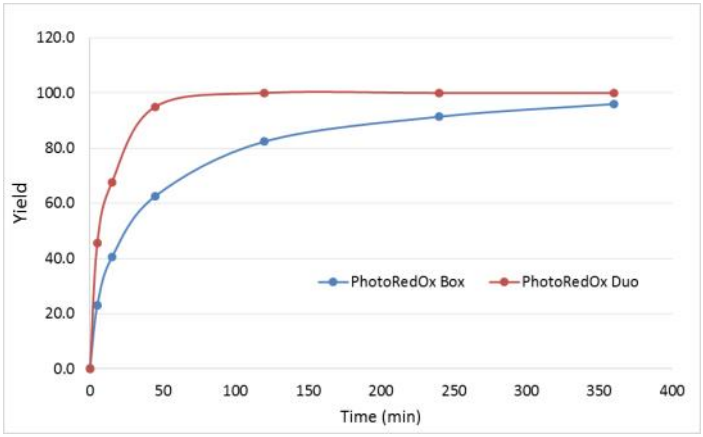


Experimental Details:

In duplicate in a 4-ml vial equipped with a teflon septa and 2x7 mm stir bar, were weighed 4-bromoacetophenone (4.95 mg, 25 µmol) and potassium benzyltrifluoroborate (4.50 mg, 25 µmol, 1 equiv.). To this vial was added a 1.0 ml solution in DMA containing $NiCl_2$-dme (1.1 mg, 5 µmol, 20 mol %), dtbbpy (1.3 mg, 5 µmol, 20 mol %) and Ir(dF-CF3-ppy)$_2$(dtbpy) (1.12 mg, 1 µmol, 4 mol %) followed by addition of 2,6-lutidine (17.5 µl, 150 µmol, 6 equiv.) . The solution was sparged with nitrogen via submerged needle for 5 minutes and vial was placed in EvoluChem photoreactor with blue Kessil 34W LED or reactor with two blue kessil 34W. Reaction time course was monitored at 0, 5, 15, 45, 120, 240, 360 and 1440 minutes.

PhotoRedOx Box → **PhotoRedOx Duo**

96 % yield, 360 min → **95% yield, 45 min**



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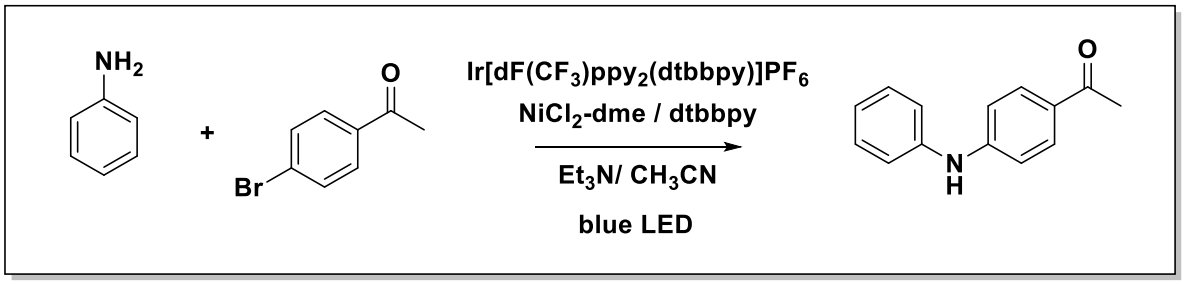
EvoluChem™ PhotoRedOx Flow Reactor

The common limitation to scaling up photoredox chemistry is due to the low penetration of the light in to the reaction mixture (few mm) which prohibits the use of large reaction vessels. Surface area is key to shorten reaction time. It is possible to significantly increase the surface area by running the reaction in flow. This will decreases the reaction time and allows to be run in continuous mode for scale-up.

To solve this challenge, we designed a flow reactor that can be used in the PhotoRedOx Box. This flow reactor is using PFA tubing and has volume of 2 ml. Comparing reactions in flow and in batch we observed significant decrease in reaction time.

