



ΕΘΝΙΚΟ ΜΕΤΣΟΒΙΟ ΠΟΛΥΤΕΧΝΕΙΟ
ΣΧΟΛΗ ΧΗΜΙΚΩΝ ΜΗΧΑΝΙΚΩΝ

6^ο Υπολογιστικό Εργαστήριο Σχεδιασμού Χημικών Βιομηχανιών

Αζεοτροπική απόσταξη

Διδάσκων: Α. Νικολακόπουλος, Ε.ΔΙ.Π.

ΠΕΡΙΕΧΟΜΕΝΑ

- Αζεοτροπική απόσταξη: εισαγωγή
- Τεχνικές διαχωρισμού συστατικών αζεότροπου:
 - Διαχείριση-εναλλαγή της πίεσης λειτουργίας (Pressure swing)
 - Ετερογενής αζεοτροπική απόσταξη
 - Καμπύλες υπολειμμάτων (Residue curves)

Εισαγωγή

- Υπάρχουν 2 είδη αζεοτρόπων:
 - Μέγιστου βρασμού (maximum-boiling)
 - Ελάχιστου βρασμού (minimum-boiling)

Παράδειγμα αζεότροπου μέγιστου βρασμού: ακετόνη-χλωροφόρμιο

- Πώς διαπιστώνουμε την ύπαρξη αζεότροπου με το Aspen Plus;
 - Παραγωγή διαγραμμάτων
 - T_{xy}
 - P_{xy}
 - $y-x$
 - Azeotrope find
- ΑΡΧΕΙΑ σε φάκελο: MAXIMUM BOILING AZEOTROPE

Acetone-Chloroform MaxBoiling.bkp - Aspen Plus V11 - aspenONE

File **Home** **View** **Customize** **Resources** **Search Exchange**

Cut Copy Paste Clipboard METCBAR Unit Sets Components Methods Units

Setup Na⁺ Chemistry Draw Structure Methods Assistant Clean Parameters Retrieve Parameters

Customize Prop Sets Navigate

TDE NIST DECHEMA DIPPR Data Source

Analysis Estimation Regression Run Mode

Run Summary Analysis

Properties

All Items

- Setup
- Components
 - Specifications
 - Molecular Structure
 - Assay/Blend
 - Light End Properties
 - Petro Characterization
 - Pseudocomponents

Find Elec Wizard SFE Assistant User Defined Reorder Review

Components - Specifications

Select components

Component ID	Type	Component name	Alias
ACETONE	Conventional	ACETONE	C3H6O-1
CHLOROFO	Conventional	CHLOROFORM	CHCL3

Results Available with Warnings Check Status

100% - +

Acetone-Chloroform MaxBoiling.bkp - Aspen Plus V11 - aspenONE

File Home View Customize Resources Search Exchange

Cut Copy Paste Clipboard METCBAR Setup Components Methods Draw Structure Tools NIST DECHEMA DIPPR Analysis Estimation Regression Run Mode Summary Analysis

Unit Sets Prop Sets Navigate

Properties

All Items

- Setup
- Components
- Methods
 - Specifications
 - Selected Methods
 - Parameters
 - Routes
 - NC Props
 - Tabpoly

Properties

Methods - Specifications

Global Flowsheet Sections Referenced Comments

Method name: UNIFAC

Method filter: COMMON

Base method: UNIFAC

Henry components:

Petroleum calculation options

- Free-water method: STEAM-TA
- Water solubility: 3

Vapor EOS: ESRK

Data set: 1

Liquid gamma: GMUFAC

Data set: 1

Liquid molar enthalpy: HLMX103

Liquid molar volume: VLMX01

Heat of mixing

Poynting correction

Use liquid reference state enthalpy

Electrolyte calculation options

- Chemistry ID:
- Use true components

Results Available with Warnings Check Status

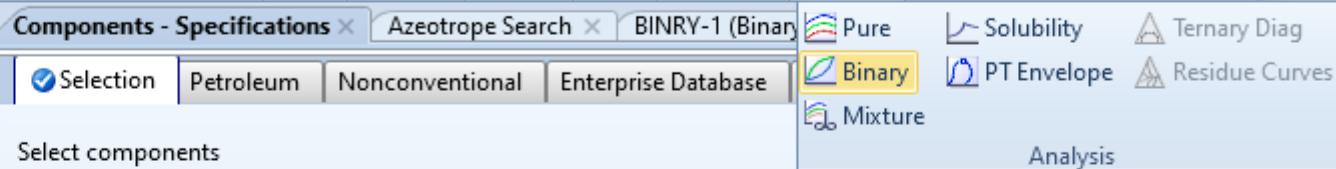
100% - +



Properties

All Items

- Setup
- Components
- Methods
- Chemistry
- Property Sets
- Data
- Estimation
- Analysis
- Customize
- Results



Select components

Component ID	Type	Binary Analysis
ACETONE	Conventional	Generate Txy, Pxy, or Gibbs free energy of mixing curves for a binary system.
CHLOROFO	Conventional	

Find

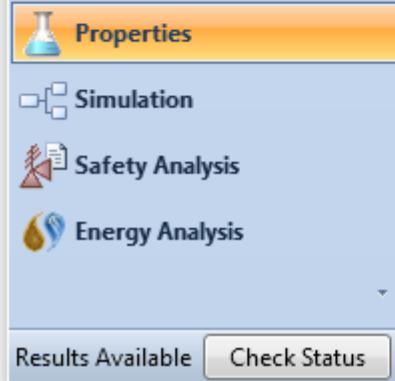
Elec Wizard

SFE Assistant

User Defined

Reorder

Review



100%



Acetone-Chloroform MaxBoiling.bkp - Aspen Plus V11 - aspenONE

File Home View Customize Resources Search Exchange

Cut METCBAR Setup Na⁺ Chemistry Methods Assistant
Copy Unit Sets Components Customize Clean Parameters
Paste Methods Prop Sets Retrieve Parameters
Clipboard Units Navigate Tools

