

# **KM 331 PROSES BENZETİM PROGRAMLARI DERS NOTLARI [1-4]**

## **Kaynaklar**

1. Chemcad User Guide and Tutorial, Chemstations, Inc. Version 6.1.
2. Aspen Technology, Inc., Aspen HYSYS ® Version 7.
3. ChemCad Eğitim Notları , Chemstations, Inc- Houston,TX,USA.
4. A Guide for Getting Started in Aspen HYSYS  
Dinu Ajikutira, Sr. Director, Engineering Product Marketing, Aspen Technology, Inc.

# Isı Değişirici Uygulamaları

## Problem Statement:

A 100 kmol/hr stream of benzene at room temperature (298 K) is fed to a heat exchanger at atmospheric pressure. A 100 kmol/hr steam at 398 K, also at atmospheric pressure, is used to heat up the liquid benzene to 350 K prior to sending it in to a reactor. Due to the piping, there is a 0.08 atm pressure drop on both the benzene and steam product lines.

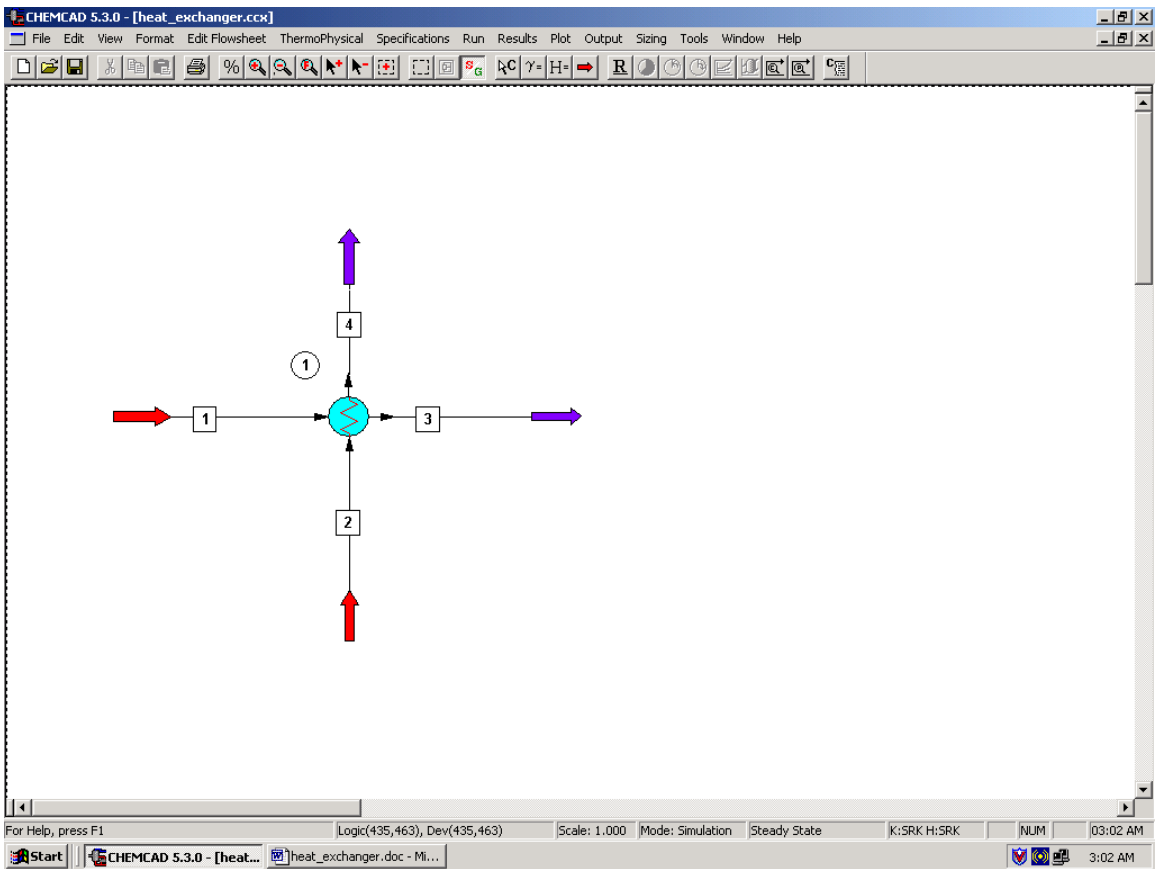
Set up a heat exchanger simulation in CHEMCAD and report the product stream temperatures and vapor fractions, heat duty of the heat exchanger and the LMTD (Log Mean Temperature Difference) for this heat exchange.