PhotoRedOx Flow Reactor (2 ml)
HCK1006-01-022

Flow reactor validation reaction 1



Time to 95% conversion: Flow 30 min, batch 24h

Reaction protocol:

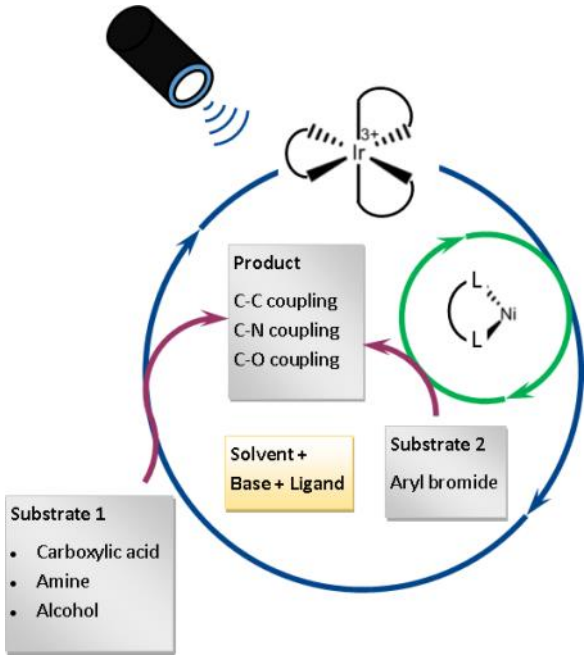
In a 4-ml vial equipped with a Teflon septa were weighed $NiCl_2$-dme (1.1 mg, 5 µmol, 5 mol %) and dtbbpy (1.3 mg, 5 µmol, 5 mol %). 1 ml of dry MeOH was added to the vial and the vial was stirred on an orbital shaker until complete dissolution. The solution was evaporated to dry at room temperature. Then Ir(dF-CF3-ppy)$_2$(dtbpy) (1.1 mg, 1 µmol, 1 mol %), and 4-bromoacetophenone (9.95 mg, 100 µmol, 1 equiv.) were added. 1 ml of dry acetonitrile was added followed by Et_3N (21 µmol, 300 µmol, 3 equiv.) and aniline (4.65 mg, 100 µmol, 1 equiv.). The solution was sparged with nitrogen via submerged needle for 5 minutes.

Several batches of 100 µl of solution were successively injected to the flow reactor placed in EvoluChem PhotoRedOx Box with blue Kessil LED using an injection module (Gilson) and the samples were circulated using a HLPC pump at different flow rates to allow residence time of 5, 10, 15, 20 and 30 min. Reaction completion was monitored by LC-MS using the ratio bromoacetophenone/product.

Iridium/Nickel Photoredox Kits

Product overview:

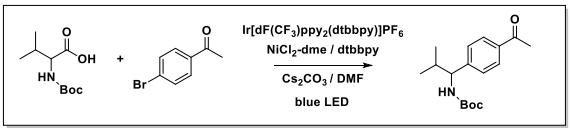
In recent years photoredox chemistry has become a powerful tool for chemical synthesis. Many reaction conditions have been reported in the literature using a wide range of catalysts and reagents. However, often these reactions are highly substrate, solvent and base specific. In order to facilitate the screening of common photochemistry reactions, HepatoChem has released a series of kits combining common Iridium, Nickel, ligand and base combinations to achieve successful cross-coupling transformations.



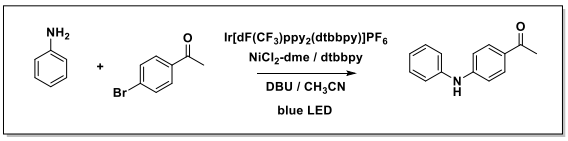
Ir/Ni catalysis versatility

Depending on the ligand, base and solvent, the Ir/Ni catalytic systems can perform different types of cross-coupling reaction.

C-C coupling

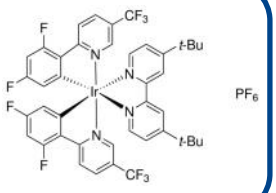


C-N coupling

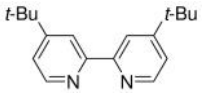


Iridium catalyst

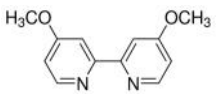
$Ir(dF\text{-}CF_3\text{-}ppy)_2(dtbpy)PF_6$



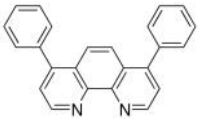
Nickel Ligands



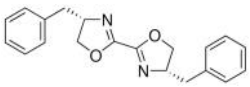
dtbbpy



$(MeO)_2bpy$



bphen



biox

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Iridium/Nickel Photoredox Kits

