

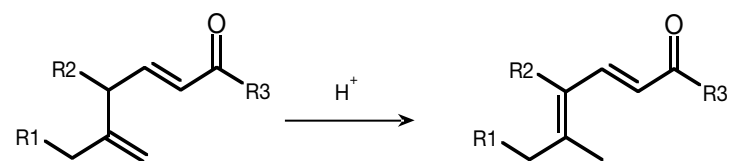


# Mini Continuous flow reactor for Fine Chemicals

## APPLICATION : PROCESS EXAMPLES DEVELOPED WITH RAPTOR®

### Isomerization & Hydrolysis

Biphasic liquid/liquid reaction



#### BATCH PROCESS

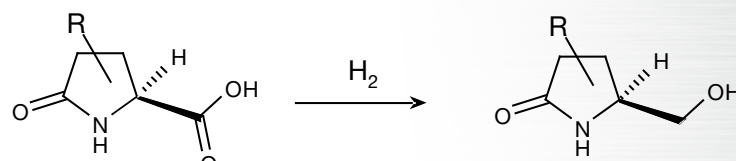
- 5 Hours
- Selectivity 66-65%
- Safety issue (class E : adiabatic rise may initiate thermal decomposition)

#### RAPTOR® PROCESS

- Res. Time < 2 mn
- Selectivity ~ 80%
- Safe process (quenching)
- Throughput : 120 l/h eq. 35-40 kg/h of end product

### High pressure hydrogenation

One step instead of two



#### BATCH PROCESS

- 2 steps synthesis : Methyl ester & NaBH4
- Cryogenic conditions
- Solvent and waste

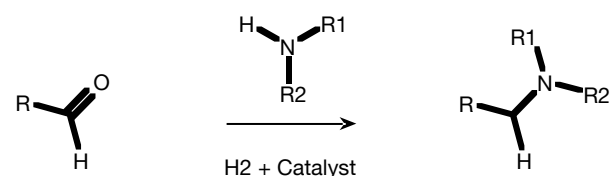
#### RAPTOR® PROCESS

- 1 step synthesis : H2 + catalyst
- High temperature
- Solvent : water



### Reductive amination

Exothermic reaction



#### BATCH PROCESS

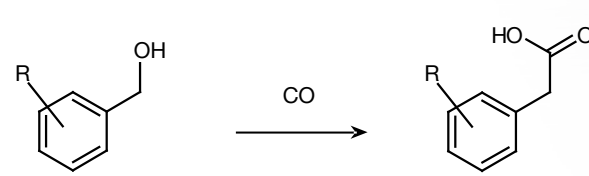
- 10 bar
- 10 h hydrogenation
- Solvent

#### RAPTOR® PROCESS

- Higher T, P
- Resid. Time < 1 min.
- Less solvent

### Carbonylation

Technology for safe Carbonylation



#### BATCH PROCESS

- 30 bar
- 4 h
- Exothermic
- High volume of CO

#### RAPTOR® PROCESS

- Higher Temp. & Pressure
- Resid. time < 3 min.
- Same dilution
- Limited amount of CO

## COMPETITIVE ADVANTAGE

- Higher productivity / reduced costs
- Improved selectivity
- Ability to handle hazardous chemicals
- Ability to carry out very high pressure reactions
- Better control of highly exothermic reactions
- Lower waste management and energy costs (less solvents)
- Less side reactions and unstable intermediate accumulation due to kinetic acceleration



## RAPTOR® TECHNICAL FEATURES

### Characteristics:

Pressure:	250 bars (3,600 psi)
Temperature:	-100°C (-150°F) to +300°C (570°F)
Heat exchange Area /volume:	150 m <sup>2</sup> /m <sup>3</sup> (3 to 5 m <sup>2</sup> /m <sup>3</sup> for a batch reactor )
Stirring system:	0 to 1,500 rpm
Residence time:	10 seconds to 10 minutes
Flow rate:	from 5 to 150 litres per hour (1.3 to 40 gallons per hour)

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