TDE NIST Data Source Run Mode Run Summary Analysis

Properties

All Items

- > Setup
- > Components
- > Methods
- > Chemistry
- > Property Sets
- > Data
- > Estimation
- Analysis
- BINRY-1
 - Input
- Customize
- Results

BINRY-1 (BINARY) - Input

Binary Analysis Tabulate Calculation Options Diagnostics Results Comments Status

Analysis type: **Txy**

Components

Component 1: **ACETONE**
Component 2: **CHLOROFO**

Pseudo-Binary

Pseudo-binary system

Entrainier

Entrainier fraction

Compositions

Basis: **Mole fraction**
Vary: **ACETONE**

Equidistant Logarithmic List of values

Start point: **0**
End point: **1**

Number of intervals: **50**
Increment: **0.02**

Pressure

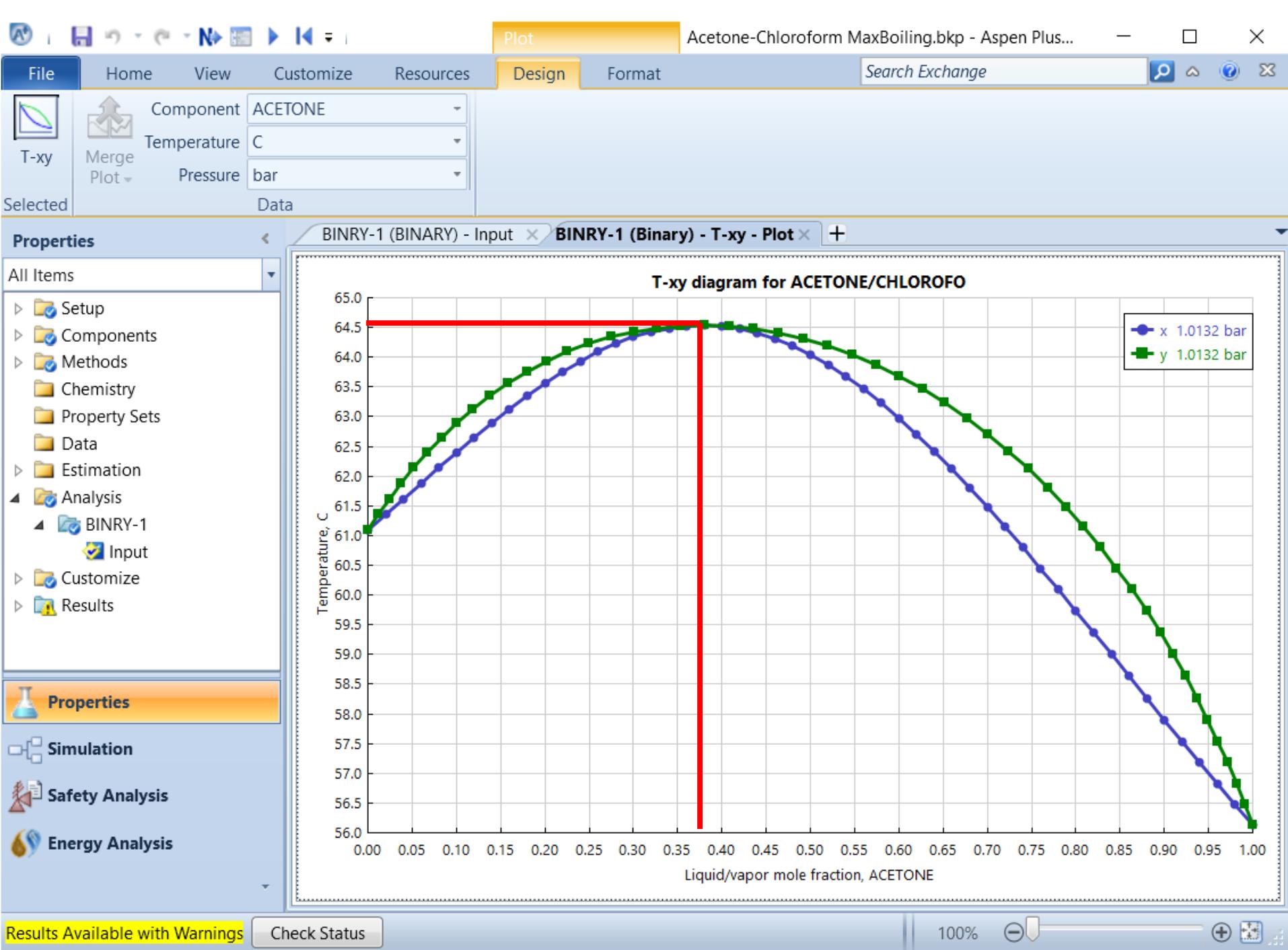
Units: **bar**
Equidistant List of values

Enter Values

	1.01325

Run Analysis

Results Available with Warnings Check Status 100%



Acetone-Chloroform MaxBoiling.bkp - Aspen Plus V11 - aspenONE

File Home View Customize Resources Search Exchange

Cut METCBAR Setup Na⁺ Chemistry Methods Assistant NIST Analysis
Copy Unit Sets Components Customize Clean Parameters DECHEMA Estimation
Paste Methods Prop Sets Retrieve Parameters DIPPR Regression Run Mode
Clipboard Units Navigate Tools Data Source Run Mode Summary Analysis

Properties

All Items

- > Setup
- > Components
- > Methods
- > Chemistry
- > Property Sets
- > Data
- > Estimation
- Analysis**
- BINRY-1**
 - Input**
- > Customize
- > Results