Ir/Ni visible-light photoredox catalysis exploration

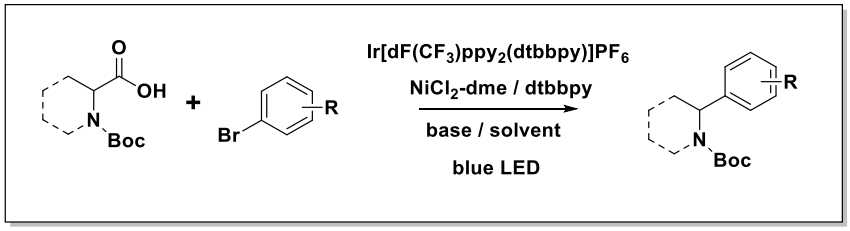
A significant number of traditional cross-coupling reactions have been performed using photochemistry. In many cases, this involves using an Iridium photocatalyst like Ir(dF-CF_3-ppy)$_2$(dtbpy)[PF_6] to activate a sluggish catalytic cycle (Ni) in the presence of a ligand and base. Many reactions conditions have been reported in the literature using a wide range of reagents. However, often these reactions are highly substrate, solvent and base specific. We describe several examples from literature that haven been modified to be performed in kit form in our PhotoRedOx box device.

Screening reaction conditions

To reduce the amount of catalysts, reagents and substrate used during reaction screening, we perform reaction condition at 5 µmol substrate in 100 µl solvent with 0.1 µmol Ir catalyst and 0.5 µmol premixed Ni-dtbbpy with 3 equiv. of base with stir in a vial capped under inert atmosphere.

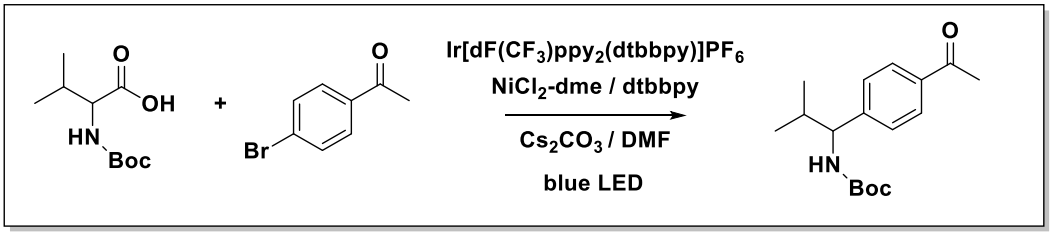
C-C coupling through decarboxylation

The decarboxylative sp3-sp2 cross-coupling of amino acids and other activated carboxylic acids with aryl halides is a powerful tool for the synthesis of new organic molecules.



See Reference: Zuo, Z., et. al. *Science* 2014, 345, 437-440.

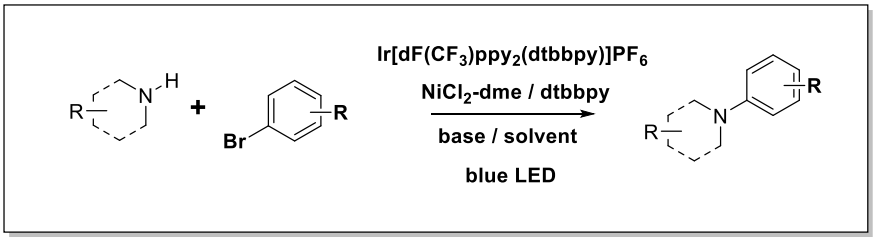
The success of this type of reaction relies on finding the right combination of Ir catalyst / Ni ligand, base and solvent. We performed the cross-coupling reaction between the substrates Boc-Val and 4-bromoacetophenone using 100 µl screening reaction condition as described previously. The results shows that the conversion is highly dependent on base. In this case Cs_2CO_3 and K_3PO_4 promote the reaction while DABCO and DBU do not.



Iridium/Nickel Photoredox Kits

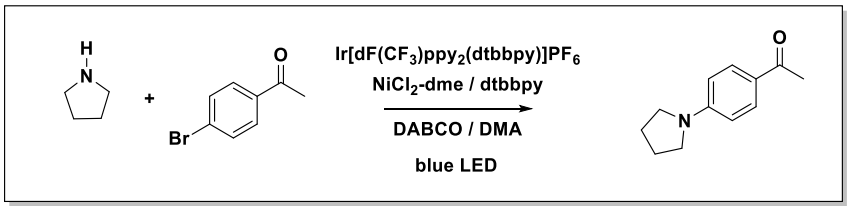
C-N coupling with secondary amines

Cross-coupling reaction between halide aryl and secondary amine aliphatic amine are possible with Ir/Ni photoredox catalysis.



