CHEMCAD TOWR Distillation Column

SUPERTEAM 2005

Experiment 300
ECH4404L

By:
Rogelio Boyd
Jared Brewer

Introduction

The purpose of this module is to introduce the basics of distillation on CHEMCAD version 5.5. The simulation is based on experiment 300 in the Unit Operations Laboratory.

Basic Setup

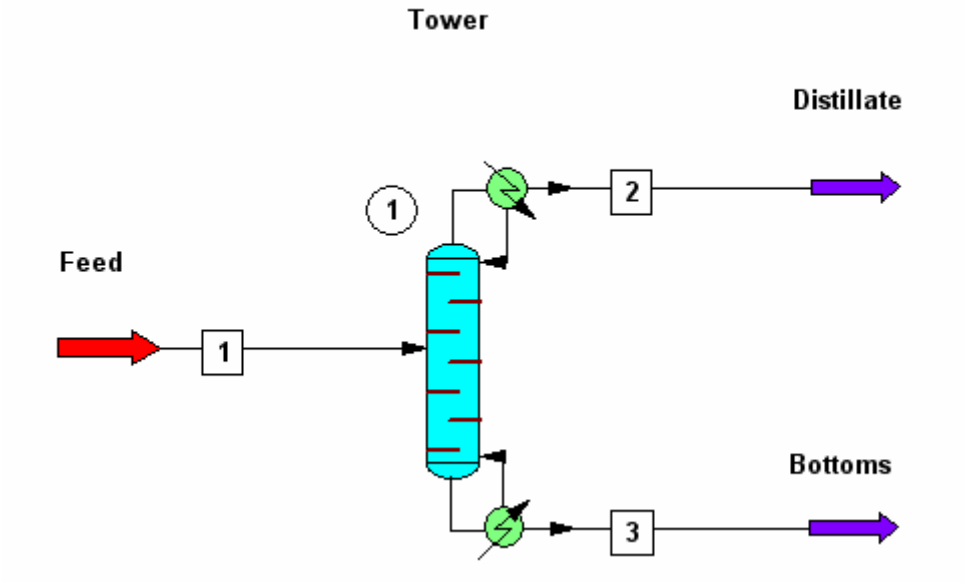


Figure #1

First you start by pasting the representative symbols from the palette on the blank workspace and you connect them as shown in the figure above.

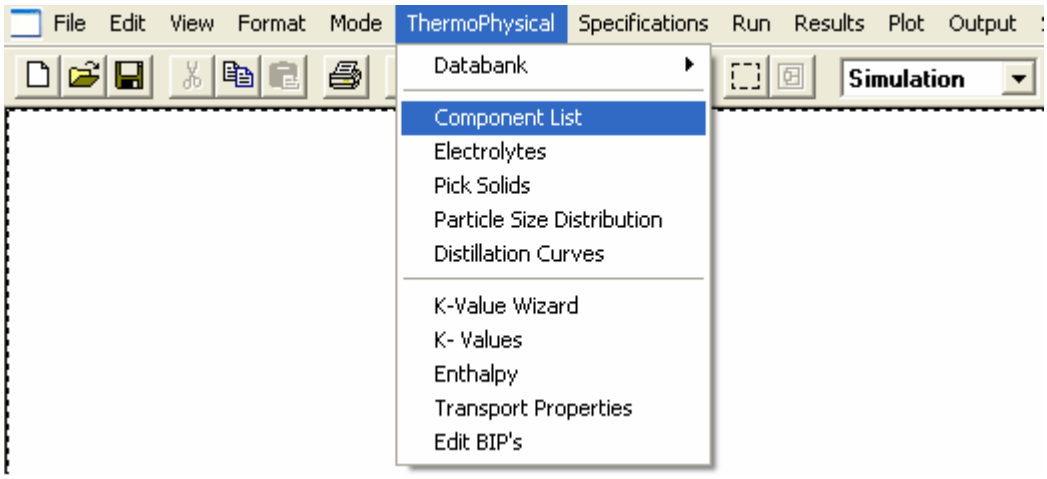


Figure #2

Step number 2 is to select the components. As seen in the picture above go to *ThermoPhysical* in the menu options and the click on *Component List*.

In our case we will use Ethanol and Propanol. **Note:** Ethanol should be chosen first because it is the more volatile species.