Properties

Simulation

Safety Analysis

Energy Analysis

BINRY-1 (BINARY) - Input

BINRY-1 (Binary) - T-xy - Plot

Binary Analysis Tabulate Calculation Options Diagnostics Results Comments Status

Analysis type: Pxy

Components

Component 1: ACETONE

Component 2: CHLOROFO

Pseudo-Binary

Pseudo-binary system

Entrainier

Entrainier fraction

Compositions

Basis: Mole fraction

Vary: ACETONE

Equidistant Logarithmic List of values

Start point: 0

End point: 1

Number of intervals: 50

Increment: 0.02

Temperature

Units: C

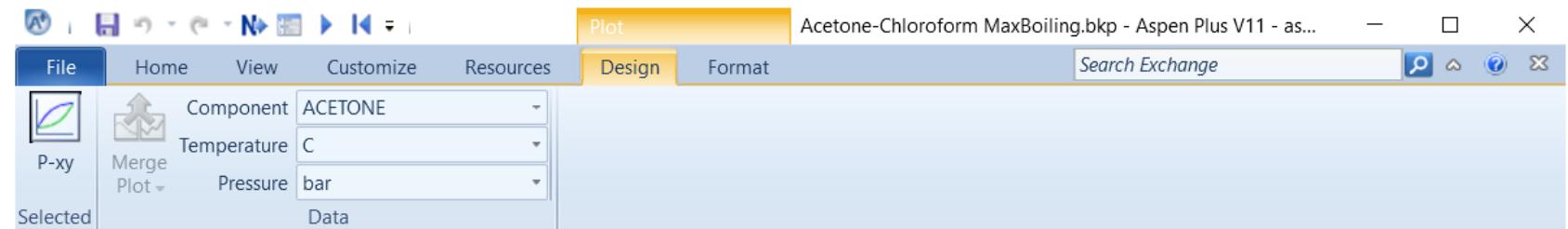
Equidistant List of values

Enter Values

	25

Run Analysis

Input Changed Check Status 100% + -



Properties

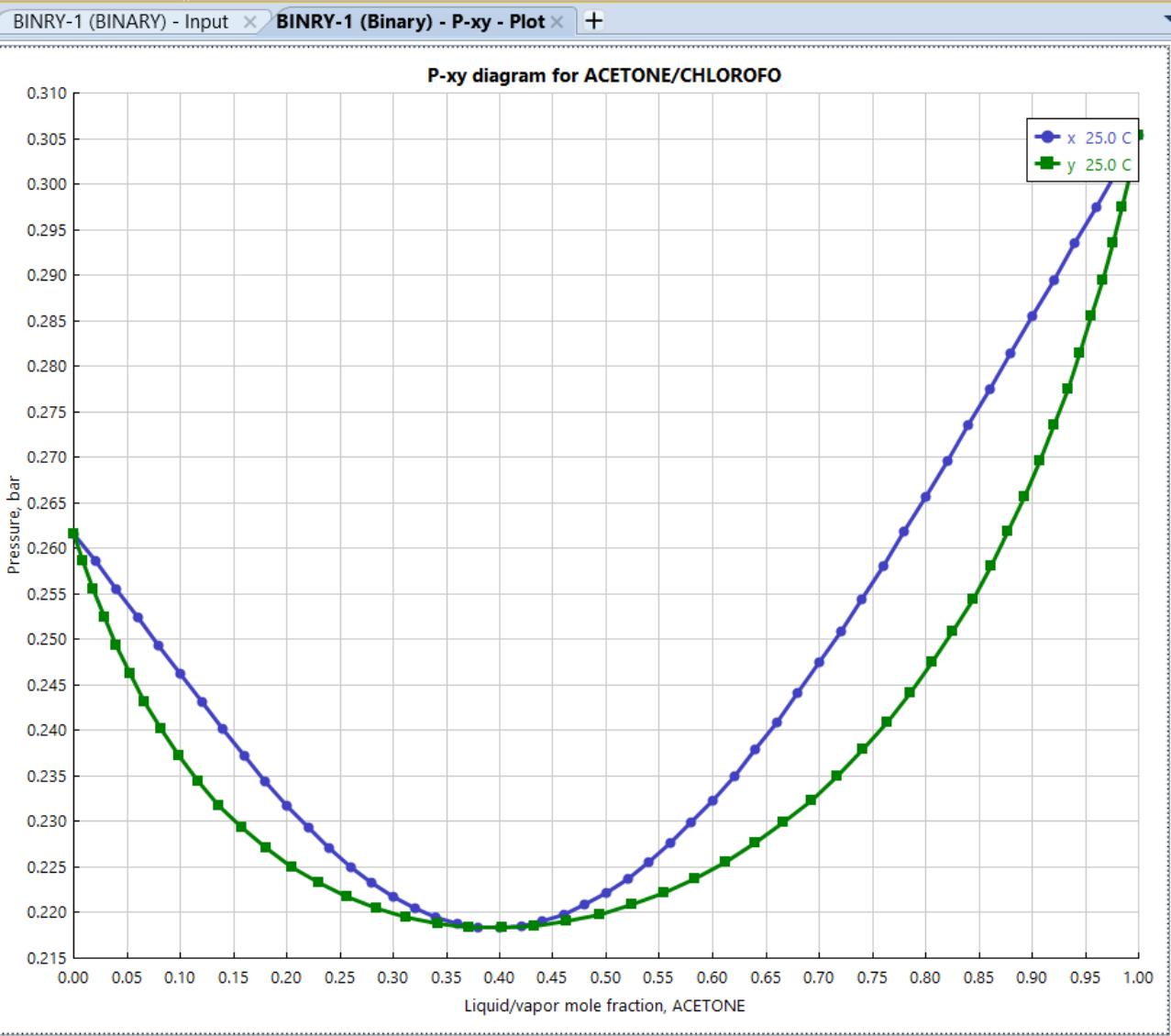
- All Items
- Setup
- Components
- Methods
- Chemistry
- Property Sets
- Data
- Estimation
- Analysis**
- BINRY-1
 - Input
- Customize
- Results

Properties

Simulation

Safety Analysis

Energy Analysis



Input Changed

Check Status

100%



Acetone-Chloroform MaxBoiling.bkp - Aspen Plus V11 - aspenONE

File Home View Customize Resources Search Exchange

Cut Copy Paste Clipboard Units METCBAR Setup Components Methods Tools Data Source Run Mode Summary Analysis P-xy P-x y-x Activity Coeff. K-values

Properties All Items

Setup Components Methods Chemistry Property Sets Data Estimation Analysis BINRY-1 Input Customization Results

BINRY-1 (BINARY) - Input

Binary Analysis Tabulate Calculation Options Diagnostics Results

Analysis type: Pxy

Components:

- Component 1: ACETONE
- Component 2: CHLOROFO

y-x: Vapor versus liquid composition.