## Procedure:

- Step 1: Creating the flow sheet
- Step 2: Entering the components and engineering units
- Step 3: Entering the composition of feed stream
- Step 4: Entering the heat exchanger specs
- Step 5: Running the simulation and retrieving the results

### Step 1: Creating the flow sheet

Go to *new* on the *File* menu and save the blank simulation. Right click on *Heat exchanger* on the CHEMCAD palette and select a heat exchanger with two inlet streams and two outlet streams. Click once on simulation window to paste it. Click on the feed icon on the palette and paste it on the workspace. Similarly, click on the product icon and place it on the workspace (for the vertical feed and product icons, one can right click on the feed/product icons and select the appropriate icons). After making sure that all the necessary icons are placed on the workspace, they can be connected by using *stream*. CHEMCAD automatically assigns numbers to streams and unit operations the order in which they are placed on the workspace. After completing the flow sheet, click once in the **S/G** icon found on the menu bar so that the simulation is changed from *edit* mode to *run* mode. The same icon can be used to toggle between these two simulation modes. Alternatively, one can toggle between *Edit Flowsheet* and *Run Simulation* on the menu bar to achieve the same.



## Step 2: Entering the components and engineering units

Go to the *Thermophysical* on the menu bar and click on *Components List*. Find benzene and water from the CHEMCAD components list and add them to the component list. Go to the *Format* menu and click on *Engineering Units* and select the desired units for such properties as temperature, pressure etc. Click OK to continue.

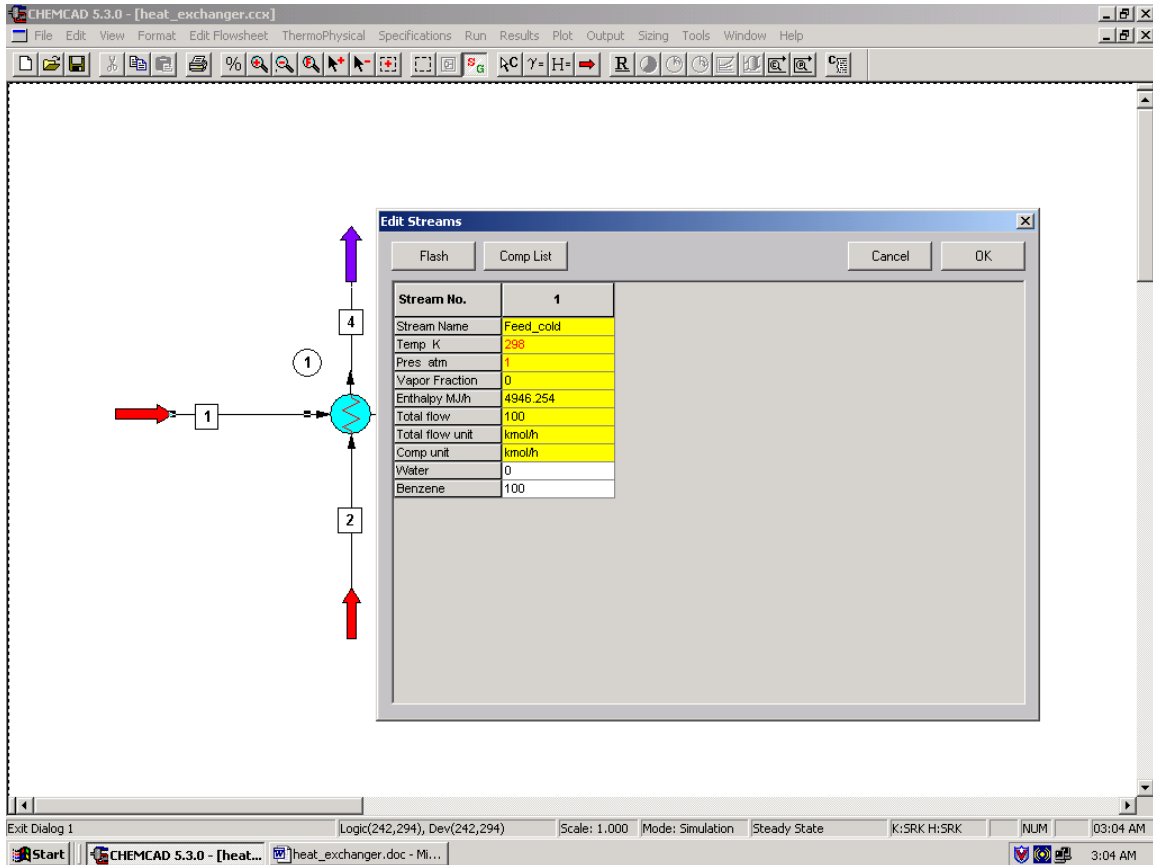
The screenshot displays the CHEMCAD 5.3.0 interface. The main window shows a process flow diagram with a central unit (a blue circle with a lightning bolt) and four streams: Stream 1 (red arrow, left), Stream 2 (red arrow, bottom), Stream 3 (purple arrow, top), and Stream 4 (purple arrow, right). A circled '1' is next to the unit. A 'Component Selection' dialog box is open, showing the following data:

