

Vapor Liquid Equilibrium (VLE)

기액평형

1. Excel을 이용한 풀이(기체흐름의 분율과 액체흐름의 조성)

1단계 - 스프레드시트 입력하기

	A	B	C	D	E	F	G	H
1			$v =$	0.425837				
2			Phase					
3			Equilibrium	term1 =	term2 =	Ratio =		
4		z_i	k -value	$(k_i - 1)z_i$	$(k_i - 1)v + 1$	term1/term2	x_i	y_i
5	Propane	0.1000000	6.8000000	0.5800000	3.4698546	0.1671540	0.0288197	0.1959736
6	<i>n</i> -Butane	0.3000000	2.2000000	0.3600000	1.5110044	0.2382521	0.1985434	0.4367956
7	<i>n</i> -Pentane	0.4000000	0.8000000	-0.0800000	0.9148326	-0.0874477	0.4372385	0.3497908
8	<i>n</i> -Octane	0.2000000	0.0520000	-0.1896000	0.5963065	-0.3179573	0.3353980	0.0174407
9		1.0000000			$f(v) =$		0.9999995	1.0000006
10								

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1. Excel을 이용한 풀이(기체흐름의 분율과 액체흐름의 조성)

2단계 - D1를 변화시켜 F9의 값이 0이 되게 하기

F9		fx		=F5+F6+F7+F8				
	A	B	C	D	E	F	G	H
1			$v =$	0.425846257				
2			Phase					
3			Equilibrium	term1 =	term2 =	Ratio =		
4		z_i	k -value	$(k_i - 1)z_i$	$(k_i - 1)v + 1$	term1/term2	x_i	y_i
5	Propane	0.1000000	6.8000000	0.5800000	3.4699083	0.1671514	0.0288192	0.1959706
6	<i>n</i> -Butane	0.3000000	2.2000000	0.3600000	1.5110155	0.2382504	0.1985420	0.4367923
7	<i>n</i> -Pentane	0.4000000	0.8000000	-0.0800000	0.9148307	-0.0874479	0.4372393	0.3497915
8	<i>n</i> -Octane	0.2000000	0.0520000	-0.1896000	0.5962977	-0.3179620	0.3354029	0.0174410
9		1.0000000			$f(v) =$	-0.0000081	1.0000034	0.9999954
10								
11								
12								
13								
14								
15								
16								
17								

목표값 찾기 상태

셀 F9에 대한 값 찾기
답을 찾았습니다.

단계(S) 일시 중지(P)

목표값: 0
현재값: -0.0000081

확인 취소

2. MATLAB을 이용한 풀이(기체흐름의 분율과 액체흐름의 조성)

1단계 - vpequil.file 만들기

2단계 - vpequil(0.2) 실행하기

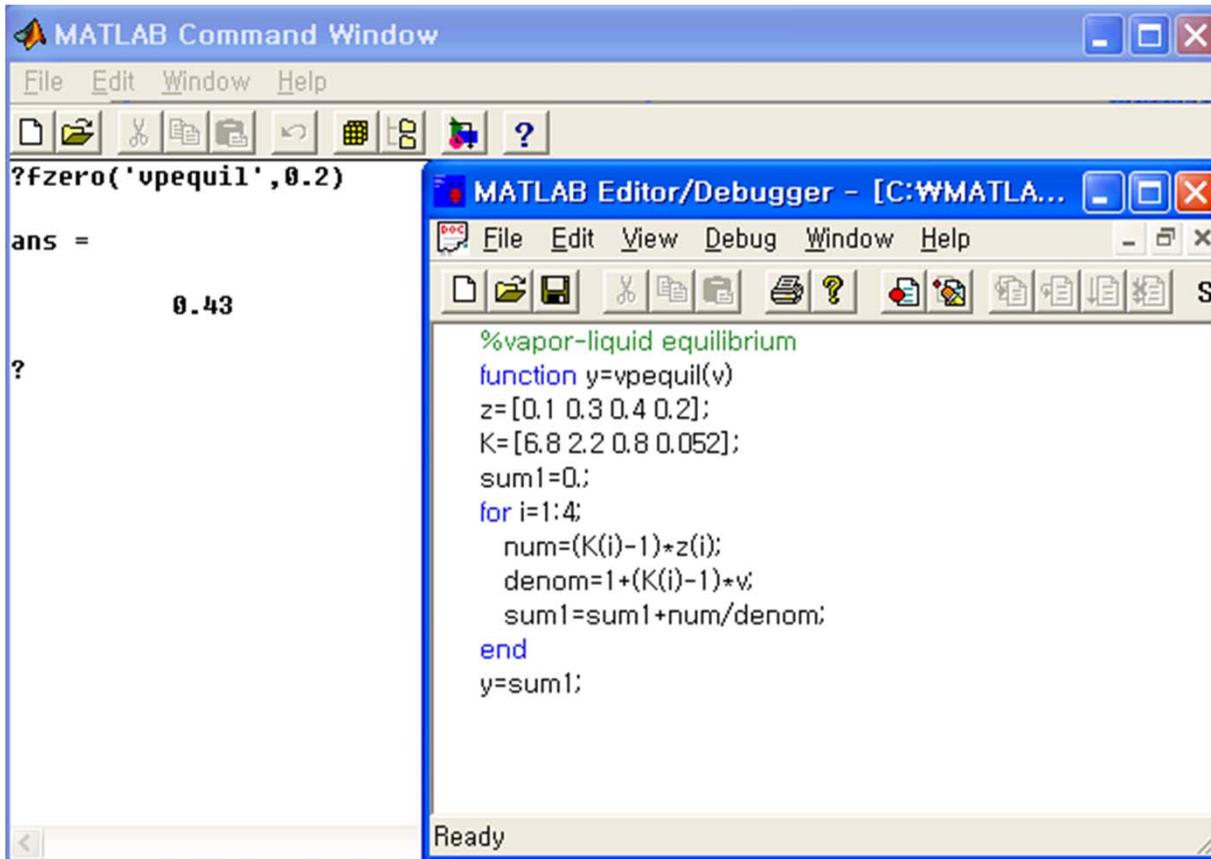
```
MATLAB Editor/Debugger - [C:\WMATLA...
File Edit View Debug Window Help
%vapor-liquid equilibrium
function y=vpequil(v)
z=[0.1 0.3 0.4 0.2]
K=[6.8 2.2 0.8 0.052]
sum1=0.;
for i=1:4
    num=(K(i)-1)*z(i)
    denom=1+(K(i)-1)*v
    sum1=sum1+num/denom
end
y=sum1
Ready
```

```
MATLAB Command Window
File Edit Window Help
?feval('vpequil',0.2)
z =
    0.10    0.30    0.40    0.20
K =
    6.80    2.20    0.80    0.05
y =
    0.24
ans =
    0.24
?|
```