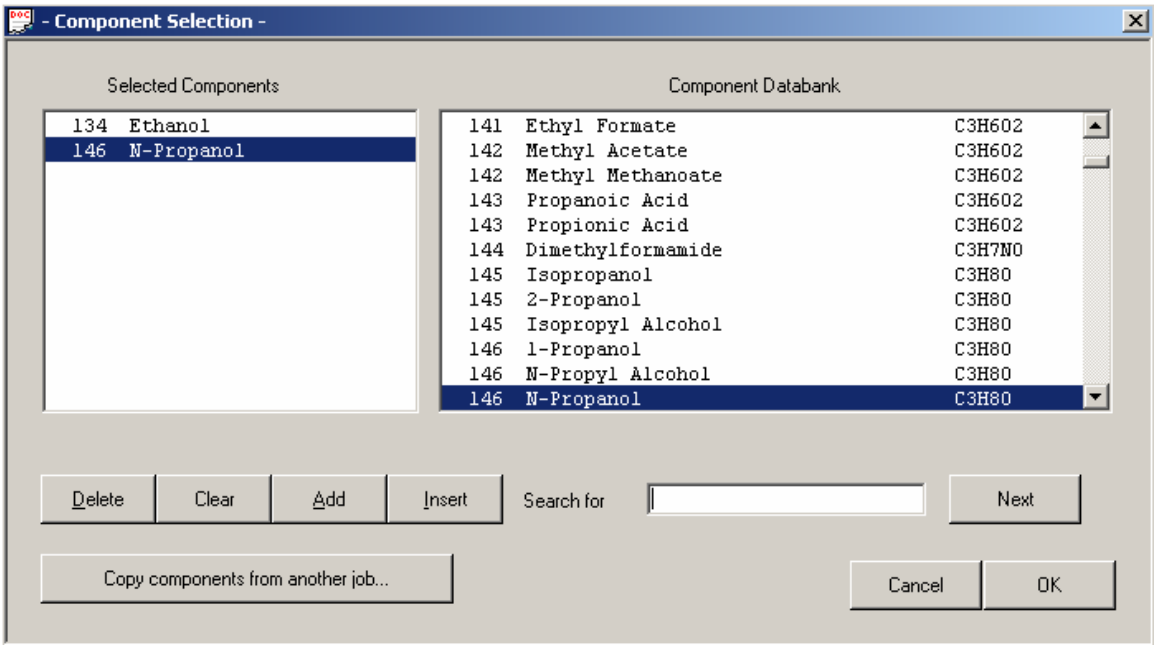


Figure #3

For a proper and smooth simulation it is best if you state the appropriate units. From the menu, select *Format* and then click on *Engineering Units*.

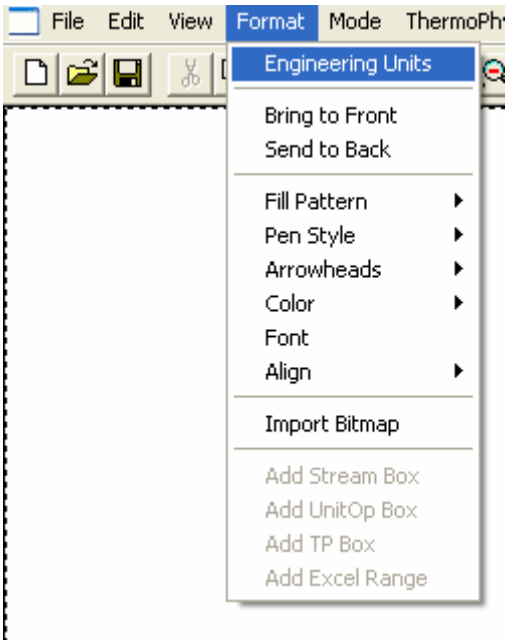


Figure #4

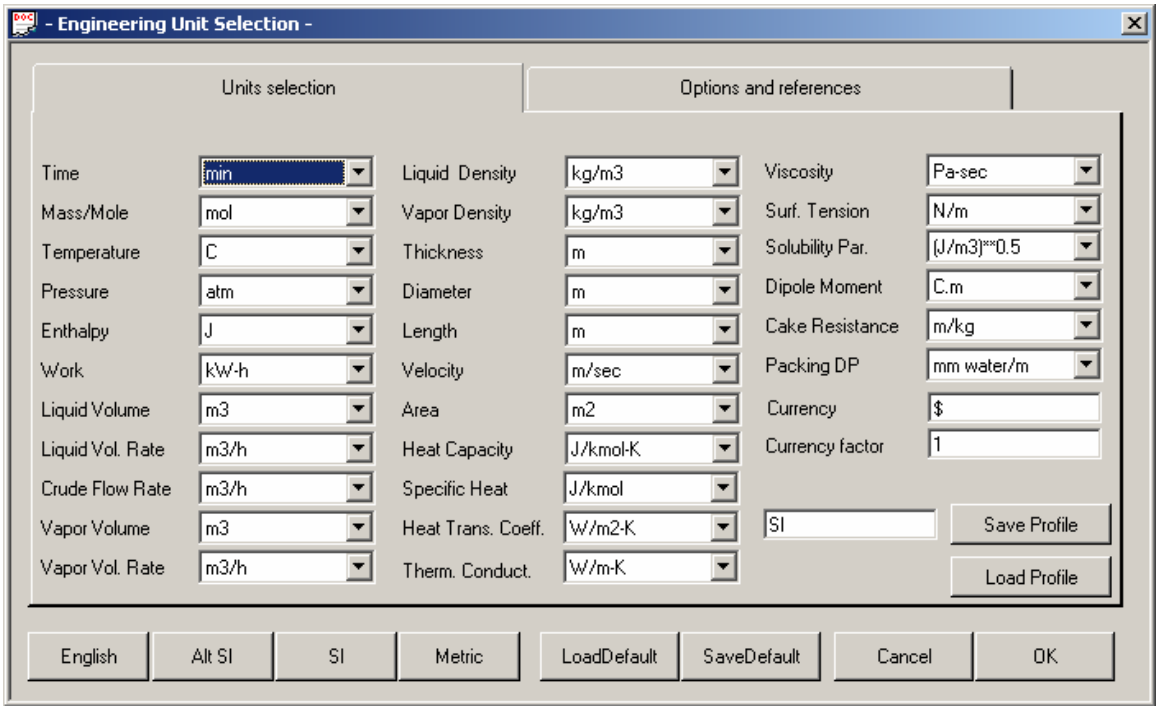


Figure #5

For convenience, we shall change the component flow units from mol/time to mol fractions. This can be done by clicking the *Options and references* tab while in the Engineering Units Selection screen.

