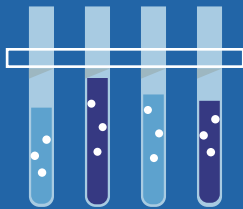


# PharmaBlock



## Chemistry and Engineering Technologies

**PharmaBlock Sciences (Nanjing), Inc.**

[www.pharmablock.com](http://www.pharmablock.com)  
[product.pharmablock.com](http://product.pharmablock.com)

# Flow Chemistry

210+  
projects

30+  
reaction types

kilo to metric ton scale

## Application in safer, more stable, higher-yield processes

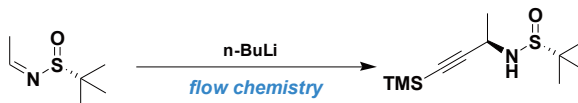
- High temperature/pressure
- Highly energetic
- Cryogenic
- Highly reactive and air-sensitive
- Toxic and/or stinky agents
- Unstable intermediates
- Oxidation and/or ozonization
- Diazotization

## Reactors

- Single-tube
- Multi-tube
- Static mixer
- Fixed/micropacked bed
- CSTR
- Electrochemistry reactor
- Photo-flow reactor
- Other materials

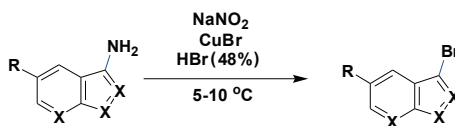
## Cases

### Cryogenic reaction



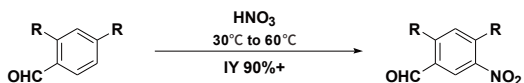
Entry	Comparison	Batch	Flow
1	Feasibility of scaling up	×	√
2	Temperature	-70 to -60°C	-40 to 10 °C
3	Yield	N/A	84%
4	Scaling-up risk	High	Low
<b>Result</b>	Completed 260 kg product with 240 mL continuous flow reactor in 30 hours		

### Diazotization



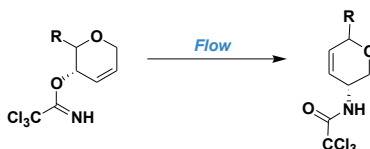
Entry	Comparison	Batch	Flow
1	Feasibility of scaling up	×	√
2	Temperature	N/A	5 to 10 °C
3	Yield	N/A	80 - 85%
4	Scaling-up risk	High	Low
<b>Result</b>	Completed 200 kg product with a set of 100 mL continuous flow reactor in 2-3 days		

## Nitration



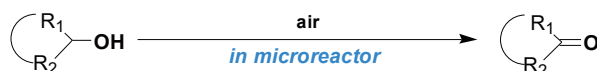
Entry	Comparison	Batch	Flow
1	Feasibility of scaling up	×	√
2	Temperature	20 - 30 °C	30 - 60 °C
3	Yield	N/A	90 - 93%
4	Scaling-up risk	High	Low
5	Automatic level	Low	High
<b>Result</b>	Over 300 kg of product completed with an integrated continuous tubing reactor		

## High temperature



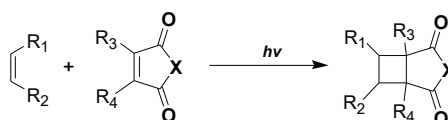
Entry	Comparison	Batch	Flow
1	Feasibility of scaling up	×	√
2	Temperature	200 °C	220 - 250 °C
3	Yield	N/A	> 94%
4	Scaling-up risk	High	Low
5	Automatic level	Diphenyl ether (BP: 258°C)	Toluene (BP: 110 °C)
<b>Result</b>	Over 100 kg of product completed		

## Oxidation



Entry	Comparison	Batch	Flow
1	PMI	15	7
2	Time	> 4 h	10 min
3	Yield	88 - 90%	95%
4	Complexity of work-up	High	Low
<b>Result</b>	Over 100 kg of product completed		

## Photocatalytic reaction



Entry	Comparison	Batch	Flow
1	Feasibility of scaling up	×	√
2	Time	30 h	40 - 50 min
3	Light source	Medium pressure mercury lamp	365 nm LED
4	Scaling-up risk	High	Low
<b>Result</b>	Over 500 kg of product completed		

