# Continuous Stirred Tank Reactor

**Spoken Tutorial Project**
**http://spoken-tutorial.org**

**National Mission on Education through ICT**
**http://sakshat.ac.in**

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# System Requirement

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- Any OS: Linux, Mac OS X or FOSSEE OS on ARM.

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# Prerequisites

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- Add **material** and **energy** streams and specify their properties

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**To practice this tutorial, you should know**

- **Add components to a flowsheet**
- **Select thermodynamic packages**
- **Add material and energy streams and specify their properties**
- **Add kinetic reaction in reaction manager**

- **http://spoken-tutorial.org**
- **You can access these tutorials and all the associated files from this site**

# Reaction, Package and Inlet Condition

| Reaction | $C_2H_5OH(l) + CH_3COOH(l) \rightleftharpoons CH_3COOC_2H_5(l) + H_2O(l)$ | |
|---|---|---|
| Package | **NRTL** | |
| Inlet Stream | Mass Flow | 3600 kg/h |
| | Temperature | 70 $^\circ$C |
| | Pressure | 1 bar |
| | Mole fraction | $x_{C_2H_5OH} = 0.48$ $x_{CH_3COOH} = 0.5$ $x_{H_2O} = 0.02$ |

# Reactor Parameters and Reaction Kinetics

| Reactor type | Isothermal |
|---|---|
| Reactor Parameters | Volume= 0.14 m$^3$ |
| Reaction Kinetics | $r_A = K_0 C_A C_B$ <br> K=0.005 <br> n=2 |

# Summary

**In this tutorial, we have learnt to:**

- **Simulate a Continuous Stirred Tank Reactor**
- **Calculate Conversion and Residence time for a reaction in a CSTR**

**Repeat the simulation with**

- **Different compounds**
  **Methyl Acetate, 1-Butanol**
  **Methanol & N-Butyl Acetate**
  $$CH_3COOCH_3 + C_4H_{10}O \rightleftharpoons C_6H_{12}O_2 + CH_3OH$$

- **Different package**
  **Raoult's Law**

**Repeat the simulation with**

- **Different feed conditions**
  **Mass Flow: 3600kg/h**
  **Mole Fraction($CH_3OH$): 0.1**
  **Mole Fraction($C_4H_9OH$): 0.45**
  **Mole Fraction($CH_3COOCH_3$): 0.45**
  **Temperature: 75 $^\circ C$, Pressure: 5 bar**

# Assignment

**Repeat the simulation with**

- **Different CSTR dimensions**
  **Volume: 4 m$^3$**

- **Different reaction kinetics**
  $r_A = KC_A C_B$
  **K=0.01 1/s, n = 2**

# About the Spoken Tutorial Project

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- If you do not have good bandwidth, you can download and watch it

# Spoken Tutorial Workshops

**The Spoken Tutorial Project Team,**

- **Conducts workshops using spoken tutorials**

- **Gives certificates to those who pass an online test**

- **For more details, please write to contact@spoken-tutorial.org**

# Forum for specific questions

- Do you have questions in this Spoken Tutorial?
- Please visit http://forums.spoken-tutorial.org
- Choose the minute and second where you have the question
- Explain your question briefly
- Someone from the FOSSEE team will answer them

# DWSIM Flowsheeting Project

- **The FOSSEE team coordinates conversion of existing flow sheets**

- **We give honorarium and certificates for those who do this**

- **For more details, please visit this site http://dwsim.fossee.in/flowsheeting-project**

# Textbook Companion Project

- **The FOSSEE team coordinates coding of solved examples of popular books**
- **We give honorarium and certificates for those who do this**
- **For more details, please visit this site http://dwsim.fossee.in/textbook-companion-project**

# Lab Migration Project

- **The FOSSEE team helps migrate commercial simulator labs to DWSIM**

- **We give honorarium and certificates for those who do this**

- **For more details, please visit this site http://dwsim.fossee.in/lab-migration-project**

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- **Thanks for joining**