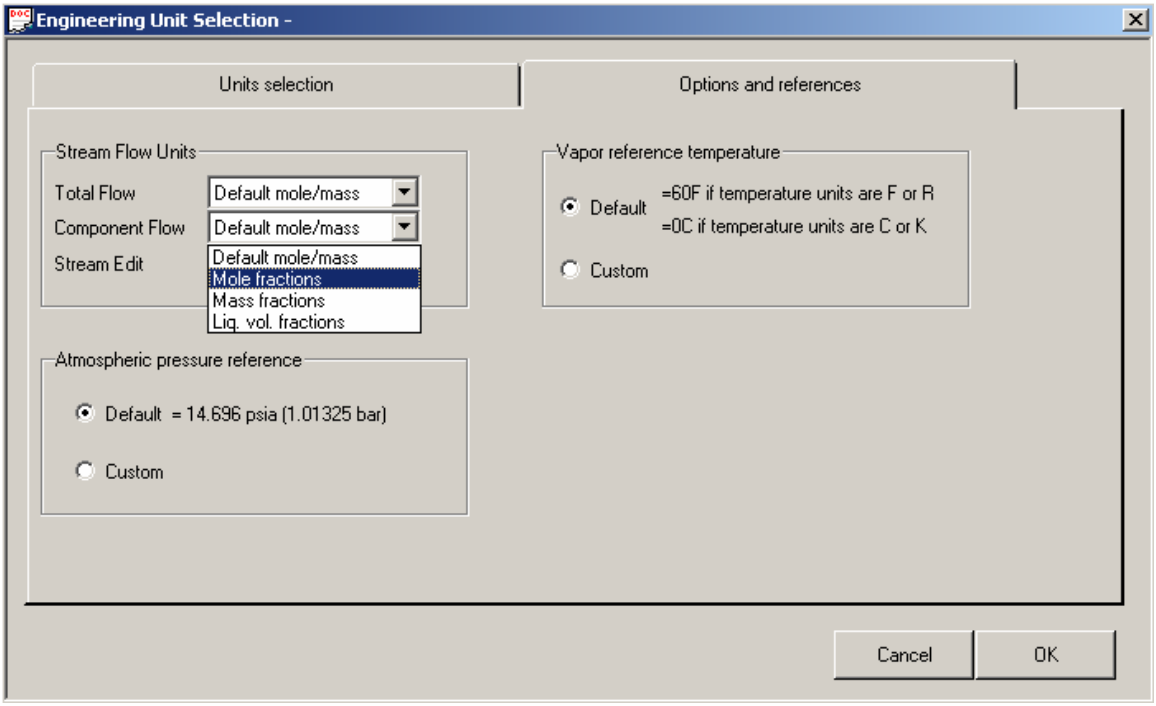


Figure #6

Before starting the simulation you have to set the correct K-values calculation. To see the K-value wizard select *ThermoPhysical* from the menu and then select the *K-value wizard* option. From the list of models select the *Wilson* model.