기액평형

2. MATLAB을 이용한 풀이(기체흐름의 분율과 액체흐름의 조성)

3단계 - fzero 구하기

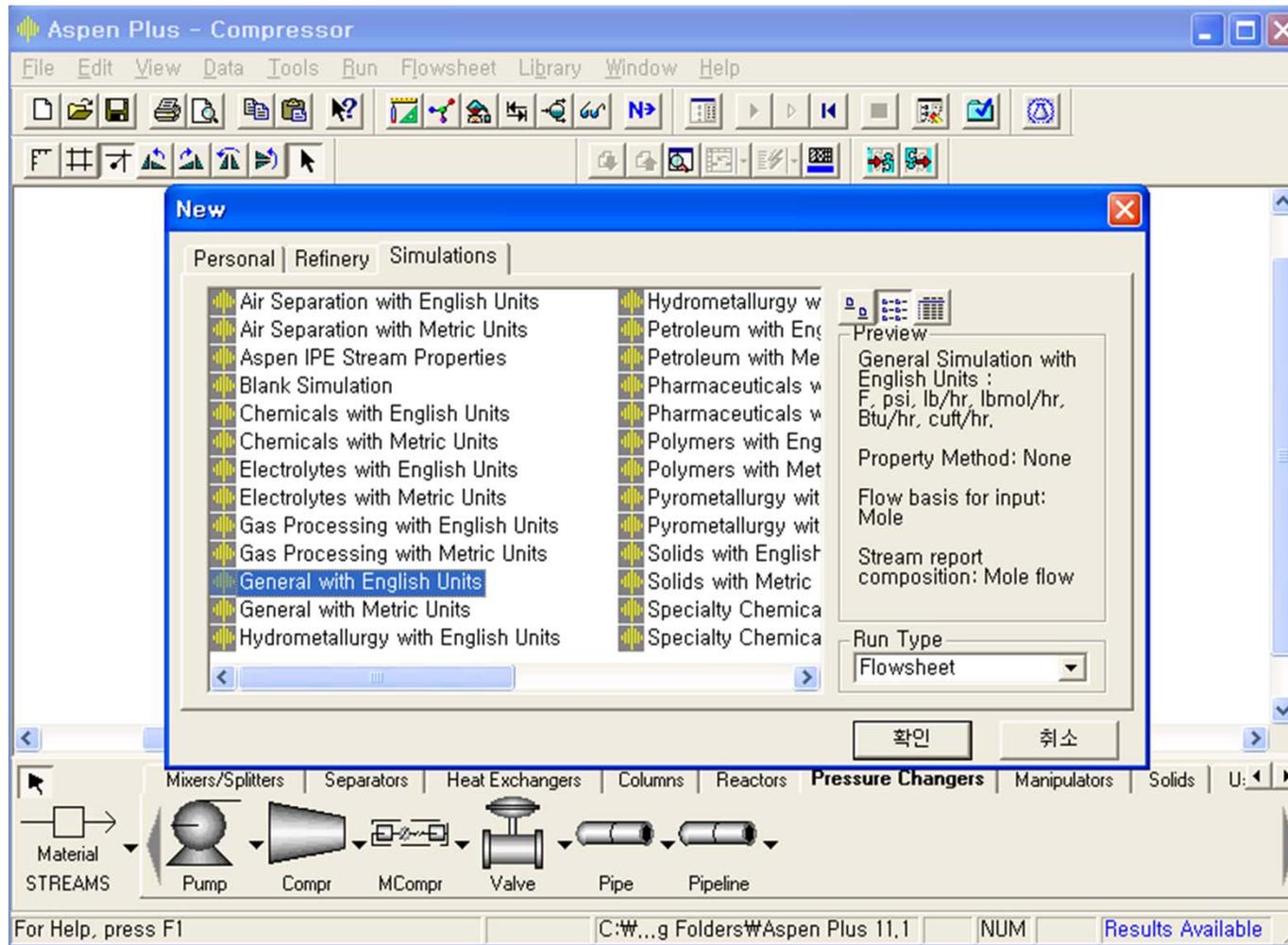


The image shows two overlapping MATLAB windows. The 'MATLAB Command Window' on the left displays the command `?fzero('vpequil', 0.2)` and the result `ans = 0.43`. The 'MATLAB Editor/Debugger' window on the right shows the source code for the `vpequil` function:

```
%vapor-liquid equilibrium
function y=vpequil(v)
z=[0.1 0.3 0.4 0.2];
K=[6.8 2.2 0.8 0.052];
sum1=0.;
for i=1:4;
    num=(K(i)-1)*z(i);
    denom=1+(K(i)-1)*v;
    sum1=sum1+num/denom;
end
y=sum1;
```