Selected Components		Component Databank		
62	Water	1	Hydrogen	H2
40	Benzene	2	Methane	CH4
		3	Ethane	C2H6
		4	Propane	C3H8
		5	I-Butane	C4H10
		6	N-Butane	C4H10
		7	I-Pentane	C5H12
		8	N-Pentane	C5H12
		9	Neopentane	C5H12
		10	N-Hexane	C6H14
		11	N-Heptane	C7H16
		12	N-Octane	C8H18

The dialog box also includes buttons for 'Delete', 'Clear', 'Add', 'Insert', 'Search for', 'Next', 'Copy components from another job...', 'Cancel', and 'OK'. The status bar at the bottom shows 'For Help, press F1', 'Logic(265,1), Dev(265,1)', 'Scale: 1.000', 'Mode: Simulation', 'Steady State', 'K:SRK, H:SRK', 'NUM', and '03:03 AM'.

### Step 3: Entering the composition of feed stream

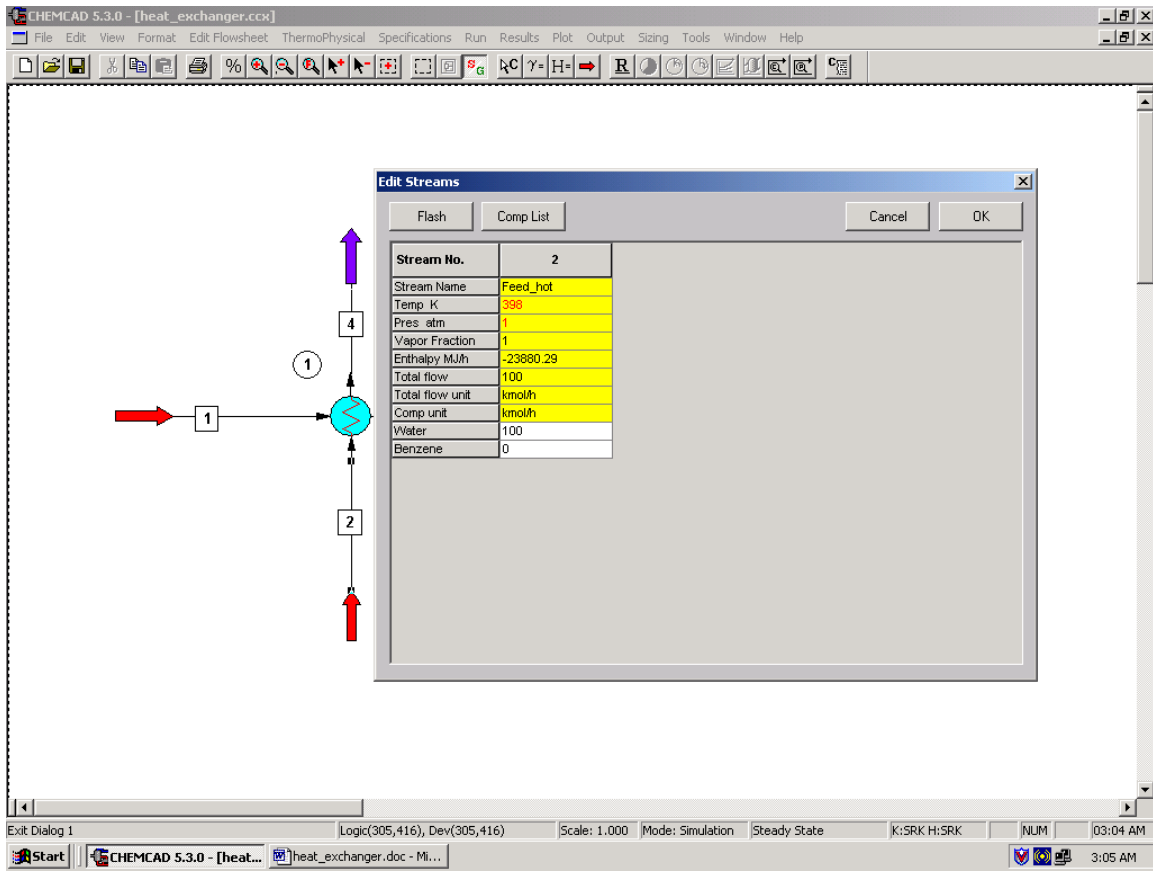
Double click on the feed streams and enter the feed information (temperature, pressure and total flow rate) given in the problem statement. Click once on *Flash* to get the feed stream enthalpy and vapor fraction in feed at the feed conditions.