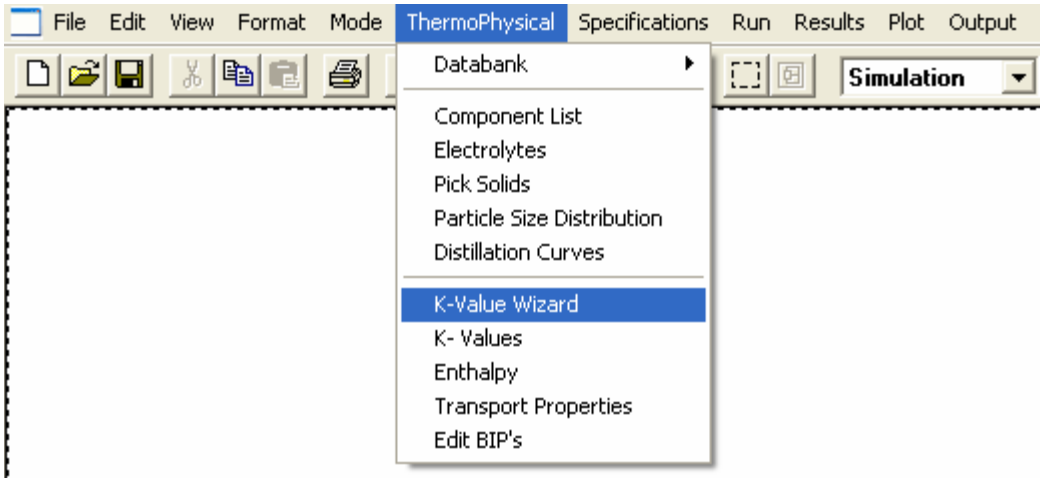


Figure #7

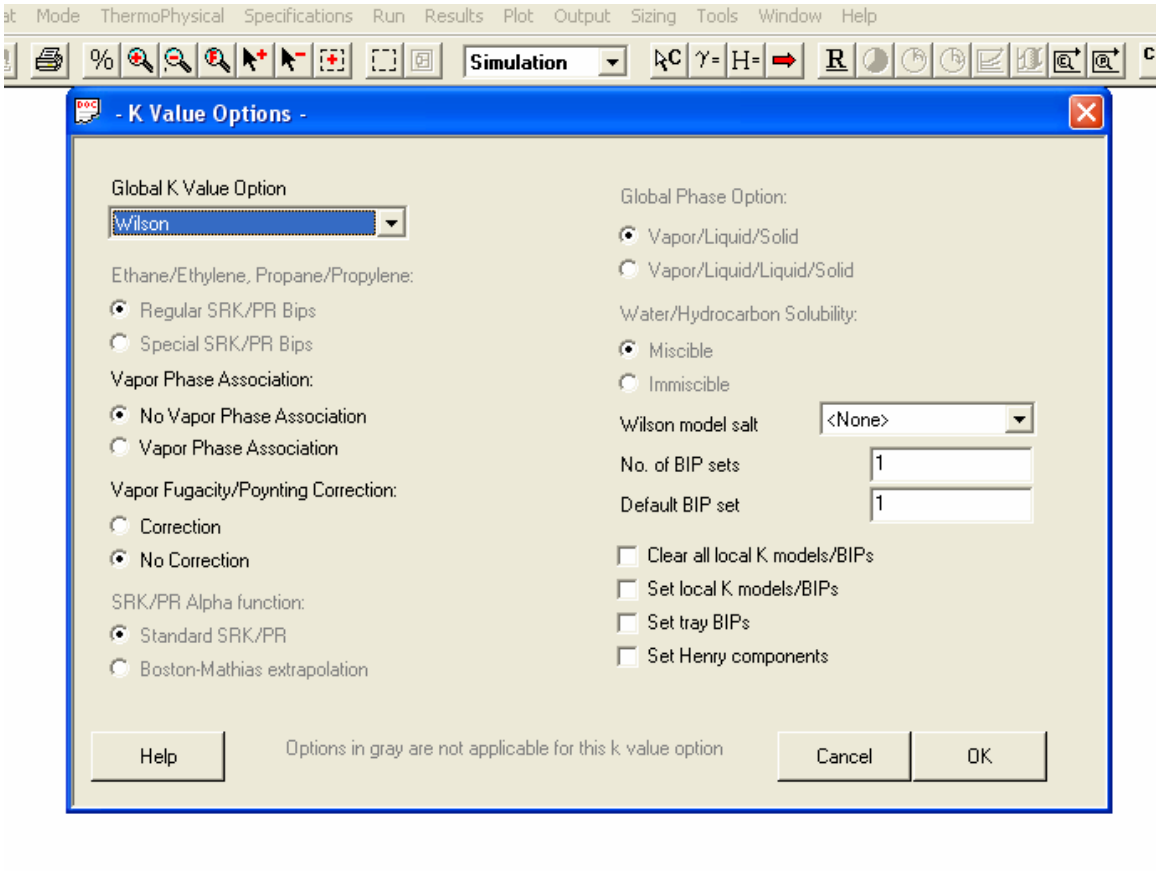


Figure #8

The starting feed is 50 ºC and 3.5 mol/min, 0.5 mol fraction and 0.5 mol fraction ethanol and propanol respectively.

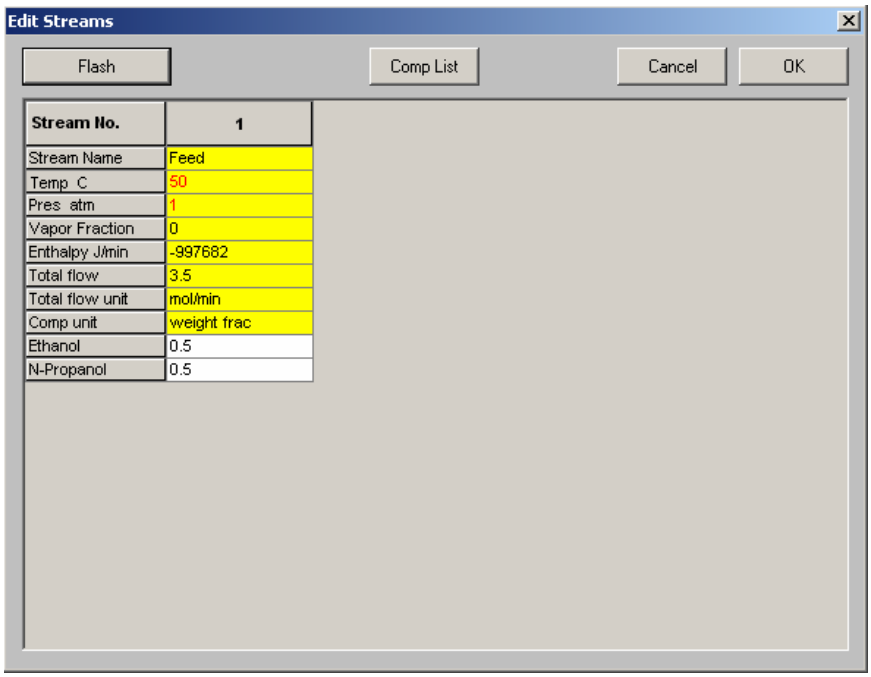


Figure #9

Tower Configuration

To modify the specs of the column double click on the tower and sub menu would appear.
General

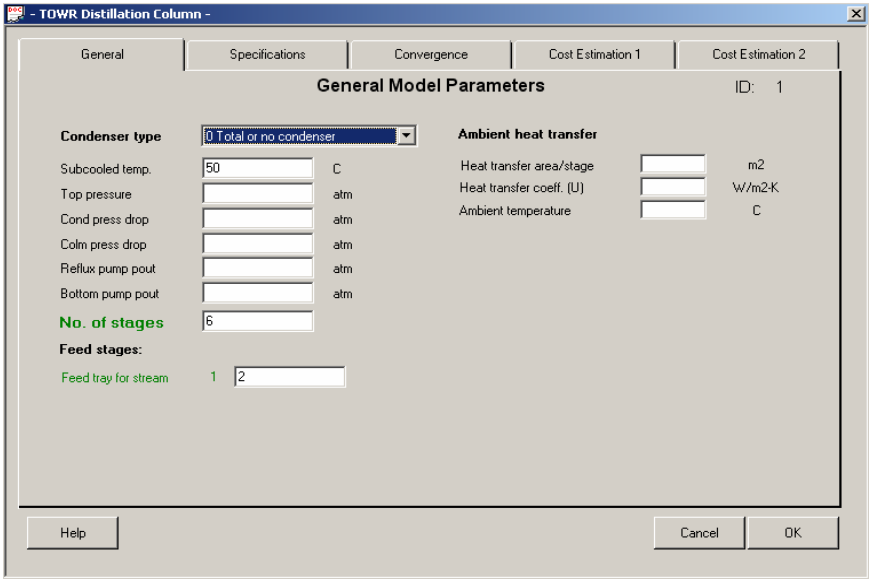


Figure #10

- Set the condenser to total or no condenser, option number 0.

