

Shell & Tube Heat Exchanger

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

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

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Learning Objectives

In this tutorial, we will learn to:



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In this tutorial, we will learn to:

- Simulate **Shell & Tube Heat Exchanger**



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- Simulate **Shell & Tube Heat Exchanger**
- Calculate **Outlet stream temperatures**



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- Calculate **Overall Heat Transfer Coefficient**



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- Calculate **Overall Heat Transfer Coefficient**
- Calculate **Heat Exchange Area**
- Calculate **Thermal Efficiency and**



System Requirement



System Requirement

- DWSIM v 4.3



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- Windows 7



System Requirement

- DWSIM v 4.3
- Windows 7
- Any OS: Linux, Mac OS X or FOSSEE OS on ARM



Prerequisites

To practice this tutorial, you should know



Prerequisites

To practice this tutorial, you should know

- Add components to a **flowsheet**



Prerequisites

To practice this tutorial, you should know

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



Prerequisites

To practice this tutorial, you should know

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



Compounds and Inlet stream conditions

Compounds	Water, Methanol	
Inlet Streams	Cold(H ₂ O)	Hot(CH ₃ OH)
Mass Flow	15000 kg/h	25000 kg/h
Mole Fraction	$x_{\text{CH}_3\text{OH}} = 0$	$x_{\text{CH}_3\text{OH}} = 1$
Mole Fraction	$x_{\text{H}_2\text{O}} = 1$	$x_{\text{H}_2\text{O}} = 0$
Temperature	10 °C	80 °C
Pressure	1 bar	5 bar



Heat Exchanger Properties and Property Package

Flow type	Counter Current
Overall HT Coefficient	450 W/[m².K]
Heat Exchanger Area	250 m²
Cold Fluid Pressure Drop	0.002 bar
Hot Fluid Pressure Drop	0.025 bar
Package	Raoult's Law



Shell & Tube Exchanger Properties

Type of Exchanger	2-8 Shell % Tube
Total no of tubes	2048
Tube Spacing	25 mm
Tube Layout	Square
Thermal Conductivity	60 W/mK
Tube Roughness	0.05 mm
Fouling Factor (Tube)	0.00035 Km²/W
Fouling Factor(Shell)	0.00035 Km²/W



Shell & Tube Exchanger Properties

External Diameter for tube	20 mm
Tube thickness	2.5 mm
Tube Length	5 m
Shell Internal Diameter	1000 mm
Baffle Spacing	250 mm
Baffle Cut	25%
Fluid in Shell	Methanol



Summary

In this tutorial, we have learnt to:

- Simulate Shell & Tube Heat Exchanger
- Calculate Outlet stream temperatures
- Calculate Overall Heat Transfer Coefficient
- Calculate Heat Exchange Area
- Calculate Thermal Efficiency and



Assignment

Compounds	Toluene, Styrene	
	Cold(C_7H_8)	Hot(C_8H_8)
Inlet Streams	Cold(C_7H_8)	Hot(C_8H_8)
Mass Flow	50000 kg/h	70000 kg/h
Mole Fraction	$x_{C_7H_8} = 1$	$x_{C_7H_8} = 0$
Mole Fraction	$x_{C_8H_8} = 0$	$x_{C_8H_8} = 1$
Temperature	35 °C	150 °C
Pressure	6.5 bar	3.5 bar



Assignment

Flow type	Counter Current
Cold Fluid Pressure Drop	0.002 bar
Hot Fluid Pressure Drop	0.025 bar
Package	UNIFAC



Assignment

Type of Exchanger	2-16 Shell % Tube
Total no of tubes	1024
Tube Spacing	75 mm
Tube Layout	Square
Thermal Conductivity	70 W/mK
Tube Roughness	0.045 mm
Fouling Factor (Tube)	0 Km²/W
Fouling Factor(Shell)	0 Km²/W



Assignment

External Diameter for tube	60 mm
Tube thickness	5 mm
Tube Length	5 m
Shell Internal Diameter	990.6 mm
Baffle Spacing	250 mm
Baffle Cut	25%
Fluid in Shell	Styrene



About the Spoken Tutorial Project

- Watch the video available at http://spoken-tutorial.org/What_is_a_Spoken_Tutorial
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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



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

- Thanks for joining