Entrainer fraction:

Compositions:

Basis: Mole fraction

Vary: ACETONE

Equidistant (selected)

Start point: 0

End point: 1

Number of intervals: 50

Increment: 0.02

Temperature:

Units: C

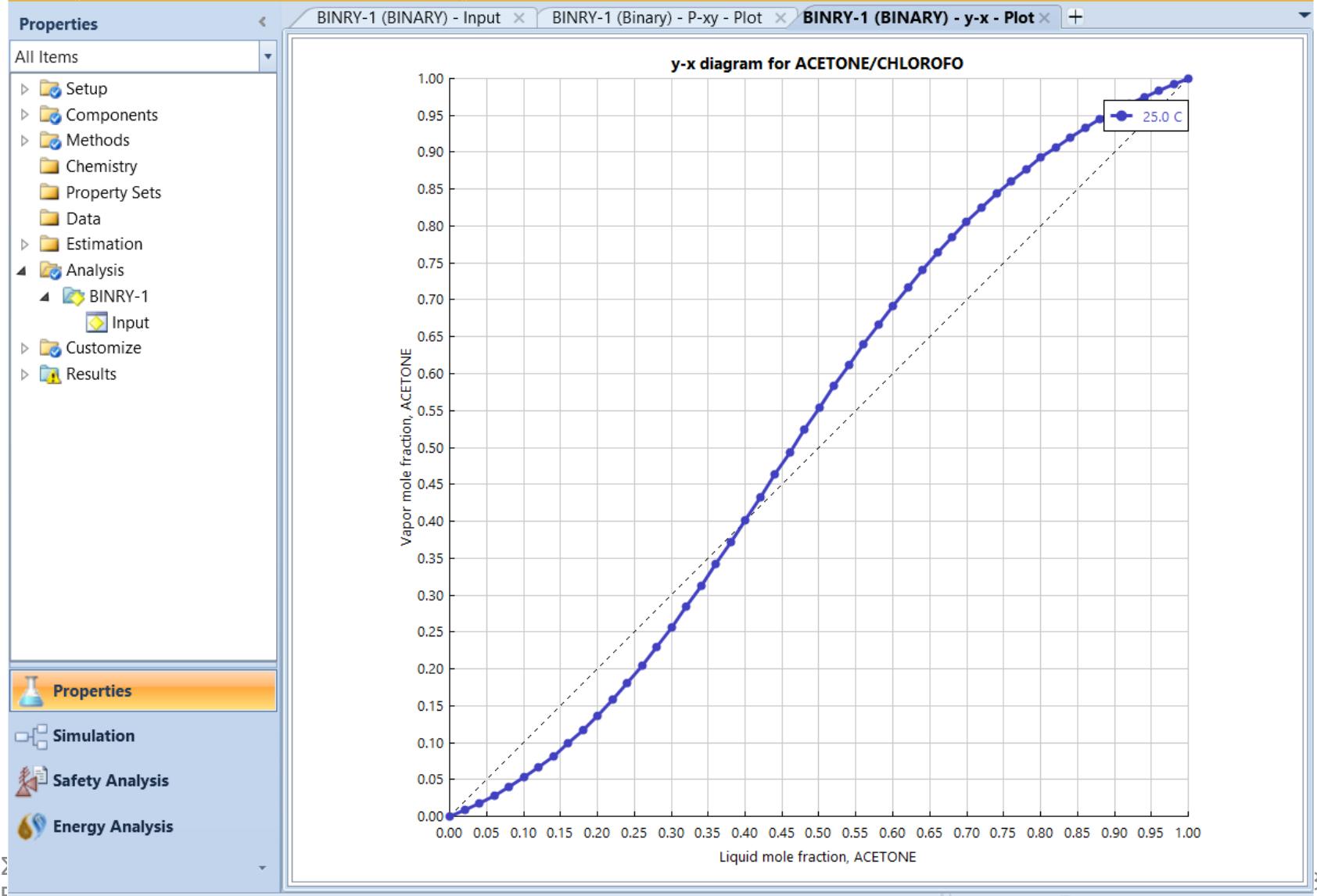
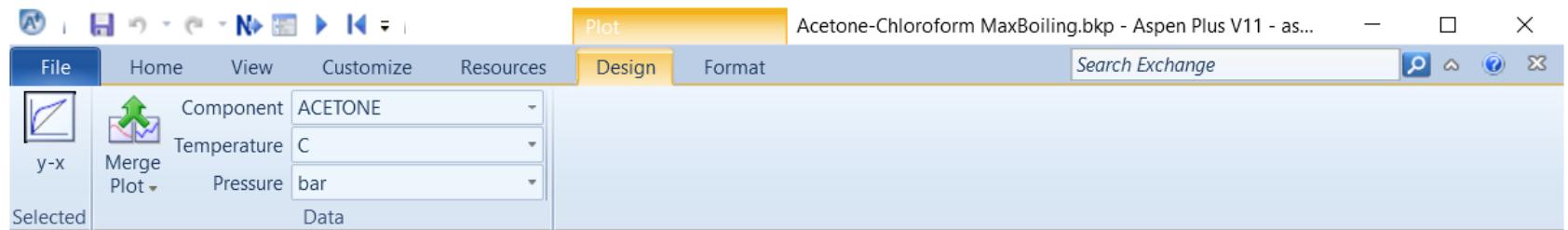
Equidistant (selected)