Note: The condenser for the Unit Operations Laboratory is a total condenser.

- Set sub-cooled temperature to 50 °C.

Note: This temperature corresponds to the measured temperature of the reflux stream.

- Set number of stages to 6 and the Feed tray for stream to stage 2.

Note: Six stages in Chemcad is equivalent to four trays, one reboiler, and one condenser.

Note: Setting the feed tray to stage two is equivalent to the top of the column. The location will depend on the actual feed location of the unit being simulated.

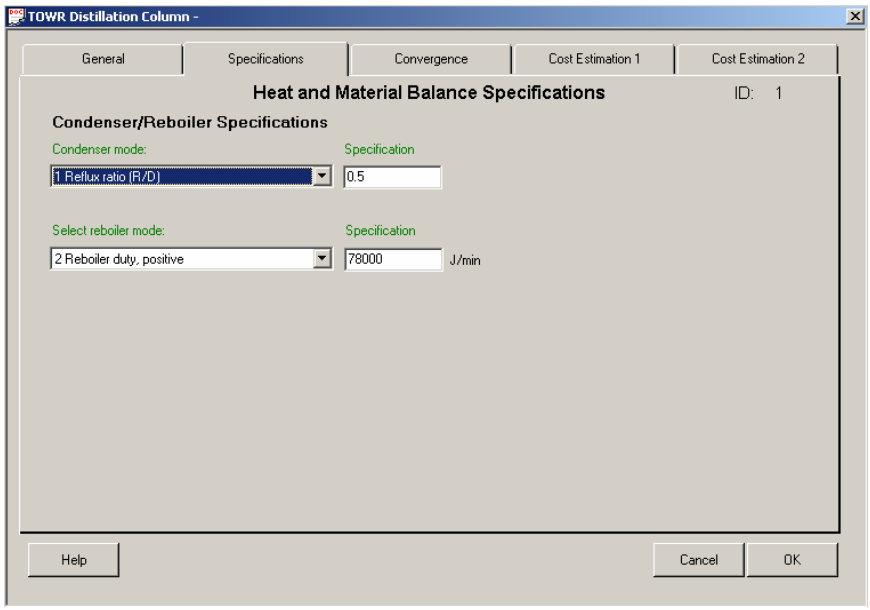


Figure #11

The next set of specifications, set the condenser mode to option number 1 Reflux ratio and set the ratio to 0.500, for the reboiler mode select option number 2 Reboiler duty positive and set it to 78000 J/min which is equivalent to 1300 W (the effective heat duty of the reboiler in the lab).

After you finished with the steps described above you are set to run the simulation. From the menu go to *Run* and select the option *Run All*.

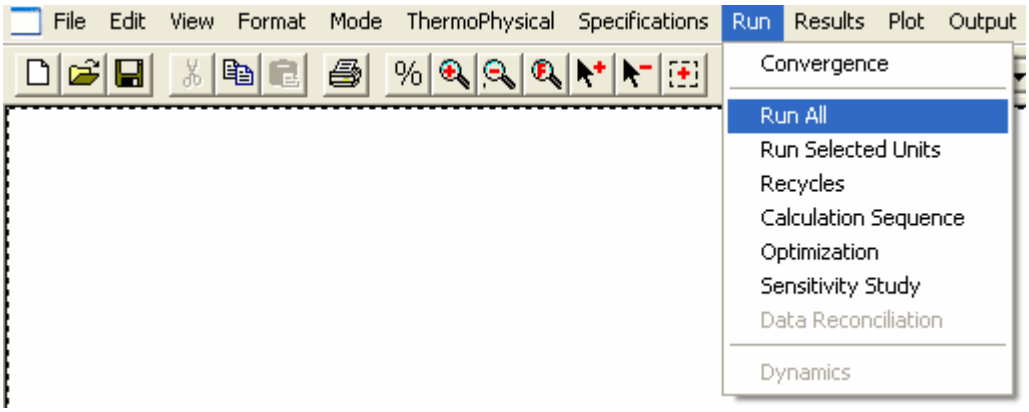


Figure #12

Next, it is necessary to obtain the data from the simulation. This is done by going to stream compositions from the Results menu. After clicking on *Stream Compositions* followed by *All Streams*, a window showing the compositions for each stream will appear.