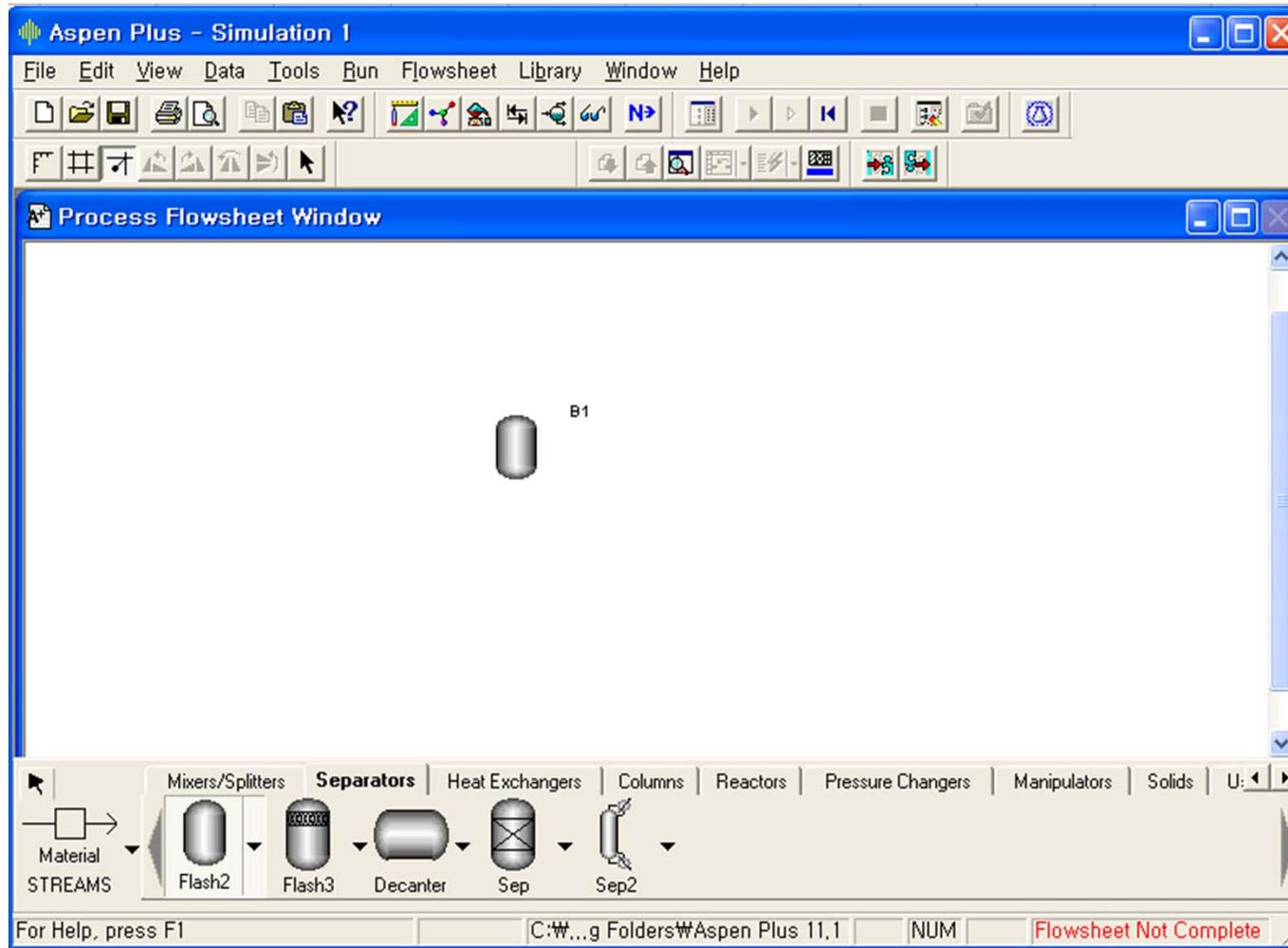
3. Aspen Plus을 이용한 풀이(Flash2)