# Micropacked Bed Technology

300+  
projects

kilo to metric ton scale

commercial and GMP projects

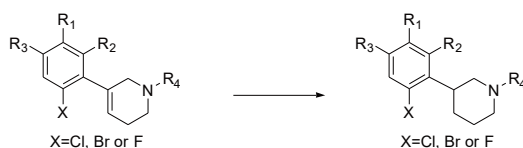
## Technical advantages

- **Safety, Efficiency, Consistency**
  - Meet safety regulations
  - Increased productivity
  - No batch variation
  - Heavy metal < 10 ppm
- **Superior selectivity**
- **Significant cost savings**
  - Lower catalyst cost
  - Lower solvent usage
  - Shorter production time

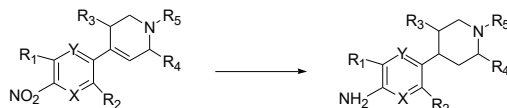
## Reactions applied at manufacturing scale

- Deprotection
- Nitro reduction
- Nitrile reduction
- Diazo reduction
- Oxime reduction
- Olefin/acetylene reduction
- Reductive amination
- Phenyl ring reduction
- Selective dehalogenation
- Pyridine ring reduction
- Asymmetric hydrogenation

## Cases



Comparison	Batch	Micropacked bed
Activity	Not feasible	Conversion rate $\geq$ 90%
Impurity	Not feasible	Dehalogenation impurity < 3%



Comparison	Batch	Micropacked bed
Yield	70%	$\geq$ 85%
Impurity	~15%	< 3%
Work up	Complex	Easy
Catalyst cost	High	Reduced 91% noble metal consumption

## Integrated solutions

- Proof of concept and bench-scale R&D of flow hydrogenation process
- Pilot-scale process research, design and operation
- Turnkey solution service for industrial-scale plant operation (including hydrogenation process, equipment and catalyst)