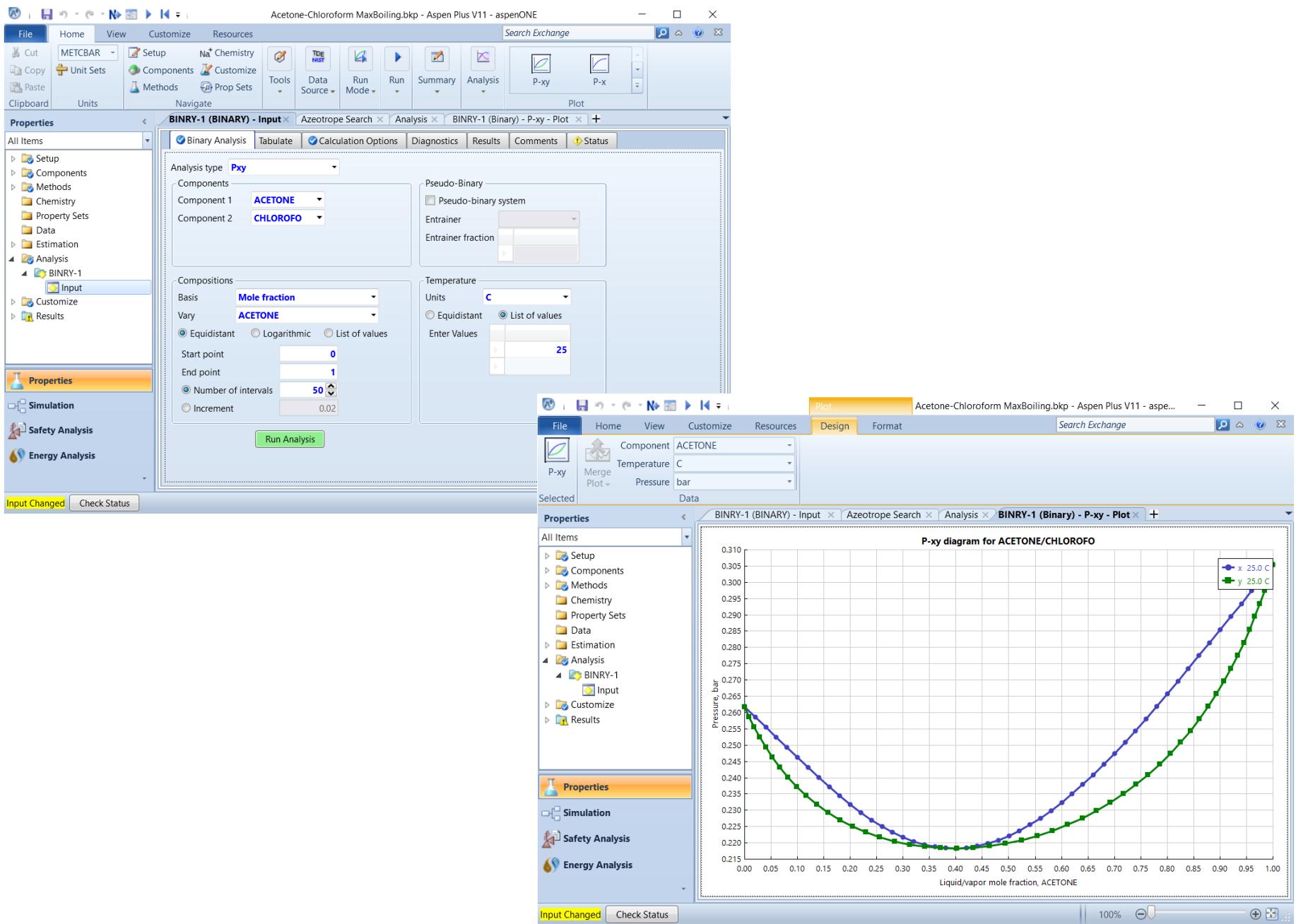
List of values (selected)