1단계 - Aspen Plus 실행하기



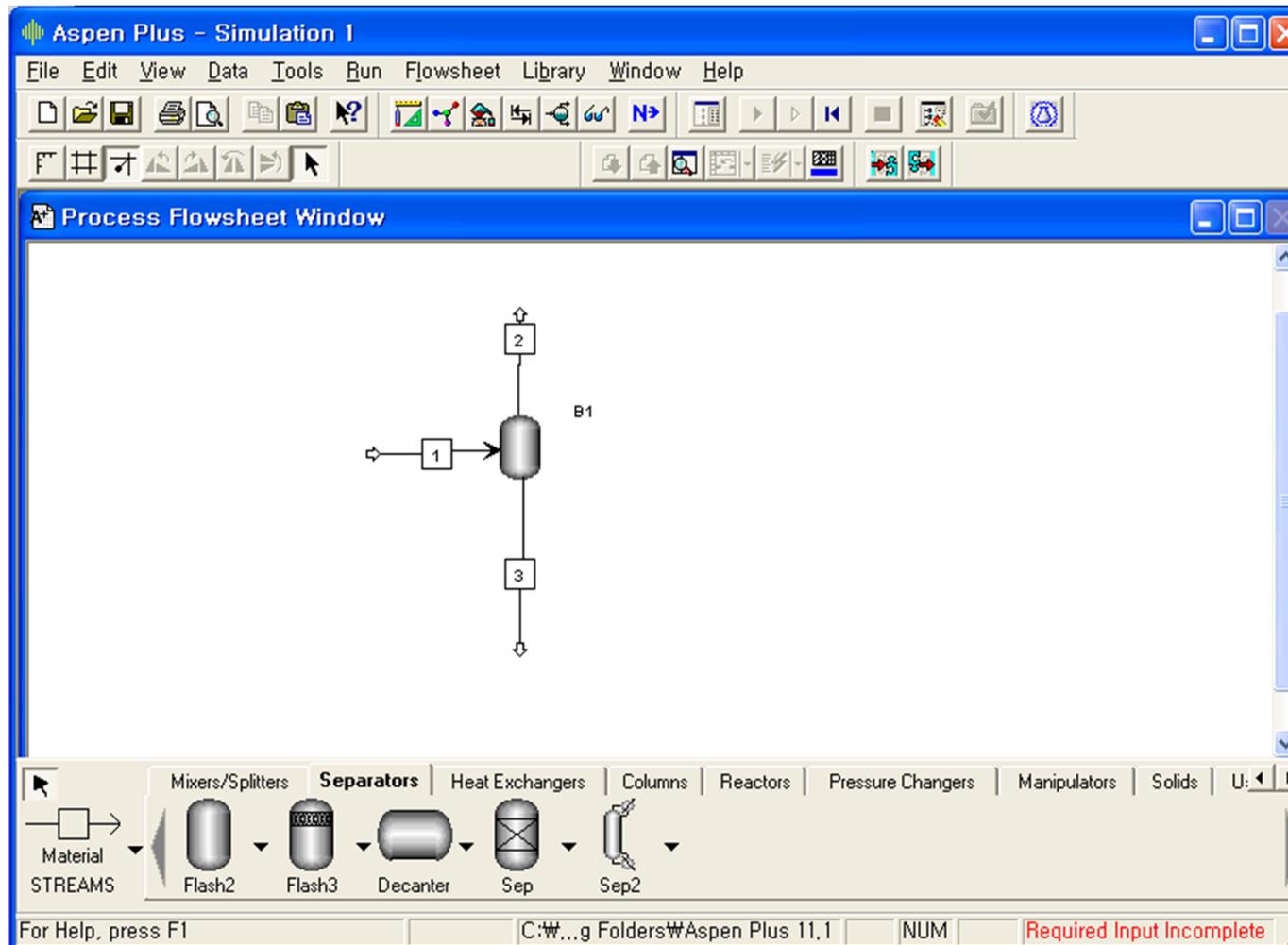
3. Aspen Plus을 이용한 풀이(Flash2)

2단계 - Flash2 선택하기



3. Aspen Plus을 이용한 풀이(Flash2)

3, 4단계 – Stream 그리기



3. Aspen Plus을 이용한 풀이(Flash2)

5단계 – Component/Specification값 입력하기

Components Specifications - Data Browser

Specifications

Selection Petroleum Nonconventional Databanks

Define components

Component ID	Type	Component name	Formula
▶ PROPANE	Conventional	PROPANE	C3H8
N-BUTANE	Conventional	N-BUTANE	C4H10-1
N-PENTANE	Conventional	N-PENTANE	C5H12-1
N-OCTANE	Conventional	N-OCTANE	C8H18-1
*			

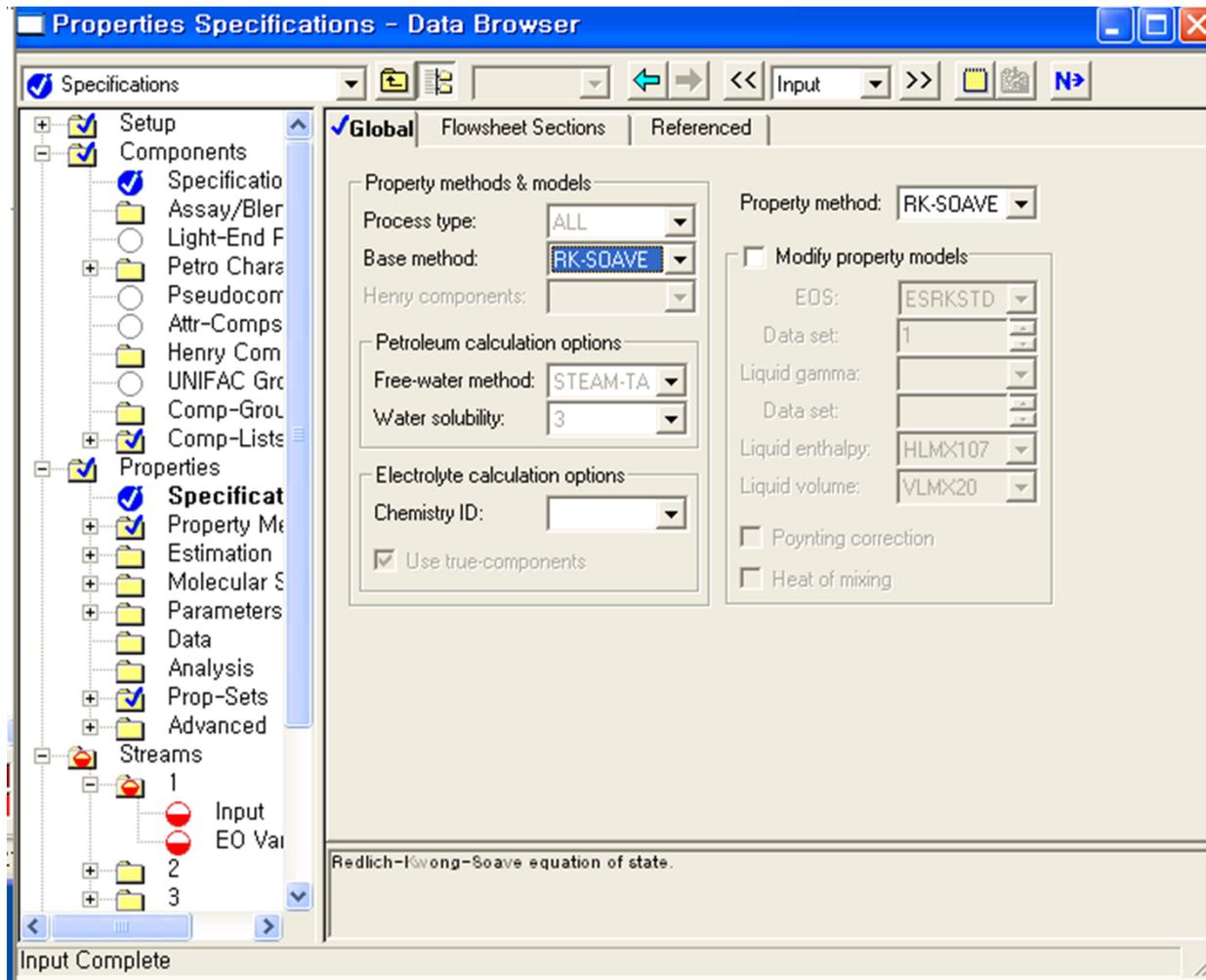
Find Elec Wizard User Defined Reorder Review