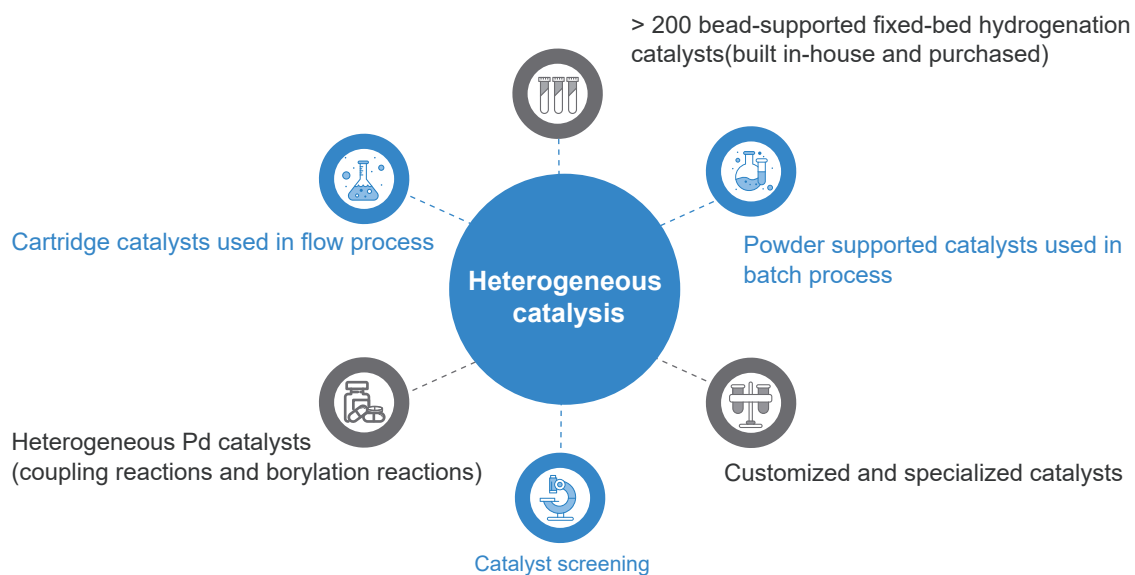
# Catalysis

300+  
heterogeneous catalysts

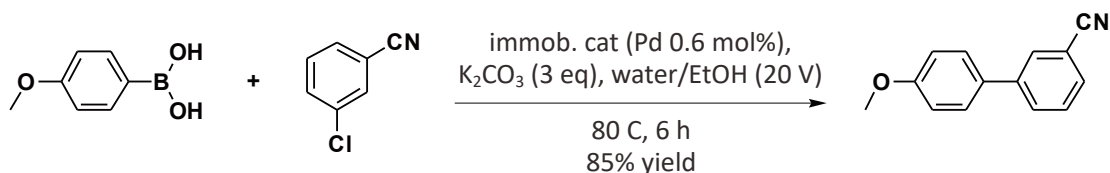
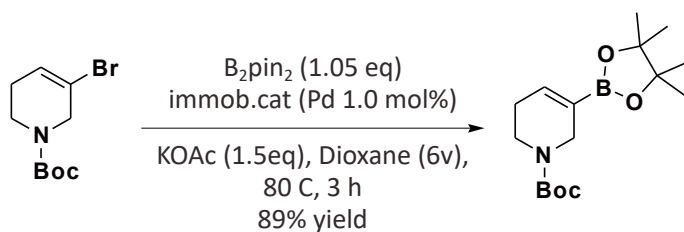
200+  
biocatalysis projects

kilo to hundred-kilo scale

## Heterogeneous catalysis



## Miyaura borylation and Suzuki coupling case



Phosphine compound is polymerized into bulk material, thus the ligand is micronized and suitable for separation and recycling.

# Catalysis

## Biocatalysis



Library enzyme screening

Process development

Manufacturing

### Benefits

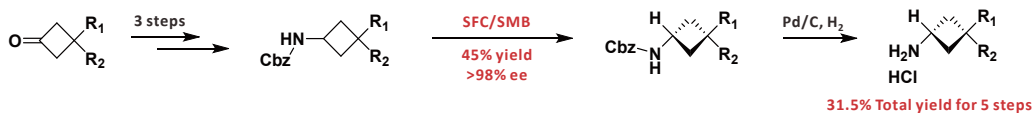
Significant cost savings

Safer process, better quality and shorter timeline

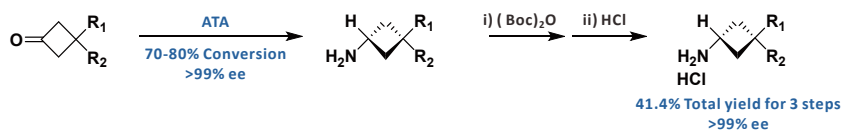
Continuous improvement enabled by continuous enzyme engineering

- > 500 enzymes in stock (commercial and in-house)
- Fermentation: up to 100 L
- Screening and process development
- Directed evolution

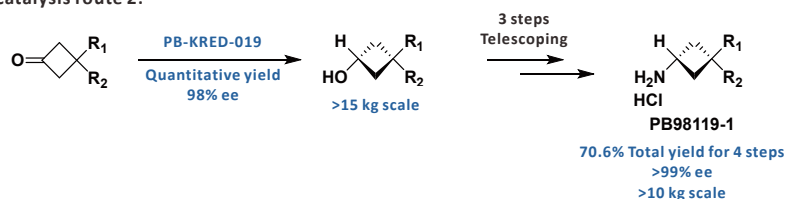
## Case



Biocatalysis route 1:



Biocatalysis route 2:



## About PharmaBlock

PharmaBlock Sciences (Nanjing), Inc. (SZSE: 300725) is a leading provider of innovative chemistry products and services throughout the pharmaceutical R&D process and commercial production. Its core businesses include a rationally designed building blocks collection, (supplying from discovery to development and commercialization), development and manufacturing of RSMs, intermediates and APIs, and drug products for drug development and commercialization. Integrating the cutting-edge technologies such as continuous flow chemistry, micropacked bed technology, catalysis, and AI, the company is exploring green, safe and intelligent manufacturing models to promote the innovative development of the biopharmaceutical industry.

Since its founding in 2008, PharmaBlock has partnered with almost all the top 20 pharmaceutical companies, and hundreds of small to medium-sized biotech companies around the world. Its ever-evolving mission leverages the top notch expertise in chemistry and new technologies to support partners to accelerate drug discovery and development, and move the new molecules into market at full speed.

## Teams

Our core management and technical teams have in-depth industry experience in leadership and R&D, previously spearheading drug discovery and CMC campaigns at Roche, GSK, Boehringer Ingelheim, Merck, Agios and other global pharmaceutical and biotech companies.

**2,400+**

Employees

**1,000+**

Well-trained scientists

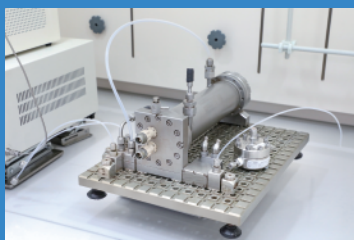
**100+**

PhDs

**40%+**

Master's & above

## Capacity



# PharmaBlock

Innovative chemistry for a better future

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