# 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., Apsen 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.

# **Plug Flow Reactor with Multiple Reactions**

#### THE PROBLEM STATEMENT

Allyl chloride is to be produced in a 12-ft. long 2-in ID tube operating at isothermal PFR. The feed is a 4:1 molar ratio of propylene to chlorine and enters at a feed rate of 0.85 lbmole/hr and 2 atm of pressure and temperature of 1000 Rankine. The reactor pressure is assumed to be constant.

$$Cl_{2} + C_{3}H_{6} \xrightarrow{k_{1}} C_{3}H_{5}Cl + HCl \qquad ....Reaction1$$

$$Cl_{2} + C_{3}H_{6} \xrightarrow{k_{2}} C_{3}H_{6}Cl_{2} \qquad ...Reaction2$$

The rate constants have units of  $lbmoles/(hr-ft^3-atm^2)$  and are:

$$k_1 = 206000 * \exp(\frac{-27200}{RT})$$
$$k_2 = 11.7 * \exp(\frac{-6860}{RT})$$

where *T* is in degrees Rankine and R is in Btu/(lbmole  $^{\circ}$ R). The rate expressions are

$$r_{1} = k_{1} \times P_{C_{3}H_{6}} P_{Cl_{2}}$$
$$r_{2} = k_{2} \times P_{C_{3}H_{6}} P_{Cl_{2}}$$

Calculate

- 1) The exiting stream concentrations from the reactor.
- 2) Plot the change in concentration of the reactants and products along the volume of the reactor.

# **Procedure:**

Step 1: Creating the flow sheetStep 2: Entering the components and formatting engineering unitsStep 3: Entering the feed stream compositionStep 4: Entering the reactor specsStep 5: Running the simulation and retrieving the results

### Step 1: Creating the flow sheet

Select and right click on the *kinetic reactor* and choose the *kinetic reactor #2 (plug flow reactor), feed* and *product* icons on the workspace. Connect the three using the *stream*. Click on the drop down menu that currently says *Flowsheet* and change it to *Simulation*.



# Step 2: Entering the components and formatting engineering units

Go to the *Format* menu and click on *Engineering Units* and select the desired units for such properties as R for temperature, and atm for pressure etc. Use *English* units option to convert all units at the same time. Click OK to continue.

👺 - Engineering Unit Selection - 🛛 🔀					
Stream Flow Units Total Flow Defa	ult mole/mass 💌	Component Flow	efault mole/mass 💌	Stream Edit Au	tomatic conversion 💌
Time	h 💌	Liquid Density	lb/ft3 🗨	Viscosity	сР
Mass/Mole	Ibmol 💌	Vapor Density	lb/ft3	Surf. Tension	dyne/cm 💌
Temperature	R	Thickness	ft 💌	Solubility Par.	(cal/cc)**0.5 🗨
Pressure	atm 💌	Diameter	ft	Dipole Moment	debyes 💌
Enthalpy	MMBtu 💌	Length	ft	Cake Resistance	ft/lb 💌
Work	hp-hr 💌	Velocity	ft/sec 💌	Packing DP	in water/ft 🛛 💌
Liquid Volume	ft3 💌	Area	ft2 💌	Currency	\$
Liquid Vol. Rate	ft3/hr 💌	Heat Capacity	Btu/Ibmol-F	Currency factor	1
Crude Flow Rate	BPSD 💌	Specific Heat	Btu/lbmol		
Vapor Volume	ft3 💌	Heat Trans. Coeff.	Btu/hr-ft2-F	ENGLISH	Save Profile
Vapor Vol. Rate	ft3/hr 💌	Therm. Conduct.	Btu/hr-ft-F		Load Profile
English     Alt SI     SI     Metric     LoadDefault     SaveDefault     Cancel     OK					

Go to the *Thermophysical* on the menu bar and click on *Components List*. Find propylene, chlorine, hydrogen chloride, allylchloride and 1,2-DiCl-Propane from the CHEMCAD component databank and click *Add*.

2	- Compone	nt Selection	] -					
	Selec	ted Component	s			Component Da	itabank	
	23 Pr 105 Ch 104 Hy 255 A1 259 1,	opylene lorine drogen Chl lyl Chlori 2-Dichloro	oride de propane		251 252 253 254 255 255 256 257 257 258 258 258	1,2-Diaminoethane Acrolein Acrylic Acid Vinyl Formate Allyl Chloride 3-Chloropropene 1,2,3-Trichloropropane Propionitrile Propanenitrile Cyclopropane Trimethylene 1,2-Dichloropropane	C2H8N2 C3H40 C3H402 C3H5C1 C3H5C1 C3H5C13 C3H5C13 C3H5N C3H5N C3H6 C3H6 C3H6C12	
	Delete Copy o	Clear components fro	<u>A</u> dd m another job	<u>I</u> ns	ert	Search for	Cancel	Next OK

When the *Thermodynamic Suggestions* window appears, input the desired ranges of temperatures and pressures, then click OK. (Also click OK through the next 3 windows that pop up.)