Component ID. If data are to be retrieved from databanks, enter either Component Name or Formula. See Help.

Input Complete

3. Aspen Plus을 이용한 풀이(Flash2)

6단계 – Property/Specification값 입력하기



3. Aspen Plus을 이용한 풀이(Flash2)

7단계 – Stream값 입력하기

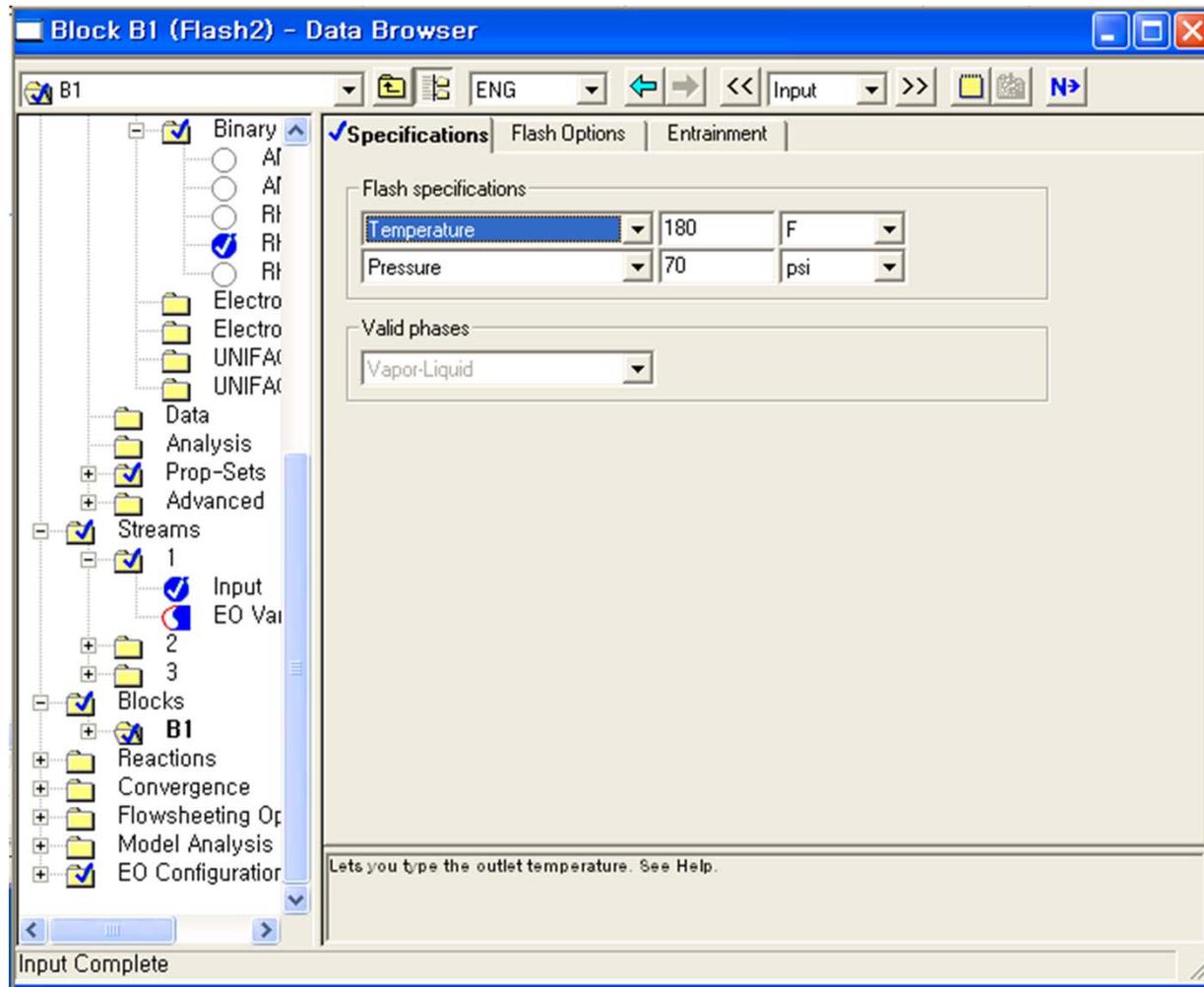
The screenshot shows the 'Stream 1 (MATERIAL) Input - Data Browser' window in Aspen Plus. The 'Specifications' tab is selected, and the substream name is 'MIXED'. The temperature is set to 180 F, and the pressure is 70 psi. The total flow is 100 lbmol/hr. The composition table is as follows:

Component	Value
PROPANE	10
N-BUTANE	30
N-PENTAN	40
N-OCTANE	20

The total flow is 100 lbmol/hr. The solvent field is empty. The status bar at the bottom indicates 'Input Complete'.