The screenshot shows the CHEMCAD 5.3.0 interface. In the background, a process flow diagram features a central blue circular unit with four streams: a red arrow labeled '1' entering from the left, a red arrow labeled '2' entering from the bottom, a purple arrow labeled '4' exiting to the top, and a stream labeled '1' exiting to the right. A circled '1' is positioned near the unit. The foreground displays the 'Edit Streams' dialog box, which is open to the 'Comp List' tab. The dialog box contains the following data:

Stream No.	1
Stream Name	Feed_cold
Temp. K	298
Pres. atm	1
Vapor Fraction	0
Enthalpy MJ/h	4946.254
Total flow	100
Total flow unit	kmol/h
Comp unit	kmol/h
Water	0
Benzene	100

The status bar at the bottom of the window shows 'Exit Dialog 1', 'Logic(242,294), Dev(242,294)', 'Scale: 1.000', 'Mode: Simulation', 'Steady State', 'K:SRK H:SRK', 'NUM', and '03:04 AM'. The taskbar at the very bottom shows the Start button and open files: 'CHEMCAD 5.3.0 - [heat...' and 'heat\_exchanger.doc - Mi...'. The system clock shows '3:04 AM'.



#### Step 4: Entering the SCDS Column specs

Double click on the *Heat exchanger*.

##### *Calculation Modes:*

These three modes can be left to the default settings and the reader is encouraged to learn more about other options for the calculation modes by clicking on *Help* button located on the bottom left corner.

##### *Pressure drops:*

Enter the value '0.08' for the pressure drop in both the streams, as given in the problem statement.