🗒 - Thermodynamic Suggestions -						
Thermodynami	cs Wizard					
The selection of thermodynamic models is based on the component class, data availibility as well as the T/P operation range of the process. Use the suggestions of the expert system as a guide only						
Please enter the temperat	Please enter the temperature/pressure range of the process:					
Temperature Min	493.47	R				
Temperature Max	1500	R				
Pressure Min	1	atm				
Pressure Max	10.2069	atm				
Bip data threshhold	0.5					
	Cancel	ОК				

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

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

Edit Streams			
Flash	Comp List	Cancel	ОК
Stream No.	1		
Stream Name	Feed		
Temp R	1000		
Pres atm	2		
Vapor Fraction	1		
Enthalpy MMBtu/h	0.01489161		
Total flow	1		
Total flow unit	lbmol/h		
Comp unit	lbmol/h		
Propylene	0.8		
Chlorine	0.2		
HydrogenChloride	0		
Allyl Chloride	0		
1,2-DiCl-Propane	0		
,			

#### **Step 4: Entering the reactor specs**

Double click on the reactor.

General Specifications Page:

a. Number of reactions: Since there are two reactions in the given problem, enter '2'

b. *Reactor Pressure:* Enter the reactor pressure as given in the problem statement (2 atm)

c. *Pressure Drop:* There is no pressure drop in the reactor given in the problem statement.

d. *Kinetic Rate Expression:* There are two options for this. The default option (*Standard*) is used when the rate equation is in standard form. The other option (*User Specified*) is used when the rate law is not in its standard form and the user needs to enter this manually. For more information on this, the user can always click on the *help* button that appears at the bottom left corner on this page. For this problem, the kinetic rate expression is given, so select the (*User Specified*) option.

e. *Reaction Phase:* Since the reactants and products are in vapor phase, click on the *vapor only* option.

f. *Specify Reactor Type:* As the reactor described in the problem statement is a plug flow reactor, *PFR* should be selected form the drop box.

g. *Thermal Mode:* As the temperature of the reaction is given at 1000 Rankine, select *isothermal* and imput 1000 in the box next to it.

h. *Specify Calculation Mode:* As the conversion is to be calculated, *Specify Volume, Calculate Conversion* option should be selected.

i. *Reactor Volume:* This can be left blank or can be calculated. The volume can be specified as a combination of the reactor diameter and length in *more specifications*.

j. *Key Component:* The key component is to be specified when we choose the *Specify conversion, Calculate volume* option. So this can be left blank

k. *Conversion:* This needs to be left blank, as this is the value that is calculated in the simulation.

📁 - Kinetic Reactor (KR	REA) -			
General Specifica	ations	More Spec	ifications	
Number of reactions	2		ID: 1	
Reactor pressure	2	atm		
Pressure drop		atm		
Kinetic rate expression	User specified		•	
Specify reactor type: PFR (Plug Flow)	•	C Liquid only Vapor only Liquid reaction Vapor reaction	n, Mixed phase n, Mixed phase	
Thermal Mode:				
<ul> <li>Isothermal (specify tem</li> <li>Adiabatic (no heat excl</li> <li>Specify heat duty</li> <li>Spec PFR temp. profile</li> <li>Specify PFR utility U</li> </ul>	p) [· hange) ; (later) [	1000	R MMBtu/h Btu/hr-ft2-F	
Specify calculation mode. Specify volume, Calcul Specify conversion, Ca Reactor Volume Key Component	ate conversion Ilculate volume f one>	t3 Conversion		
Help		Cance	el OK	

# Don't Click OK yet! There is more to complete in the More Specifications page!

More Specifications:

Length of tubes: Enter the Length of the reactor specified in the problem statement (12 ft)

*Diameter of tubes:* Enter the Length of the reactor (note: convert 2 inches to feet = 0.1667 ft)

Number of tubes: Enter '1'

*# of steps, Stepsize* and *Tolerance* can be left blank as these are optional fields.

*Reaction Engineering Units:* Change the units so that the units are consistent with the rate law (Change *time* units to *minutes*)

*Temperature reference for heat of reaction:* Can be left blank. Chemcad chooses the default reference temperature.