3. Aspen Plus을 이용한 풀이(Flash2)

8단계 - Block값 입력하기



3. Aspen Plus을 이용한 풀이(Flash2)

9단계 - 결과보기

Results Summary Streams - Data Browser

Streams

- Streams
- Blocks
- Results Summary
 - Run Status
 - Streams
 - Convergence

Material | Heat | Load | Work | Vol. % Curves | Wt. % Curves | Petro. Curves | Poly. Curves

Display: All streams | Format: GEN_E | Stream Table

	1	2	3	
Temperature F	180.0	180.0	180.0	
Pressure psi	70.00	70.00	70.00	
Vapor Frac	0.419	1.000	0.000	
Mole Flow lbmol/hr	100.000	41.898	58.102	
Mass Flow lb/hr	7355.297	2587.239	4768.058	
Volume Flow cuft/hr	3865.903	3735.260	130.643	
Enthalpy MMBtu/hr	-6.767	-2.262	-4.505	
Mole Flow lbmol/hr				
PROPANE	10.000	7.881	2.119	
N-BUTANE	30.000	18.016	11.984	
N-PENTAN	40.000	15.096	24.904	
N-OCTANE	20.000	0.905	19.095	

Results Available

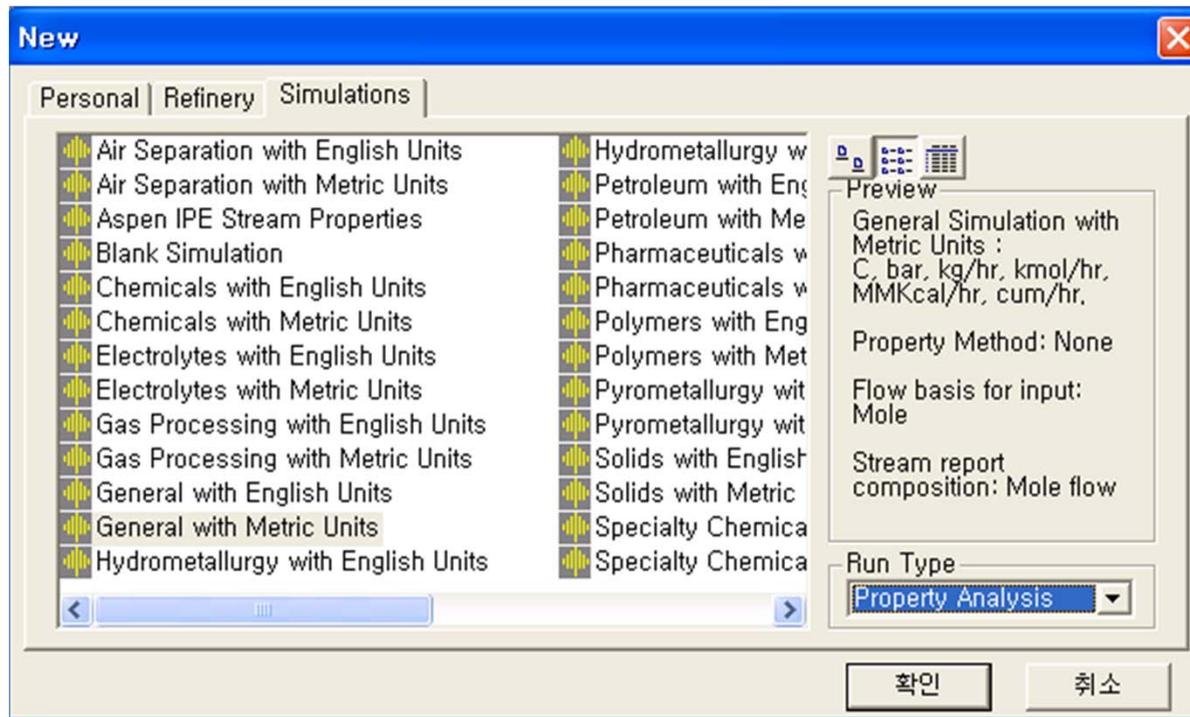
3. Aspen Plus을 이용한 풀이(Flash2)

10단계 - 스프레드시트 형태 변환하기

1		1	2	3
2				
3	Temperature F	180	180	180
4	Pressure psi	70	70	70
5	Vapor Frac	0.419	1	0
6	Mole Flow lbmol/hr	100	41.898	58.102
7	Mass Flow lb/hr	7355.297	2587.239	4768.058
8	Volume Flow cuft/hr	3865.903	3735.26	130.643
9	Enthalpy MMBtu/hr	-6.767	-2.262	-4.505
10	Mole Flow lbmol/hr			
11	PROPANE	10	7.881	2.119
12	N-BUTANE	30	18.016	11.984
13	N-PENTAN	40	15.096	24.904
14	N-OCTANE	20	0.905	19.095