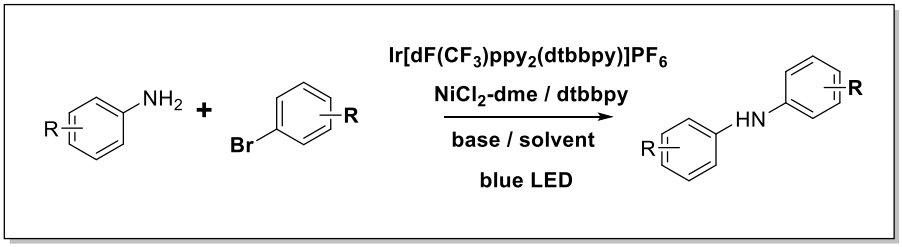
See reference: Corcoron, E. *et. al., Science* 2016, 353, 279-283.

Like decarboxylative sp3-sp2 cross-coupling, the success of this C-N cross-coupling relies on finding the right combination of Ir catalyst / Ni ligand, base and solvent. For example the cross-coupling reaction between the substrates pyrolidine and 4-bromoacetophenone (see below) is highly dependent of the used base. In that case DABCO promotes the reaction when Cs_2CO_3, K_3PO_4 and DBU don't.



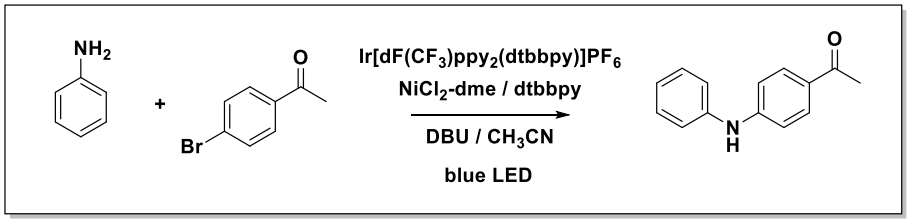
C-N coupling with aromatic amines

Cross-coupling reaction between halide aryl and aromatic amine are possible with Ir/Ni photoredox catalysis.



See reference: Oderinde, M., *et. al. Angew. Chemie,* 2016, 55, 13219-13223

In that case aniline and 4-bromoacetophenone are reacting in presence of DBU or DABCO.



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EvoluChem™
Chemistry screening kits

Iridium/Nickel Photoredox Kits

Results summary

Selection of base and solvent important to find condition for appropriate coupling (5 µmol per reaction /100 µL scale)

Reaction Type	Substrates	Solvent	Base			
			Cs_2CO_3	K_3PO_4	DABCO	DBU
C-C coupling through decarboxylation	Boc-Val 4-bromoacetophenone	DMF	✓	✓		
C-N coupling (secondary amines)	Pyrolidine 4-bromoacetophenone	DMA			✓	
C-N coupling (aromatic amine/ secondary amine)	Indoline 4-bromoacetophenone	DMA		✓		
C-N coupling (aromatic amine)	Aniline 4-bromoacetophenone	ACN			✓	✓

Iridium/Nickel Photoredox Kits

In order to facilitate the screening of common photochemistry reactions, EvoluChem™ has released a series of kits combining common Iridium, nickel, ligand and base combinations to achieve the following transformations.

Standard Protocol:

5 µmol of substrates in 100 µl solvent with Ir catalyst (2 mol %), $NiCl_2$•dme (10 mol %), ligand (10 mol %), and 3 equivalent of base.

Features

- 0.3 ml vial with crimp cap and stirring bar
- Pre-weighed reagents and catalysts
- Temperature maintained at RT
- Reagents are packaged under inert atmosphere

HepatoChem
Reinventing Chemistry for Life Sciences

Iridium/Nickel Photoredox Kits

Ir/Ni base and solvent screen kit: HCK1009-01-002

This kit is designed to screen reaction conditions with 8 different bases, Iridium catalyst Ir(dF-CF_3-ppy)$_2$(dtbbpy)[PF_6] and Ni ligand dtbbpy. This is the quickest way to find which base will work with your substrates.