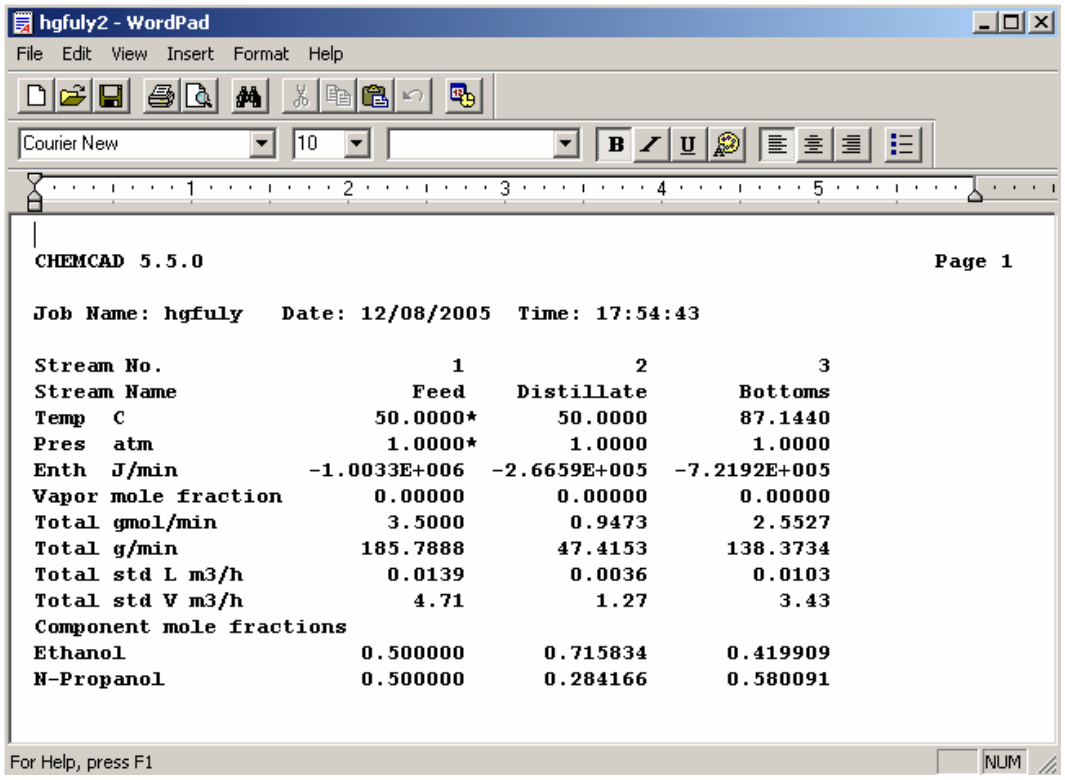


Figure #13

Next, you need to get the table which has the Unit Op's summary. This is found under the results menu by clicking on *Unit Op's*.

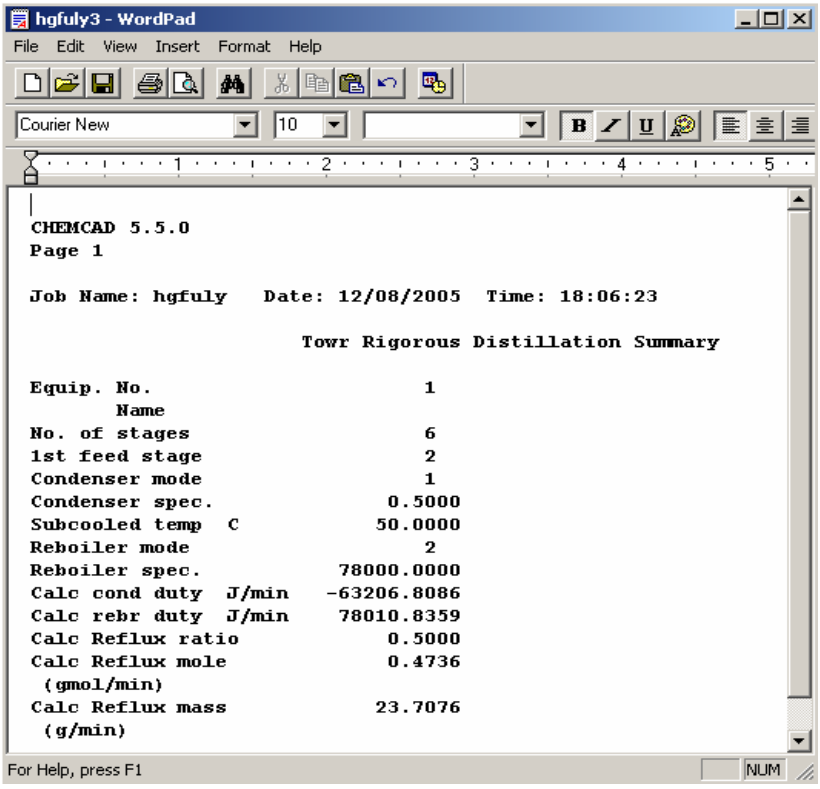


Figure #14

Another result that is desired is the tower profile. This is also found under the results menu by clicking on *Tower Profiles.*