Edit reaction number: Can be left blank.

Ľ	Kinetic Reactor (KRE	A) -						×
	General Specifica	ations		м	lore Specificatio	ns 1		
	Length of tubes 1 Diameter of tubes 0 Number of tubes 1 Number of steps 5 Stepsize 7 Tolerance	2.1667	ft ft	Speci (Therr	PF Specific fy utility flow dire mal mode 5 only Counter curren	R cations ection		
	Reaction Engineering Units Concentration Flag: 0 moles/volume Activation E/H of Rxn Ur 0 Btu	s Volume Unit: 0 Cubic feet nit: Molar Flow Un 0 Lb-moles	iit:	• •	Time Unit 1 Minutes Mass Flov 0. Lb	: v Unit:	•	
	Temp. reference for heat of <b>Calculated variab</b> Utility Temp at L Overall IG Heat of Rxn Overall Liq Heat of Rxn	reaction		R R MM	Edit reaction no 18tu/h 18tu/h	umber		
	Help				Cancel	ОК		

Click OK after completing the specifications page. A new window appears and the stoichiometric coefficients for *Reaction 1* (The reaction number is displayed on the top left hand corner of this window) of all the components are entered in this window as shown in the following figures. Also, enter the values in for the activation energy and the frequency factor as shown below. Click OK after entering these coefficients.

👺 - Kinetic Data -					X
Reaction Nu	mber: 1				
Frequency factor	206000	Beta factor		Specifi	ed heat of reaction is
Activation energy	27200	Heat of reac	tion	Ideal g	gas state 💌
Component	Stoichiometric coefficient	Exponential factor	Adsorption factor	Adsorption energy	Adsorption exponent
2 Chlorine 💌	.1				
1 Propylene 💌	.1				
4 Allyl Chloride 💌	1				
3 HydrogenChloric 💌	1				
<none></none>	]				
<none></none>	]				
<none></none>	]				
<none></none>	]				
<none></none>	]				
<none></none>	]				
Help C	Edit next reaction Edit specified rxn Exit reactions	Rxn #		Cancel	ОК

Similarly, enter the stoichiometric constants for *reaction 2* and click OK.

📁 - Kinetic Data -						X
Reaction Nu	imber: 2					
Frequency factor	11.7	Beta factor		Specif	ied heat of reaction is	
Activation energy	6860	Heat of reac	tion	Ideal	gas state 📃 💌	
Component	Stoichiometric coefficient	Exponential factor	Adsorption factor	Adsorption energy	Adsorption exponent	
2 Chlorine 🖉	-1					
1 Propylene 🗨	.1					
51,2-DiCl-Propan	1					
<none></none>						
<none></none>						
<none></none>						
<none></none>						
<none></none>						
<none></none>	]					
<none></none>						
Help C	Edit next reaction Edit specified rxn Exit reactions	Rxn #		Cancel	ОК	

As the *User Specified* option is selected for kinetic rate expression, another window with the title *User Rate Expressions* appears. If a separate Visual Basic code is available, the user can browse those files using options available on *File path* tab. For most practical purposes, the user can go directly to the *Rxn1* tab or the *Rxn2* tab:

Unit: 1 - User Rate Expressions	×
File Paths   Rxn 1   Rxn 2	
Visual Basic File For Rate Expressions	
PFRE xampleUR.bas	Browse
Excel workBook path	
PFRE xampleUR.xls	Browse
User Rate Expression Notes:	
	~
	OK Cancel

Select the *Rxn1* Tab and enter the rate expression for the reaction1.

Name for the Chemical Reaction: Allyl Chloride formation

*Variables for User Rate Expressions:* CHEMCAD supplies the user with the variables described in this section to be used for user rate expressions.

Write User Rate Expression: RxnRate001 = FF \* ExpERT \* P001 \* P002

Unit: 1 - User Rate Expressions	X					
File Paths Rxn 1 Rxn 2						
Name for the Chemical Reaction (optional): Allyl Chloride Formation						
Variables for User Rate Expressions:	Operators					
FF Frequency Factor ExpERT Term Exp(-E/RT) Temp Temperature R Pres Pressure atm	<ul> <li>Add</li> <li>Subtract</li> <li>Multiply</li> <li>✓</li> </ul>					
Write User Rate Expression: (e.g., RxnRate001 = FF * ExpE	RT * C001 * C002 ^ 2 )					
RxnRate001 = FF * ExpERT * P001 * P002						
	OK Cancel					

Select the *Rxn2* Tab and enter the rate expression for the reaction2.