With Iridium catalyst Ir(dF-CF_3-ppy)$_2$(dtbbpy)PF_6 and Ni ligand dtbbpy

	Cs_2CO_3	K_3PO_4	K_2HPO_4	KOH	Li_2CO_3	K_2CO_3	DABCO	DBU
Solvent A Solvent B	2 sets of 8 bases per kit (16 total vials) HCK1009-01-002							

Ir/Ni base and ligand screen kits: HCK1009-01-003/ HCK1009-01-004

This kit is designed to screen both bases and Ni Ligand with Iridium catalyst Ir(dF-CF_3-ppy)$_2$(dtbbpy)[PF_6]. It is recommended for difficult or complex substrates.

With Iridium catalyst Ir(dF-CF_3-ppy)$_2$(dtbbpy)[PF_6]

	Cs_2CO_3	K_3PO_4	K_2HPO_4	K_2CO_3	DABCO	DBU
dtbbpy bphen $(MeO)_2$bpy biox	2 sets of 4 bases and 4 ligands per kit (32 total vials) HCK1009-01-003				2 sets of 6 bases and 4 ligands per kit (48 total vials)	

Ir/Ni base and Ir catalyst screen kit: HCK1009-01-005

This kit is designed to screen both bases (3) and Iridium catalysts (6) with Ni Ligand. It is recommended for difficult or complex substrates.

	Cs_2CO_3	CsF	DBU
Ir(dF-CF_3-ppy)$_2$(dtbbpy)PF_6 Ir(dtbbpy)(ppy)$_2PF_6$ Ir(dF-CF_3-ppy)$_2$(bpy)PF_6 Ir(dF-ppy)$_3$ Ir(dmppy)$_2$(dtbbpy)PF_6 Ir(dF-CH_3-ppy)$_2$(dtbbpy)PF_6	2 sets of 3 bases and 6 Ir catalysts per kit (36 total vials) HCK1009-01-005		

With
Ni ligand dtbbpy

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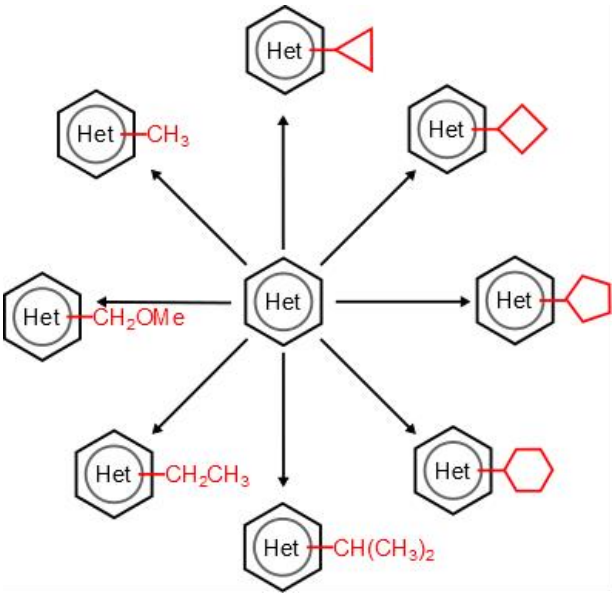
EvoluChem™
Chemistry screening kits

Photocatalytic Alkylation Diversification Kit

8 Different Diversification Groups



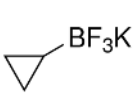
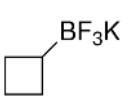
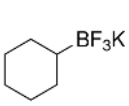
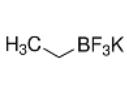
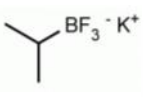
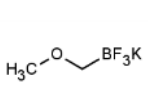
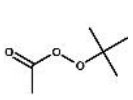
Product overview: HCK1016-01-001

The trifluoroborate alkylation reaction (Minisci reaction) described by Prof. Molander is a powerful late stage functionalization tool. Our kit allows to conveniently produce in one step 8 different analogues of a lead compound in mg quantities. Each reaction vial contains 75 µmol of trifluoroborate alkylation reagent (pre-weighed) and a stirring bar to react with 50 µmol of substrate. C-H functionalization will primarily occur on electron-deficient heteroarenes at one or several positions.