##### *Enter one specification only:*

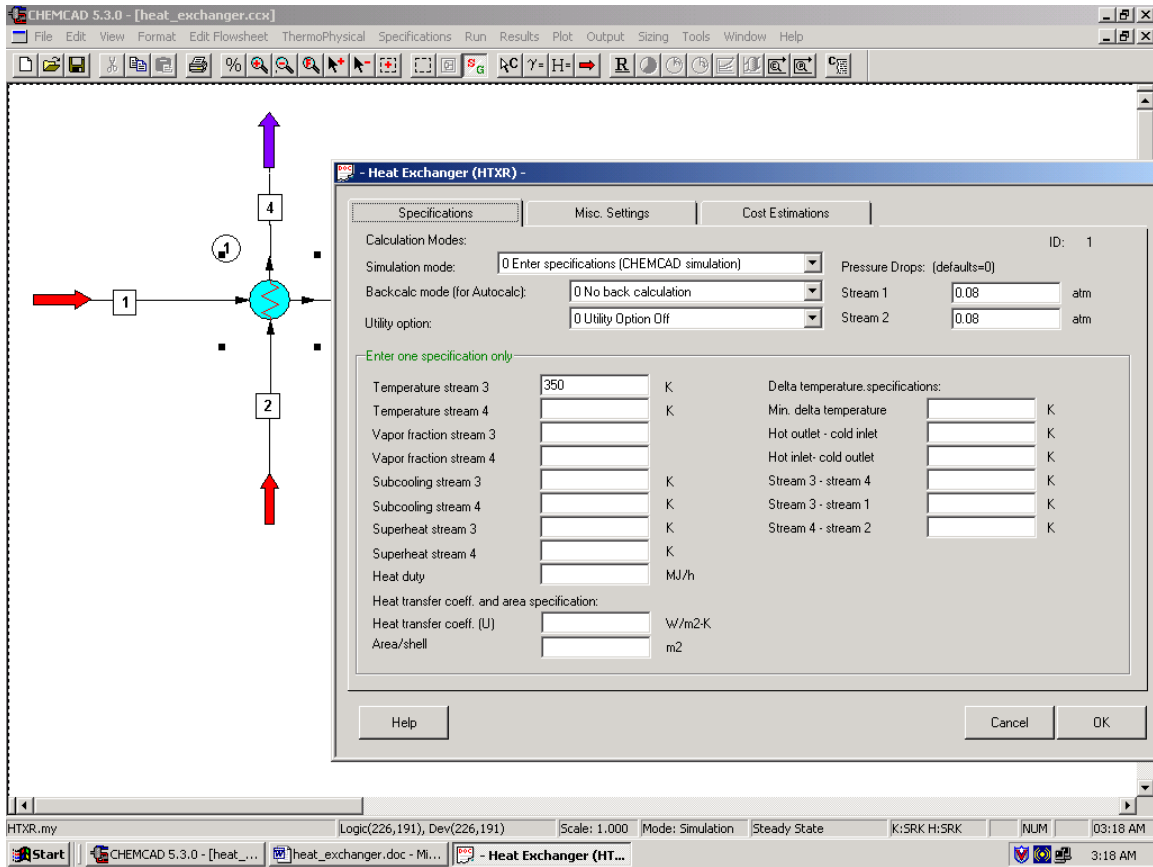
One can enter value for any one of the specifications listed in this field. From the problem statement, it can be seen that the requirement for this particular heat exchanger

is a 350 K temperature for the benzene stream. Enter '350' in the box next to the stream number corresponding to the benzene product.

*Note:*

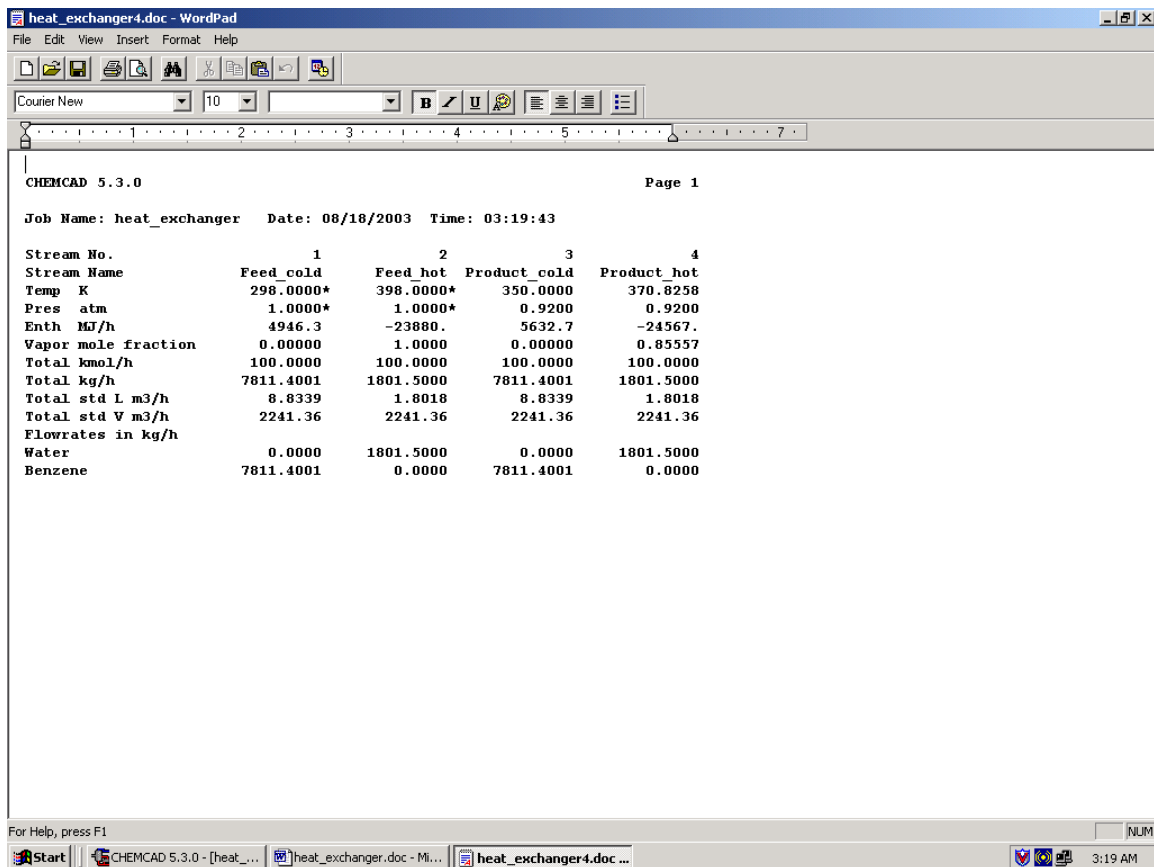
Miscellaneous settings and Cost estimations fields are optional and can be left blank, as pertinent information is not provided in the problem statement.