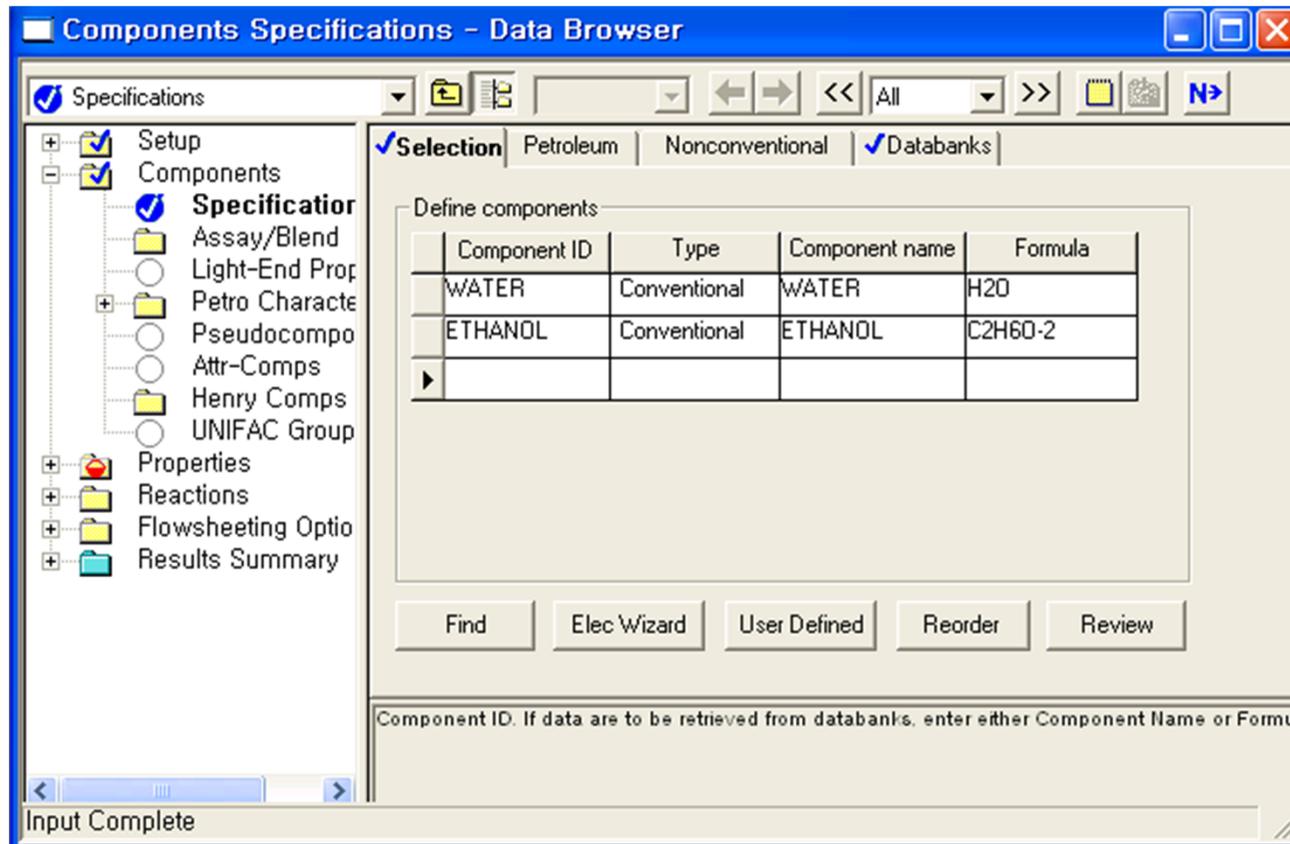
3. Aspen Plus을 이용한 풀이(비이상액체)

1단계 - Aspen Plus 실행하기



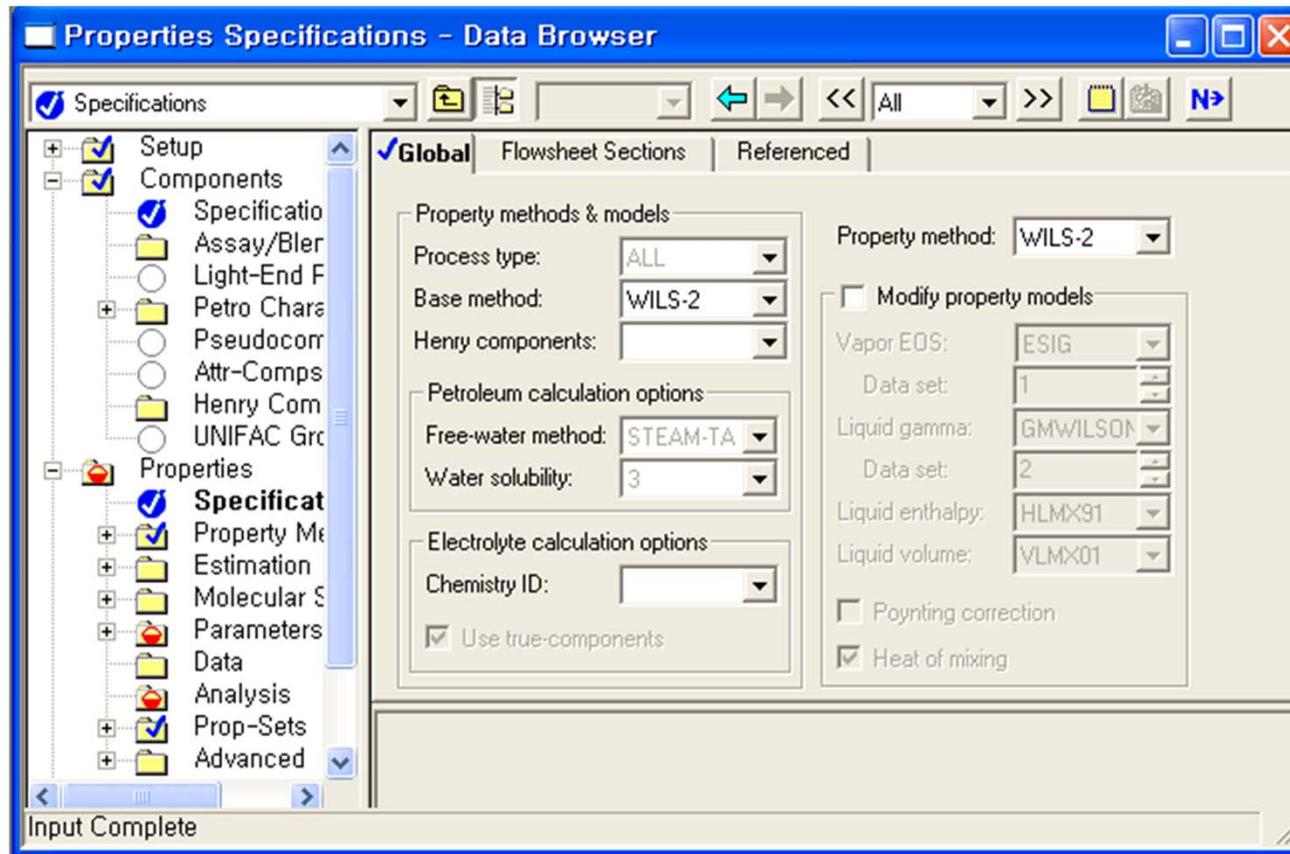
3. Aspen Plus을 이용한 풀이(비이상액체)