Kit contents HCK1016-01-001: 2 reaction vials of each BF_3K reagents (75 µmol) and $K_2S_2O_8$ (100 µmol), 2 vials of photocatalysts and 2 vials of TFA, 16 reaction vials total

Kit Protocol: For each kit, 4 mL of a 0.1 M solution of substrate (400 µmol total) in DMSO is prepared with 8.98 mg photocatalyst $Ir(dF\text{-}CF_3\text{-}ppy)_2(dtbpy)$ (8 µmol, 2 mol%) and trifluoroacetic acid (153 µL, 5 equiv) included. The solution is sparged with nitrogen. Each vial contains 27.0 mg $K_2S_2O_8$ (100 µmol, 2 equiv.) and 1.5 equiv. BF_3K reagent (75 µmol) in 2 ml vial equipped with stir bar and Teflon septa. Alternatively for methylation, vial contains 39.9 µL of TBPA tert-butyl peracetate. Vials are prepared under argon. 500 µL of substrate solution added via syringe and vial is placed in PhotoRedox Box equipped with PAR 6200K white light. Reaction is stirred for 2-24 hr.

Photocatalytic Alkylation Reagents (2 Vials of each)

	cyclopropyl	cyclobutyl	cyclopentyl	cyclohexyl	ethyl	isopropyl	methoxy methyl	*t*-Butyl peracetate
								
MW (g/	147.98	162.00	176.03	190.06	135.97	149.99	151.97	132.16
CAS	1065010-87-8	1065010-88-9	1040745-70-7	446065-11-8	44248-07-9	1041642-13-0	910251-11-5	107-71-1

Literature references:

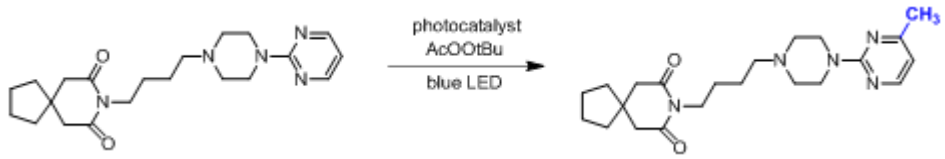
Jennifer K. Matsui, David N. Primer and Gary A. Molander Chem. Sci., 2017,8, 3512-3522

Tim Cernak, Kevin D. Dykstra, Sriram Tyagarajan, Petr Vachal and Shane W. Krska Chem. Soc. Rev., 2016,45, 546-576

Photocatalytic Methylation Array

Product overview: HCK1009-01-001

With the EvoluChem photomethylation kit, we have demonstrated the reproducibility of both the photomethylation kit and the device.



Kit Protocol: The typical protocol is performed at 0.05 mol/l concentration reaction condition using a solution of substrate in 4 different solvents. Each sealed reaction vial contains 0.1 µmol of photocatalyst and 12.5 umol of *tert*-butyl peracetate. Based on the concentration of the substrate stock solution and the volume added, the following reaction stoichiometry can be achieved with the standard photomethylation kit.

	$[Ir\{dF(CF_3)ppy\}_2(dtbbpy)]PF_6$	$[Ir(ppy)_2(dtbbpy)]PF_6$
50/50 Acetonitrile/TFA	5 equiv. tert-butyl peracetic acid HCK1009-01-001	
Acetonitrile (10 equiv. TFA)		
Acetic acid (10 equiv. TFA)		
Acetic acid/H_2O (10 equiv. TFA)		

Kit contents HCK1009-01-001

Part number	Description	Quantity	Amount
K-0132-01-001	$Ir[dF(CF_3)ppy]_2(dtbbpy)][PF_6]$ / *tert*-butyl peracetate	8x vial	0.1 µmol / 12.5 umol
K-0133-01-001	$Ir[(ppy)_2(dtbbpy)[PF_6]$ / *tert*-butyl peracetate	8x vial	0.1 µmol / 12.5 umol
K-0010-03-001	50/50 Acetonitrile/ trifluoroacetic acid	1x vial	1 ml
K-0011-03-001	Acetonitrile (10 equiv. trifluoracetic acid*)	1x vial	1 ml
K-0012-03-001	Acetic acid (10 equiv. trifluoracetic acid*)	1x vial	1 ml
K-0012-03-001	Acetic acid /water (10 equiv. trifluoroacetic acid*)	1x vial	1 ml
K-0003-04-001	Substrate stock vial 1	1x vial	---
K-0003-04-002	Substrate stock vial 2	1x vial	---
K-0003-04-003	Substrate stock vial 3	1x vial	---
K-0003-04-004	Substrate stock vial 4	1x vial	---

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Light Protective Devices

Safety Glasses

Skyper Eyewear, Orange Lens, Polycarbonate, UVextreme AF, Black Frame, TPU, UVEX / Honeywell S1933X

Safety Glasses
Catalog number: HCK1015-01-001

Protective Screen

This screen is designed to fit in standard chemistry hood and limit direct exposition to photochemical light.