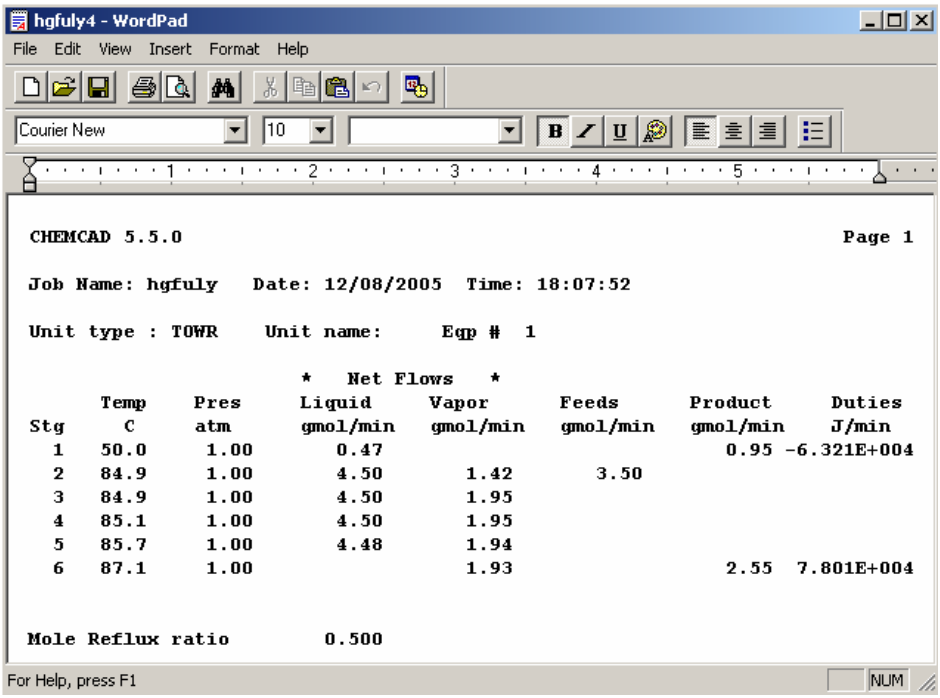
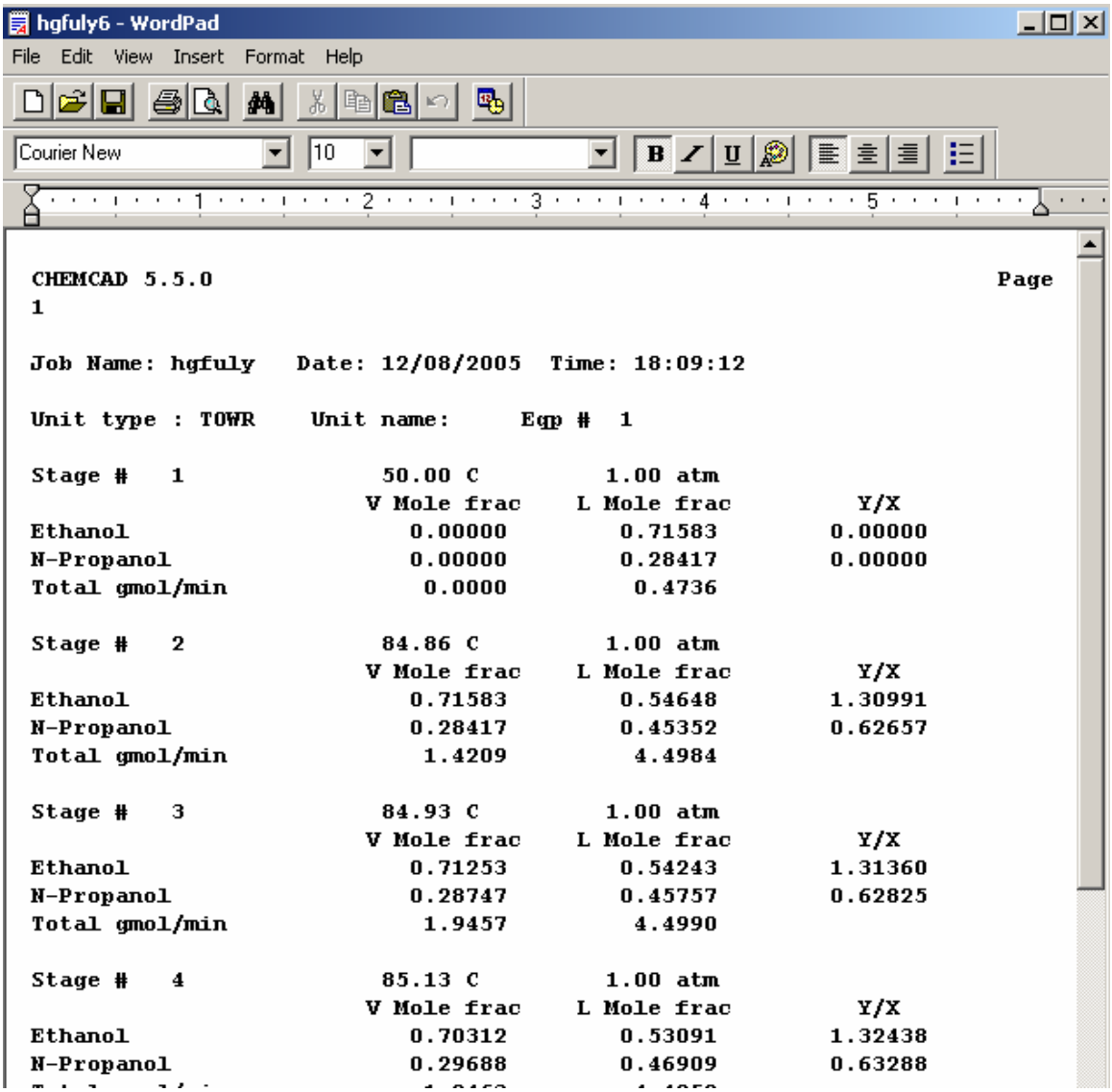


Figure #15

The last two tables of results that are desired are the tray compositions and tray properties. These are found under the results menu by clicking on *Tray Compositions* or *Tray Properties.*