Click on *Ok* to continue.



## Step 5: Running the simulation and retrieving the results

After entering the available information on the workspace as described in the previous steps, one can run the simulation by clicking on R on the menu bar. Alternatively, one can run the simulation by clicking on *Run* on the menu bar and selecting *Run all*. The status of the simulation can be found at the bottom left hand corner of the screen. The message, *Run Finished* appears in this place if the run is successfully completed. To view the product stream properties, one can either double click on the individual product streams or by clicking *Results* on the menu bar and selecting *Stream Compositions* and further selecting *All Streams*. The results obtained from the latter method will be in a WordPad file.



CHEMCAD 5.3.0 Page 1

Job Name: heat\_exchanger Date: 08/18/2003 Time: 03:19:43

Stream No.	1	2	3	4
Stream Name	Feed_cold	Feed_hot	Product_cold	Product_hot
Temp K	298.0000*	398.0000*	350.0000	370.8258
Pres atm	1.0000*	1.0000*	0.9200	0.9200
Enth MJ/h	4946.3	-23880.	5632.7	-24567.
Vapor mole fraction	0.00000	1.0000	0.00000	0.85557
Total kmol/h	100.0000	100.0000	100.0000	100.0000
Total kg/h	7811.4001	1801.5000	7811.4001	1801.5000
Total std L m3/h	8.8339	1.8018	8.8339	1.8018
Total std V m3/h	2241.36	2241.36	2241.36	2241.36
Flowrates in kg/h				
Water	0.0000	1801.5000	0.0000	1801.5000
Benzene	7811.4001	0.0000	7811.4001	0.0000

All the results associated with the heat exchanger can be found by clicking on *Results* menu and selecting *Unit Op's* and then the heat exchanger. The results will then be available in a WordPad file.



heat\_exchanger5.doc - WordPad

File Edit View Insert Format Help

Courier New 10

**B** U

1 2 3 4 5 6 7

CHEMCAD 5.3.0 Page 1

Job Name: heat\_exchanger Date: 08/18/2003 Time: 03:20:21

Heat Exchanger Summary

Equip. No.	1
Name	
Pressure drop 1 atm	0.0800
Pressure drop 2 atm	0.0800
T Out Str 1 K	350.0000
Calc Ht Duty MJ/h	686.4331
LMTD (End points) K	59.5530
LMTD Corr Factor	1.0000
Str1 Pout atm	0.9200
Str2 Pout atm	0.9200

For Help, press F1

Start | CHEMCAD 5.3.0 - [heat\_... | heat\_exchanger.doc - Mi... | heat\_exchanger5.doc ... | NUM 3:20 AM