Shortcut Distillation

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

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

Script: Prof Kannan Moudgalya
Narration: Kaushik Datta
IIT Bombay

Original: 28 May 2015
Revised: 14 November 2019

Learning Objectives

Learning Objectives

In this tutorial, we will learn to:

Learning Objectives

In this tutorial, we will learn to:

- **Simulate a Shortcut distillation column**

Learning Objectives

In this tutorial, we will learn to:

- **Simulate a Shortcut distillation column**
- **Calculate Minimum number of stages**

Learning Objectives

In this tutorial, we will learn to:

- **Simulate a Shortcut distillation column**
- **Calculate Minimum number of stages**
- **Calculate Minimum reflux ratio**

Learning Objectives

In this tutorial, we will learn to:

- **Simulate a Shortcut distillation column**
- **Calculate Minimum number of stages**
- **Calculate Minimum reflux ratio**
- **Calculate Optimal Feed stage location**

Learning Objectives

In this tutorial, we will learn to:

- **Simulate a Shortcut distillation column**
- **Calculate Minimum number of stages**
- **Calculate Minimum reflux ratio**
- **Calculate Optimal Feed stage location**
- **Calculate Condenser and Reboiler duty**

System Requirement

System Requirement

- **DWSIM v 5.8 (Classic UI) Update 3**

System Requirement

- **DWSIM v 5.8 (Classic UI) Update 3**
- **Windows 10 OS**

System Requirement

- **DWSIM v 5.8 (Classic UI) Update 3**
- **Windows 10 OS**
- **Any OS: Linux, Mac OS X or FOSSEE OS on ARM**

Prerequisites

Prerequisites

To practice this tutorial, you should know to

Prerequisites

To practice this tutorial, you should know to

- **Add components to a flowsheet**

Prerequisites

To practice this tutorial, you should know to

- **Add components to a flowsheet**
- **Select thermodynamic packages**

Prerequisites

To practice this tutorial, you should know to

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

Prerequisite Tutorials and Files

- **https://spoken-tutorial.org**

Prerequisite Tutorials and Files

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

Specifications

Compounds	**Benzene, Toluene**	
Thermodynamics	**Raoult's law**	
Feed	**Flow rate** **Pressure** **Mole fractions**	**100 Kmol/h** **1 atm** **Benzene = 0.4** **Toluene = 0.6**
Method	**Fenske-Underwood-Gilliland**	

Column Properties

Reflux ratio	**1.4 times Minimum Reflux Ratio**	
Compound	**Light Key (LK)** **Heavy Key (HK)**	**Benzene** **Toluene**
Product	**Distillate** **Bottoms**	$x_D = 0.99$ $x_B = 0.01$

Results

Parameter	Value
Minimum reflux ratio	1.655
Minimum number of stages	11
Actual number of stages	20
Optimal feed location	9
Condenser Duty	1129.67 kW
Reboiler Duty	1050.86 kW

Summary

- Simulate a Shortcut distillation column
- Calculate Minimum number of stages
- Calculate Minimum reflux ratio
- Calculate Optimal Feed stage location
- Calculate Condenser and Reboiler duty

Assignment

Compounds	**Ethanol, Water**	
Thermodynamics	**Raoult's law**	
Feed	**Flow rate** **Pressure** **Mole fractions**	**100 Kmol/h** **1 atm** **Ethanol = 0.5** **Water = 0.5**
Method	**Fenske-Underwood-Gilliland**	

Assignment

Reflux ratio	1.5 times Minimum Reflux Ratio	
Compound	Light Key (LK) Heavy Key (HK)	Ethanol Water
Product	Distillate Bottoms	$x_D = 0.99$ $x_B = 0.01$

About the Spoken Tutorial Project

- **Watch the video available at https://spoken-tutorial.org/What_is_a_Spoken_Tutorial**
- **It summarises the Spoken Tutorial project**

About the Spoken Tutorial Project

- Watch the video available at https://spoken-tutorial.org/What_is_a_Spoken_Tutorial
- It summarises the Spoken Tutorial project
- 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 https://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 flowsheets**
- **We give honorarium and certificates for those who do this**
- **For more details, please visit this site https://dwsim.fossee.in/flowsheeting-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 https://dwsim.fossee.in/lab-migration-project

Acknowledgements

- **Spoken Tutorial and FOSSEE projects are funded by MHRD, Government of India**

Thanks

- **This tutorial was originally recorded by Prof Kannan Moudgalya in May 2015**