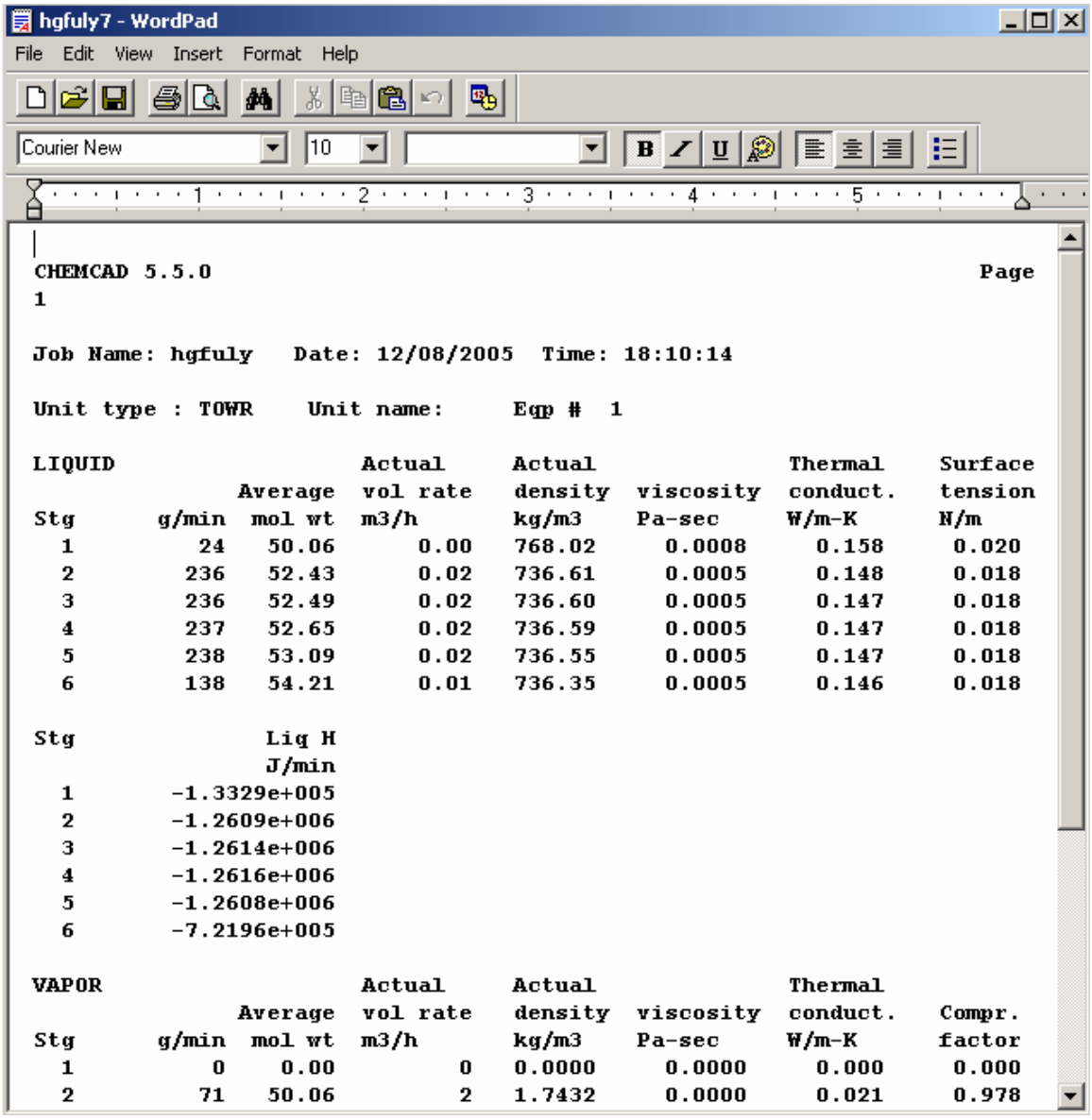
CHEMCAD 5.5.0 Page 1

Job Name: hgfuly Date: 12/08/2005 Time: 18:09:12

Unit type : TOWR Unit name: Eqp # 1

Stage # 1	50.00 C	1.00 atm	
	V Mole frac	L Mole frac	Y/X
Ethanol	0.00000	0.71583	0.00000
N-Propanol	0.00000	0.28417	0.00000
Total gmol/min	0.0000	0.4736	
Stage # 2	**84.86 C**	**1.00 atm**	
	V Mole frac	L Mole frac	Y/X
Ethanol	0.71583	0.54648	1.30991
N-Propanol	0.28417	0.45352	0.62657
Total gmol/min	1.4209	4.4984	
Stage # 3	**84.93 C**	**1.00 atm**	
	V Mole frac	L Mole frac	Y/X
Ethanol	0.71253	0.54243	1.31360
N-Propanol	0.28747	0.45757	0.62825
Total gmol/min	1.9457	4.4990	
Stage # 4	**85.13 C**	**1.00 atm**	
	V Mole frac	L Mole frac	Y/X
Ethanol	0.70312	0.53091	1.32438
N-Propanol	0.29688	0.46909	0.63288

Figure #16 – Tray Compositions



hgfuly7 - WordPad

File Edit View Insert Format Help

Courier New 10

CHEMCAD 5.5.0 Page 1

Job Name: hgfuly Date: 12/08/2005 Time: 18:10:14

Unit type : TOWR Unit name: Eqp # 1

LIQUID Stg	Average g/min	mol wt	Actual vol rate m3/h	Actual density kg/m3	viscosity Pa-sec	Thermal conduct. W/m-K	Surface tension N/m
1	24	50.06	0.00	768.02	0.0008	0.158	0.020
2	236	52.43	0.02	736.61	0.0005	0.148	0.018
3	236	52.49	0.02	736.60	0.0005	0.147	0.018
4	237	52.65	0.02	736.59	0.0005	0.147	0.018
5	238	53.09	0.02	736.55	0.0005	0.147	0.018
6	138	54.21	0.01	736.35	0.0005	0.146	0.018

Stg	Liq H J/min
1	-1.3329e+005
2	-1.2609e+006
3	-1.2614e+006
4	-1.2616e+006
5	-1.2608e+006
6	-7.2196e+005

VAPOR Stg	Average g/min	mol wt	Actual vol rate m3/h	Actual density kg/m3	viscosity Pa-sec	Thermal conduct. W/m-K	Compr. factor
1	0	0.00	0	0.0000	0.0000	0.000	0.000
2	71	50.06	2	1.7432	0.0000	0.021	0.978

Figure #17 – Tray Properties