Catalog number: HCK1015-01-002

This plexiglass color is 100% effective of blocking all ultraviolet wavelengths. It cuts off light at the 540 wavelength and works great for UV curing operations.

EvoluChem Supplies

Available Supplies:

Item	Reference	Description
Starter Kit	HCK1006-01-001	1 reaction block (24x 2ml vial, 32X 0.3ml vial, 4X 2Dram vial), 1 decapper for 8 mm crimped vial and 1 syringe Hamilton 81000.
EvoluChem Block fits 3 types of vials	HCK1006-01-002	1 reaction block (24x 2ml vial, 32x 0.3ml vial, 4x 2Dram vial)
EvoluChem Block fits 96x 0.3ml vials	HCK1006-01-003	1 reaction block (96x 0.3ml vial)
Micro stir bar 2 x 2 mm	HCK1006-01-012	50 stir bars
6 mm vials 0.3 ml	HCK1006-01-013	100 vials
Crimp caps for 6 mm vial	HCK1006-01-014	100 crimp caps
Micro stir bar 2 x 7 mm	HCK1006-01-015	50 stir bars

HCK1006-01-001

HCK1006-01-002

HCK1006-01-003

HCK1006-01-012

HCK1006-01-013

HCK1006-01-014

HCK1006-01-015

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Chemistry screening kits

Legal Information:

All catalysts and reagents are purchased from authorized distributers.

Catalog number	Item	Description
HCK1006-01-001	Starter Kit	This kit contains 1 reaction block (24x 2ml vial, 32X 0.3ml vial, 4X 2Dram vial), 1 decapper for 8 mm crimped vial and 1 syringe Hamilton 81000.
HCK1006-01-002	Reaction block	1 reaction block (24x 2ml vial, 32x 0.3ml vial, 4x 2Dram vial)
HCK1006-01-003	Reaction block 96 vials	1 reaction block (96x 0.3ml vial)
HCK1006-01-005	Kessil 34W	Kessil 34W royal blue 150
HCK1006-01-012	Micro stir bar 2 X 2mm	50 Stir bars
HCK1006-01-013	6 mm vials 0.3 ml	100 vials
HCK1006-01-014	Crimp caps for 6 mm vial	100 crimp caps
HCK1006-01-015	Micro stir bar 7 X 2mm	50 Stir bars
HCK1006-01-016	PhotoRedOx Box	PhotoRedOx Box
HCK1006-01-017	32 x 0.3 ml vials photochemistry holder for PhotoRedOx Box	32 x 0.3 ml vials photochemistry holder for PhotoRedOx Box
HCK1006-01-018	8 X 2 ml vials photochemistry holder for PhotoRedOx Box	8 X 2 ml vials photochemistry holder for PhotoRedOx Box
HCK1006-01-019	8 X 4 ml vials photochemistry holder for PhotoRedOx Box	8 X 4 ml vials photochemistry holder for PhotoRedOx Box
HCK1006-01-020	8 X 8 ml vials photochemistry holder for PhotoRedOx Box	8 X 8 ml vials photochemistry holder for PhotoRedOx Box
HCK1006-01-021	2 X 20 ml vials photochemistry holder for PhotoRedOx Box	2 X 20 ml vials photochemistry holder for PhotoRedOx Box
HCK1006-01-022	Flow reactor 1/16 tubing for PhotoRedOx Box	Flow reactor 1/16 tubing for PhotoRedOx Box
HCK1006-01-023	PhotoRedOx Box Duo	PhotoRedOx Box Duo
HCK1006-01-024	Adaptor new holder/flow on photochemistry device	Adaptor new holder/flow on photochemistry device
HCK1006-01-025	PhotoRedOx TC	PhotoRedox Box Temperature Controlled
HCK1006-01-026	Light Proofing Upgrade	Replacement vents and cover to eliminate light exposure.