Name for the Chemical Reaction: 1,2- DiCl-propane formation

Write User Rate Expression: RxnRate001 = FF \* ExpERT \* P001 \* P002

Unit: 1 - User Rate Ex	pressions				×
File Paths Rxn 1 Rxn	2				
Name for the Chemic	cal Reaction (optional):				
1,2- DiCl-propan	e Formation				
Variables for User R	ate Expressions:			Operators	
FF ExpERT Temp Proc	Frequency Factor Term Exp(-E/RT) Temperature Preserve	R		+ Add - Subtract * Multiply / Divide	
Write User Rate Exp	ression: (e.g., RxnRate001 = Fi	F * ExpERT * CO	101 * COO2 ^ ;	2)	
RxnRate002 = F	F * ExpERT * P001 * P002				
				OK	Cancel

Click *OK* when finished. A window appears to confirm that we allow the cookies from an existing excel file so that the Visual Basic program accesses the rate expression specified by us. Click on *Yes* to continue.

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

Now the simulation is ready to be run. Click once on  $\underline{R}$  to run the simulation. 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.

The product stream properties can be found either by double clicking on the product stream or by clicking once on *Results* on the menu, selecting *Stream Composition* and then clicking on *All Streams*. The results will be available in a WordPad file.

PFRModule0 - WordPad			
<u>File E</u> dit <u>V</u> iew Insert Format	<u>H</u> elp		
D 🛩 🖬 🎒 🖾 🗛 👌	( 🖻 🛍 ၊ 🖪		
Courier New 🔽	10 🖌	▼ B Z 1	u 🔊 🖹 🗄 🗄
<u> </u>	••• 2 ••• • • • • • • • 3	· · · · · · · 4 ·	······································
CHEMCAD 5.4.0			Page 1
Job Name: DFDModule	Date: 08/03/90	05 Time: 17:5	
DOD Mane. FIRMULLE	Date: 00/03/20	05 IIMe. 17.3	2.21
Stream No.	1	2	
Stream Name	Feed		
Temp R	1000.0000*	1000.0000	
Pres atm	2.0000*	2.0000	
Enth MMBtu/h	0.014892	0.0016547	
Vapor mole fraction	1.0000	1.0000	
Total lbmol/h	1.0000	0.8774	
Total lb/h	47.8460	47.8458	
Total std L ft3/hr	1.1921	1.1190	
Total std V scfh	379.48	332.94	
Flowrates in 1b/h			
Propylene	33.6648	25.2486	
Chlorine	14.1812	0.0000	
HydrogenChloride	0.0000	2.8211	
Allyl Chloride	0.0000	5.9210	
1,2-DiCl-Propane	0.0000	13.8550	
For Help, press F1			

To plot the concentrations along the volume of the reactor, Select *plot* from the toolbar and then choose *plug flow reactor profile*. The following screen will appear.

👺 - Plug Flow Reactor Plot Options -									
Plot frequency Composition options	1		ID: 101						
4. Moles	-	Temperature							
Select components to plot:									
Component	Scale	Component	Scale						
1 Propylene	•	<none></none>	•						
2 Chlorine	•	<none></none>	<b>•</b>						
4 Allyl Chloride	•	<none></none>	<b>_</b>						
51,2-DiCl-Propane	•	<none></none>	-						
<none></none>	•	<none></none>	•						
<none></none>	•	<none></none>	-						
<none></none>	•	<none></none>	•						
<none></none>	•	<none></none>							
<none></none>	•	<none></none>							
<none></none>	•	<none></none>	•						
		Cancel	ОК						

Plot Frequency: select a value of '1'.

*Composition Option*: Since we want the compositions in moles choose moles. The temperature change along the reactor can also be plotted. Since ours is an isothermal case we need not select it.

*Select Component to Plot*: Select all the components of which we want to see the change in concentration. Click *OK*.



The following graph plots the change in concentration along the reactor volume.

# SHORTCUT COLUMN

#### **Problem Statement:**

A 100 kmol/hr stream of ethanol (50 mol%) and n-propanol (50 mol%) is fed to a continuous distillation column at room temperature (298 K) and atmospheric pressure. The pressure drop across the column is negligible and a reflux ratio of 1.5 is used. About 93 mol% of ethanol in feed and 5 mol% of n-propanol in feed is desired to be present in the distillate stream.

Design a continuous distillation column to meet the desired specifications using *Shortcut column* in CHEMCAD and report the total number of stages, minimum number of stages, feed stage location, minimum and calculated reflux ratios, final distillate and bottom stream concentrations and the reboiler and condenser heat duties.

