Plug Flow Reactor

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

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

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Learning Objectives

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- **Define a Kinetic reaction**
- **Simulate a Plug Flow Reactor(PFR)**
- **Calculate Conversion and Residence time for a reaction in a PFR**

System Requirement

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- **DWSIM v 4.3**

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- **Windows 7**

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- **Windows 7**
- **Any OS: Linux, Mac OS X or FOSSEE OS on ARM.**

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- **How to add components to a flowsheet**
- **How to select thermodynamic packages**
- **How to add material and energy streams and specify their properties**

Prerequisite Tutorials and Files

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

Reaction, Package and Inlet Condition

Reaction	$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$	
Package	**Peng Robinson (PR)**	
Inlet Stream	**Mass Flow**	**3600 kg/h**
	Temperature	**425 °C**
	Pressure	**200 bar**
	Mole fraction	$x_{N_2} = 0.5$
		$x_{H_2} = 0.5$

Reactor Parameters and Reaction Kinetics

Reactor type	Isothermal
Reactor Parameters	Volume= 1 m^3 Length= 1.5 m
Reaction Kinetics	$r_A = KC_a^n$ K=0.004 n=1

Summary

In this tutorial, we have learnt to:

- Define a Kinetic reaction
- Simulate a Plug Flow Reactor (PFR)
- Calculate Conversion and Residence time for a reaction

Assignment

Repeat the simulation with

- **Different compounds**
  Ethylene oxide, Water & Ethylene glycol
  $C_2H_4O + H_2O \rightleftharpoons C_2H_6O_2$
- **Different thermodynamics**
  Raoult's Law

Assignment

Repeat the simulation with

- **Different feed conditions**

  Mass Flow: 1000 kg/h

  Mole Fraction(C_2H_4O): 0.2

  Mole Fraction(H_2O): 0.8

  Temperature: 55 °C

  Pressure: 1 bar

Assignment

Repeat the simulation with

- **Different PFR dimensions**

  Volume: 1 m^3

  Length: 1.2 m

- **Different reaction kinetics**

  r_A=KC_a^n, K=0.005 1/s, n = 1

About the Spoken Tutorial Project

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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

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

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**

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Thanks

- **Thanks for joining**