Catalog number	Kit	Description
HCK1009-01-001	Photomethylation kit	2 sets of photomethylation reaction conditions with 2 iridium catalysts, AcOOtBu and 4 different solvent systems 16 reaction vials total
HCK1009-01-002	Ir/Ni base and solvent screen kit 1	2 sets of reaction conditions with iridium catalyst Ir(dF-CF_3-ppy)$_2$(dtbbpy) PF_6, Ni/dtbbpy and 8 bases Cs_2CO_3, K_3PO_4, K_2HPO_4, KOH, Li_2CO_3,K_2CO_3, DABCO and DBU. 16 reaction vials total
HCK1009-01-003	Ir/Ni screen base and ligand kit 2	2 sets of reaction conditions with iridium catalyst Ir(dF-CF_3-ppy)$_2$(dtbbpy) PF_6, 4 Ni ligands dtbbpy bphen (MeO)2bpy and biox, and 4 bases Cs_2CO_3, K_3PO_4, K_2HPO_4, and K_2CO_3. 32 reaction vials total
HCK1009-01-004	Ir/Ni screen base and ligand kit 3	2 sets of reaction conditions with iridium catalyst Ir(dF-CF_3-ppy)$_2$(dtbbpy) PF_6, 4 Ni ligands dtbbpy, bphen, (MeO)$_2$bpy and biox, and 8 bases Cs_2CO_3, K_3PO_4, K_2HPO_4, KOH, Li_2CO_3, K_2CO_3, DABCO and DBU. 32 reaction vials total
HCK1009-01-005	Ir/Ni screen base and Ir cat kit 4	2 sets of reaction conditions with 6 iridium catalysts Ir(dF-CF_3-ppy)$_2$ (dtbbpy)PF_6, Ir(dtbbpy)(ppy)$_2PF_6$, Ir(dF-CF_3-ppy)$_2$(bpy)PF_6 Ir(dF-ppy)$_3$,Ir(dmppy)$_2$(dtbbpy)PF_6, Ir(dF-CH_3-ppy)$_2$(dtbbpy)PF_6, Ni dtbbpy , and 3 bases Cs_2CO_3, CsF and DBU. 36 reaction vials total
HCK1009-01-006	Ir/Ni base and solvent screen kit 5 (C-O coupling)	2 sets of reaction conditions with iridium catalyst Ir(dF-CF3-ppy)2(dtbbpy) PF6, Ni/dtbbpy, Quinuclidine in 8 conditions with Cs2CO3, K3PO4, ,K2CO3 (with 3 concentrations of Ni), DABCO, just Quinuclidine and no catalysts for stability standard. 16 reaction vials total
HCK1012-01-002	PAR20-18W CREE XPE 450-455 nm royal blue 25 degres	This light source is designed specifically for photoredox chemistry and the PhotoRedOx Box
HCK1012-01-003	PAR20-18W CREE XPE 475-480 nm blue 25 degres	This light source is designed specifically for photoredox chemistry and the PhotoRedOx Box
HCK1012-01-004	PAR20-18W CREE XPE 525-530 nm green 25 degres	This light source is designed specifically for photoredox chemistry and the PhotoRedOx Box
HCK1012-01-005	PAR20-18W CREE XPE 6200K cold white 25 degres	This light source is designed specifically for photoredox chemistry and the PhotoRedOx Box
HCK1012-01-008	30 W CREE XPE 450-455 nm royal blue 25 degres	This light source is designed specifically for photoredox chemistry and the PhotoRedOx Box
HCK1012-01-010	PAR20-18W LG 405 nm 25 degres	This light source is designed specifically for photoredox chemistry and the PhotoRedOx Box
HCK1012-01-011	PAR20-18W LG 365 nm 25 degres	This light source is designed specifically for photoredox chemistry and the PhotoRedOx Box
HCK1012-01-012	PAR20-18W LG 425 nm 25 degres	This light source is designed specifically for photoredox chemistry and the PhotoRedOx Box
HCK1015-01-001	UVEX Amber safety glasses	Uvex Skyper Blue Light Blocking Glasses with SCT-Orange Lens (S1933X)
HCK1015-01-002	Amber Hood Screen	Blue Light Blocking Screen 2 X 3 Ft
HCK1016-01-001	Photo-catalytic Alkylation Production Kit	Photo-catalytic alkylation production kit using 8 different BF3K reagents in 50 umol scale reaction condition.

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