#### **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 shortcut column 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. Click on *Shortcut column* on the CHEMCAD palette and 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 (do the product twice as there are two product streams). 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 ethanol and n-propanol 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.



# Step 3: Entering the composition of feed stream

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



#### Step 4: Entering the Shortcut column specs

Double click on the ShortCut Column.

#### 1. Select mode:

The *Shortcut column* can be used for both design and rating of a distillation column. As we need to design a column, option 2 or option 3 can be used for the design mode. Select one of these two and continue.

#### 2. Select condenser type:

As this is not explicitly stated in the problem statement, the condenser can be assumed to be total and can be left to this default option.

#### 3. Column pressure:

As there is negligible pressure drop across the column, one can enter the same pressure as that of the feed stream in this field (1 atm). This can also be left blank and CHEMCAD sets the pressure to default, which is the pressure of the feed stream.

4. *Column pressure drop:* This can be left blank.

#### 5. Number of stages:

CHEMCAD calculates the number of stages and stores the calculated number in this box. The user needs to leave this box blank.

6. *Reflux ratio:* Enter the value '1.5' in this field.

#### 7. *R*/*Rmin*:

One needs to enter only one of the two specs, reflux rato or R/Rmin. As the reflux ratio is specified, this field needs to be left blank.

#### 8. *Case study:*

This is optional and can be left blank for our purpose.

#### 9. Key component specifications:

- a. Light key component: Select 'Ethanol'
- b. Light key split: Enter '0.93'
- c. Heavy key component: Select 'n-propanol'
- d. Heavy key split: Enter '0.05'

#### 10. Calculated results:

These are the parameters that CHEMCAD calculates and stores the values of. All these fields need to be left blank.

Click *Ok* when finished.



#### 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 <u>R</u> on the menu bar. Alternatively, one can run the simulation by clicking on *Run* on the menu bar and selecting *Run all*. The simulator indicates the same warnings regarding the estimates as before and one can ignore them again and continue with the simulation by clicking on <u>Yes</u>. 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 compositions, 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.

📕 shortcut_column6.doc - Word	IPad					_ 8 ×				
File Edit View Insert Format	Help									
	B 🛍 🗠 💁									
Courier New 🔽 🚺		• B Z		E						
<u></u>	••• 2 •••• 1 ••••	3 • • • • • • • 4	· · · į · · · 5 · · ·	<u> </u>						
CHEMCAD 5.3.0				Page 1						
Job Name: shortcut_column Date: 08/18/2003 Time: 04:00:05										
Stream No.	1	2	3							
Stream Name	Feed									
Temp K	298.0000*	352.1509	368.5536							
Pres atm	1.0000*	1.0000	1.0000							
Enth MJ/h	-29004.	-13324.	-14754.							
Vapor mole fraction	0.00000	0.00000	0.00000							
Total kmol/h	100.0000	49.0000	51.0000							
Total kg/h	5308.2502	2292.4485	3015.8015							
Total std L m3/h	6.6011	2.8760	3.7251							
Total std V m3/h	2241.36	1098.27	1143.10							
Flowrates in kg/h										
Ethanol	2303.4501	2142.2085	161.2415							
N-Propanol	3004.8001	150.2400	2854.5600							
, For Help, press F1						NUM				
Start 6 CHEMCAD 5.3.0 - [	shortc 🕅 shortcut_	column.doc - Mi	shortcut_column6.do	)C	V 🖸 🚅	4:00 AM				

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

👿 shortcut_column7.doc - WordPad		_ 8 ×
File Edit View Insert Format Help		
Courier New ▼ 10 ▼ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■		
X · · · · · · · · · · · · · · · · · · ·		
CHEMCAD 5.3.0 Page 1		
Job Name: shortcut_column Date: 08/18/2003 Time: 04:00:45		
Shortcut Distillaton Summary		
Equip. No. 1		
Name		
Mode 2		
Light key component 1.0000		
Light key split 0.9300		
Heavy Key component 2.0000		
Refly ratio 1 5000		
Number of stages 24.0102		
Min. No. of stages 8.5531		
Feed stage 13.1607		
Condenser duty MJ/h -4764.4663		
Reboiler duty MJ/h 5690.2783		
Reflux ratio, minimum 1.4325		
Calc. Reflux ratio 1.5000		
, For Help, press F1		NUM
😹 Start 📗 🌜 CHEMCAD 5.3.0 - [shortc 🔞 shortcut_column.doc - Mi 🗐 shortcut_column7.doc	💓 💽 💷	4:00 AM