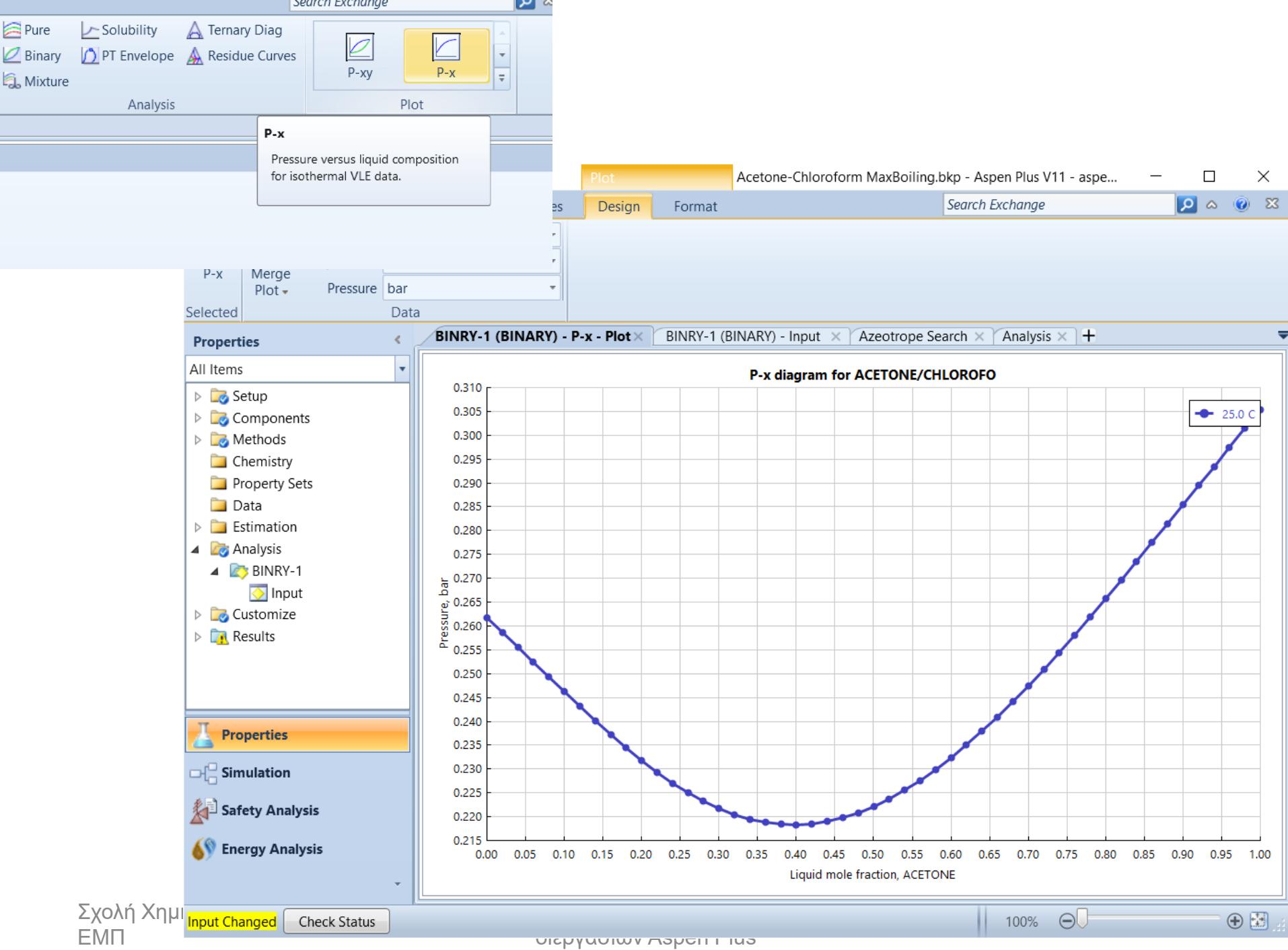
Enter Values: 25

Run Analysis

Input Changed Check Status 100% - +







File Home View Customize Resources Search Exchange

Cut METCBAR Setup Na^+ Chemistry Tools Data Source Run Mode Run Summary Analysis P-xy P-x Plot

Copy Unit Sets Components Customize Methods Prop Sets Navigate

Paste Clipboard Units

Properties

All Items

- Setup
- Components
- Methods
- Chemistry
- Property Sets
- Data
- Estimation
- Analysis**
- BINRY-1**
- Input**
- Customize
- Results

BINRY-1 (BINARY) - P-x - Plot **BINRY-1 (BINARY) - Input** Azeotrope Search Analysis +

Binary Analysis **Calculation Options** **Diagnostics** **Results** **Comments** **Status**

Analysis type **Pxy**

Components

Component 1 **ACETONE**

Component 2 **CHLOROFO**

Pseudo-Binary

Pseudo-binary system

Entrainor

Entrainor fraction

Compositions

Basis **Mole fraction**

Vary **CHLOROFO**

Equidistant Logarithmic List of values

Start point **0**

End point **1**

Number of intervals **50**

Increment **0.02**

Temperature

Units **C**

Equidistant List of values

Enter Values

25

Run Analysis

Input Changed **Check Status**

100% **LIVE**

Acetone-Chloroform MaxBoiling.bkp - Aspen Plus V11 - aspenONE

File Home Economics Batch Dynamics Equation Oriented View Customize Resources Search Exchange

Cut Copy Paste Clipboard Units Next Run Step Stop Reset Settings

Model Summary Input Stream Analysis Pressure Relief

Stream Summary History Sensitivity PRD Rating

Utility Costs Report Data Fit Distillation Synthesis Flare System

Azeotrope Search Safety Analysis

Summary Analysis

Simulation Main Flowsheet Azeotrope Search +

All Items

- Setup
- Property Sets
- Analysis
- Flowsheet
- Streams
- Blocks
- Utilities
- Reactions
- Convergence
- Flowsheeting Options
- Model Analysis Tools

Azeotrope Search

- Input
- Output
 - Pure Components
 - Azeotropes
 - Singular Points
- Report

Component List

Name	Description
ACETONE	ACETONE
CHLOROFC	CHLOROFORM

Pressure: 101325 N/SQM

Property Model: UNIFAC

Phases: VAP-LIQ

Report Units: Temperature: C

Properties

Simulation (highlighted)

Safety Analysis (highlighted)

Energy Analysis

Model Palette

Mixers/Splitters Separators Exchangers Columns Reactors Pressure Changers Manipulators

MATERIAL Mixer FSPLIT SSPLIT

Flowsheet Not Complete Check Status

100%

The screenshot shows the Aspen Plus V11 interface. The top menu bar includes File, Home, Economics, Batch, Dynamics, Equation Oriented, View, Customize, Resources, and Search Exchange. Below the menu is a toolbar with various icons for cutting, copying, pasting, and running simulations. The main workspace is titled 'Main Flowsheet' and contains a sub-tab 'Azeotrope Search'. On the left, there's a tree view of 'All Items' and a 'Properties' panel with tabs for Simulation, Safety Analysis, and Energy Analysis. The 'Simulation' tab is highlighted with a red box. In the center, the 'Azeotrope Search' interface shows a tree structure with 'Input', 'Output' (which includes 'Pure Components', 'Azeotropes', and 'Singular Points'), and 'Report'. To the right is a 'Component List' table with rows for ACETONE and CHLOROFC. On the far right, there are sections for 'Pressure' (set to 101325 N/SQM), 'Property Model' (set to UNIFAC), 'Phases' (set to VAP-LIQ), 'Report Units' (set to Temperature: C), and a 'Model Palette' containing icons for MATERIAL, Mixer, FSPLIT, and SSPLIT.

Acetone-Chloroform MaxBoiling.bkp - Aspen Plus V11 - aspenONE

File Home Economics Batch Dynamics Equation Oriented View Customize Resources Search Exchange

Cut Copy Paste Clipboard Units Next Run Step Stop Reset Control Panel Reconcile Settings Model Summary Input Stream Summary History Utility Costs Report Analysis PRD Rating Flare System Safety Analysis

Main Flowsheet Azeotrope Search +

Azeotrope Search

- Input
- Output
 - Pure Components
 - Azeotropes**
 - Singular Points
 - Report

Temp (C) Classification Type No. Comp. ACETONE CHLOROFO

1	64.536	Stable node	Homogeneous	2	0.377	0.623
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T-xy diagram for ACETONE/CHLOROFO

The diagram plots Temperature (C) on the y-axis (ranging from 56.0 to 65.0) against Liquid/vapor mole fraction, ACETONE on the x-axis (ranging from 0.00 to 1.00). Two curves are shown: a blue curve for pressure 1.0132 bar and a green curve for pressure 1.0132 bar. Both curves show a maximum point at approximately 64.5°C when the mole fraction of Acetone is about 0.4.