2단계 – Component/Specification값 입력하기



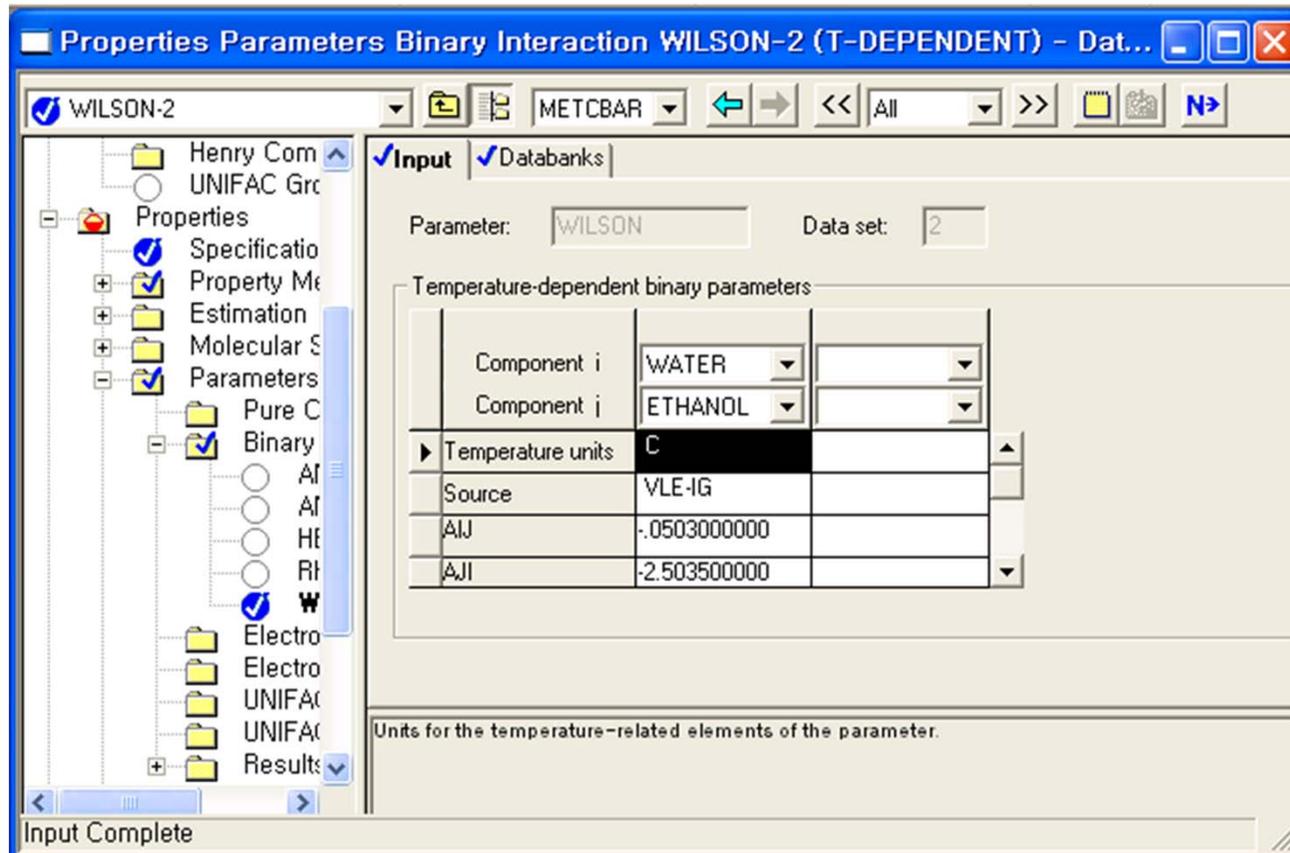
3. Aspen Plus을 이용한 풀이(비이상액체)

3단계 - Property/Specification값 입력하기



3. Aspen Plus을 이용한 풀이(비이상액체)

4단계 – Property/Parameter값 입력하기



3. Aspen Plus을 이용한 풀이(비이상액체)

5단계 – Tools/Analysis/Property/Binary값 입력하기

Binary Analysis

Analysis type: Txy

Valid phases: Vapor-Liquid

Components:
Component 1: WATER
Component 2: ETHANOL

Compositions:
Basis: Mole fraction
Component: ETHANOL

Composition: Range
Lower: 0
Upper: 1

Points: 41
 Increments

Property options:
Property method: WILS-2
Henry components:
Chemistry ID:
Simulation approach: True species

Pressure: List bar
1.01325

Save As Form Go Cancel

3. Aspen Plus을 이용한 풀이(비이상액체)

6단계 - 결과보기