Navigation Pane

Model Palette

MATERIAL ΣΧΟΛΗ Χημικών Μηχανικών ΕΜΠ

Flowsheet Not Complete Check Status

Παράδειγμα αζεότροπου ελάχιστου βρασμού: Ισοπροπυλικού αιθέρα κ' Ισοπροπυλικής αλκοόλης

- Παραγωγή διαγραμμάτων
 - T_{xy}
 - P_{xy}
 - $y-x$
- Azeotrope find
- ΑΡΧΕΙΑ σε φάκελο: MINIMUM BOILING AZEOTROPE

File Home View Customize Resources Search Exchange

Cut METCBAR Setup Na⁺ Chemistry Methods Assistant TDE NIST Analysis
 Copy Unit Sets Components Customize Clean Parameters DECHEMA Estimation
 Paste Methods Prop Sets Draw Structure DIPPR Regression Run Mode
 Clipboard Units Navigate Retrieve Parameters Data Source Summary Analysis

Properties

Components - Specifications

All Items

- Setup
- Components**
 - Specifications
 - Molecular Structure
 - Assay/Blend
 - Light End Properties
 - Petro Characterization
 - Pseudocomponents
 - Component Attributes

Properties

Simulation

Safety Analysis

Energy Analysis

Required Input Incomplete Check Status

100% - +

<input checked="" type="checkbox"/> Selection	Petroleum	Nonconventional	Enterprise Database	Comments
Select components				
	Component ID	Type	Component name	Alias
	DIISO-01	Conventional	DIISOPROPYL-ETHER	C6H14O-3
	ISOPR-01	Conventional	ISOPROPYL-ALCOHOL	C3H8O-2

Find Elec Wizard SFE Assistant User Defined Reorder Review

File Home View Customize Resources Search Exchange

Cut Setup Na^+ Chemistry Methods Assistant TDE NIST Analysis
 Copy Components Customize Clean Parameters DECHEMA Estimation
 Paste Methods Prop Sets Retrieve Parameters DIPPR Regression Run Mode
 Clipboard Units Navigate Data Source Run Summary Analysis

Properties

All Items

- Setup
- Components
- Methods
 - Specifications
 - Selected Methods
 - Parameters
 - Routes
 - NC Props
 - Tabpoly
- Classification

Properties

Simulation

Safety Analysis

Energy Analysis

Methods - Specifications

Global Flowsheet Sections Referenced Comments

Property methods & options

Method filter: COMMON
 Base method: UNIFAC
 Henry components:

Petroleum calculation options

Free-water method: STEAM-TA
 Water solubility: 3

Electrolyte calculation options

Chemistry ID:
 Use true components

Method name: UNIFAC

Modify

Vapor EOS: ESRK
 Data set: 1

Liquid gamma: GMUFAC
 Data set: 1

Liquid molar enthalpy: HLMX103
 Liquid molar volume: VLMX01

Heat of mixing
 Poynting correction
 Use liquid reference state enthalpy

Results Available Check Status 100% - +

File Home View Customize Resources Search Exchange

Cut Copy Paste Clipboard Units

Setup Na⁺ Chemistry Tools Data Source Run Mode Summary Analysis

Unit Sets Components Methods Prop Sets

NAVIGATE

Properties

All Items

- ▷ Setup
- ▷ Components
- ▷ Methods
 - Chemistry
 - Property Sets
 - Data
- ▷ Estimation
- Analysis
 - BINRY-1
 - Input
- ▷ Customize
- ▷ Results

Properties

Simulation Safety Analysis Energy Analysis

BINRY-1 (BINARY) - Input

Binary Analysis Tabulate Calculation Options Diagnostics Results Comments Status

Analysis type: Txy

Components

Component 1: DIISO-01

Component 2: ISOPR-01

Pseudo-Binary

Pseudo-binary system

Entrainier: [empty dropdown]

Entrainier fraction: [empty grid]

Compositions

Basis: Mole fraction

Vary: DIISO-01

Equidistant (radio button selected)

Logarithmic

List of values

Start point: 0

End point: 1

Number of intervals: 50

Increment: 0.02

Pressure

Units: bar

Equidistant (radio button selected)

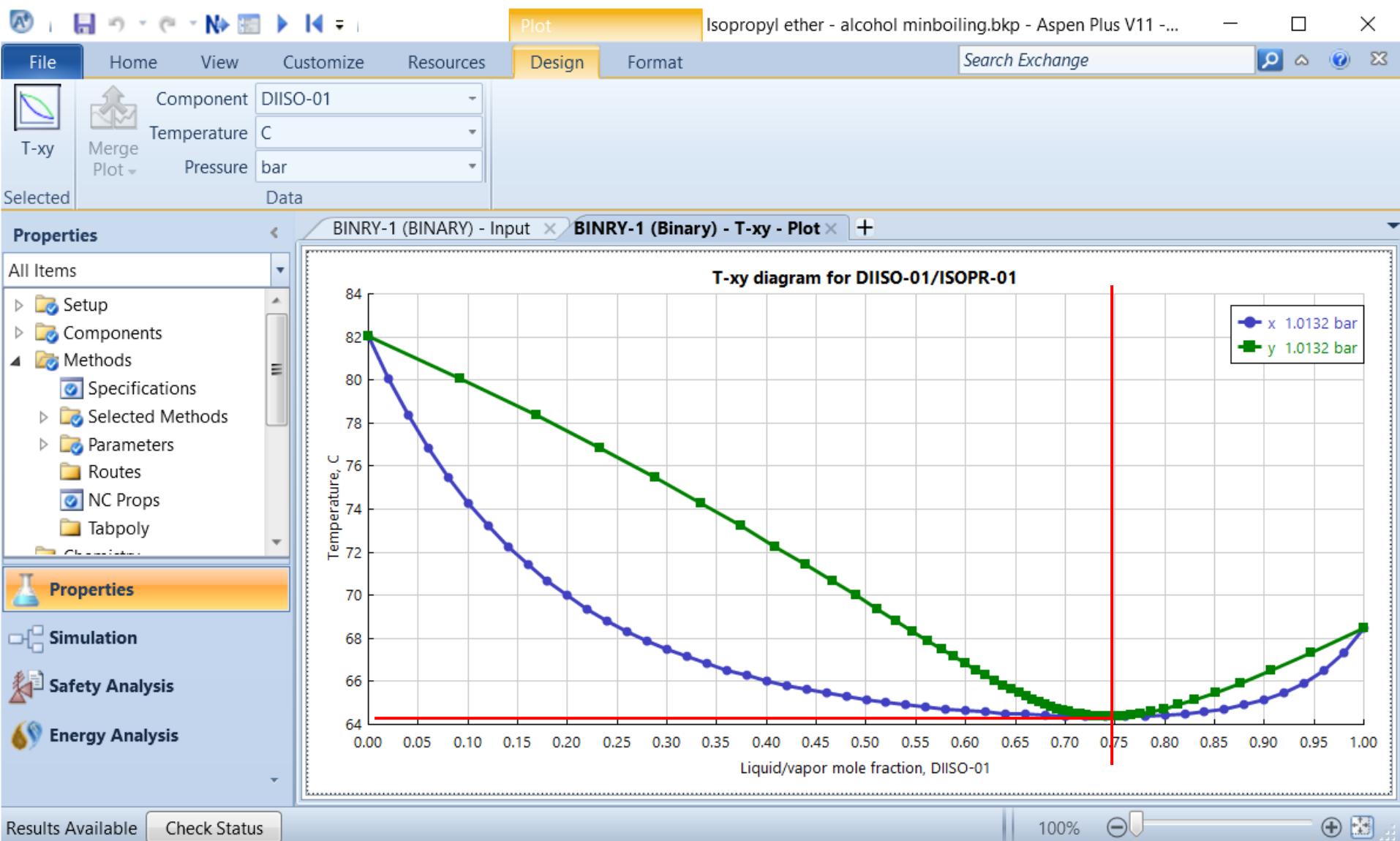
List of values (radio button selected)

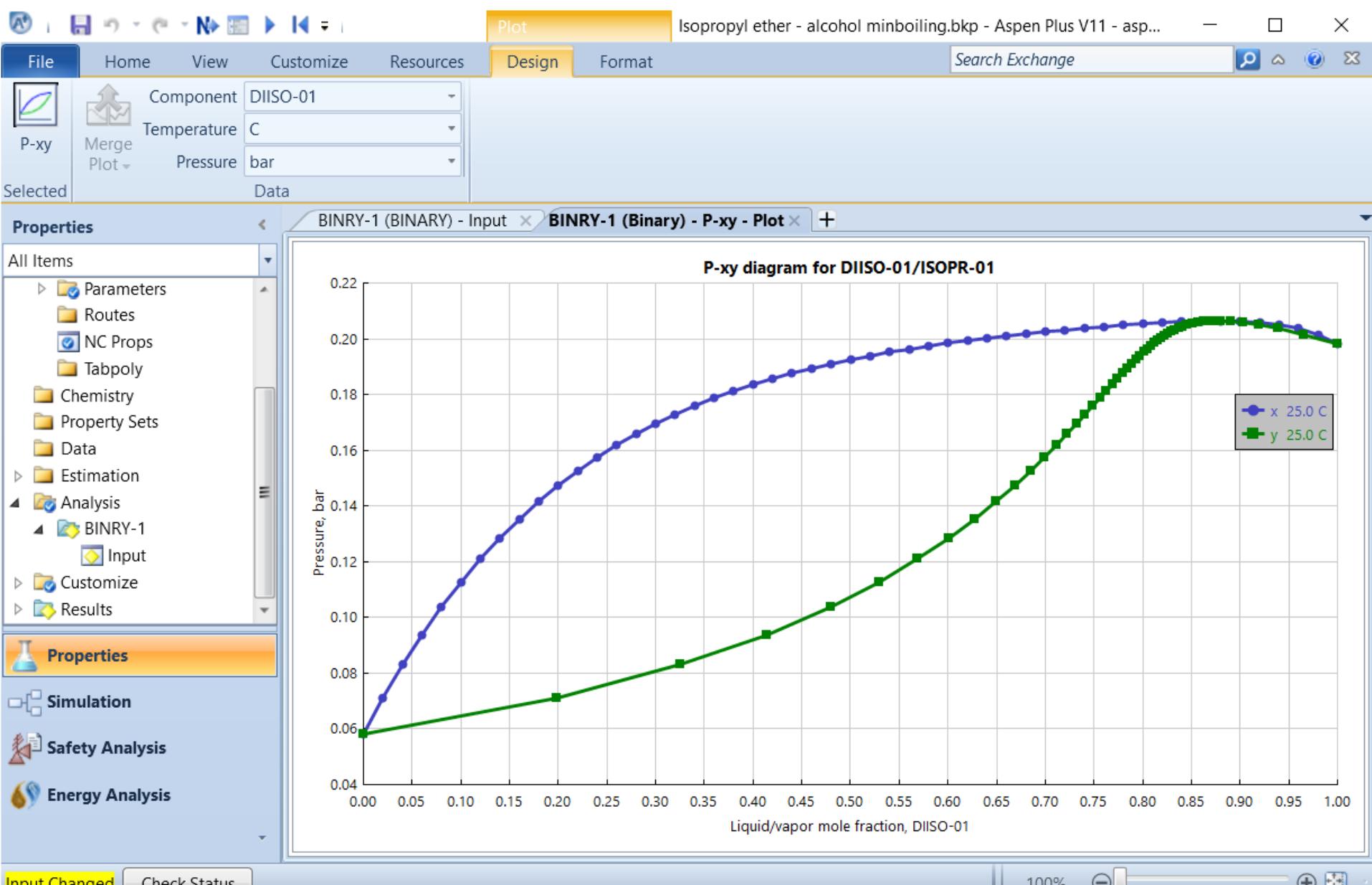
Enter Values: 1.01325

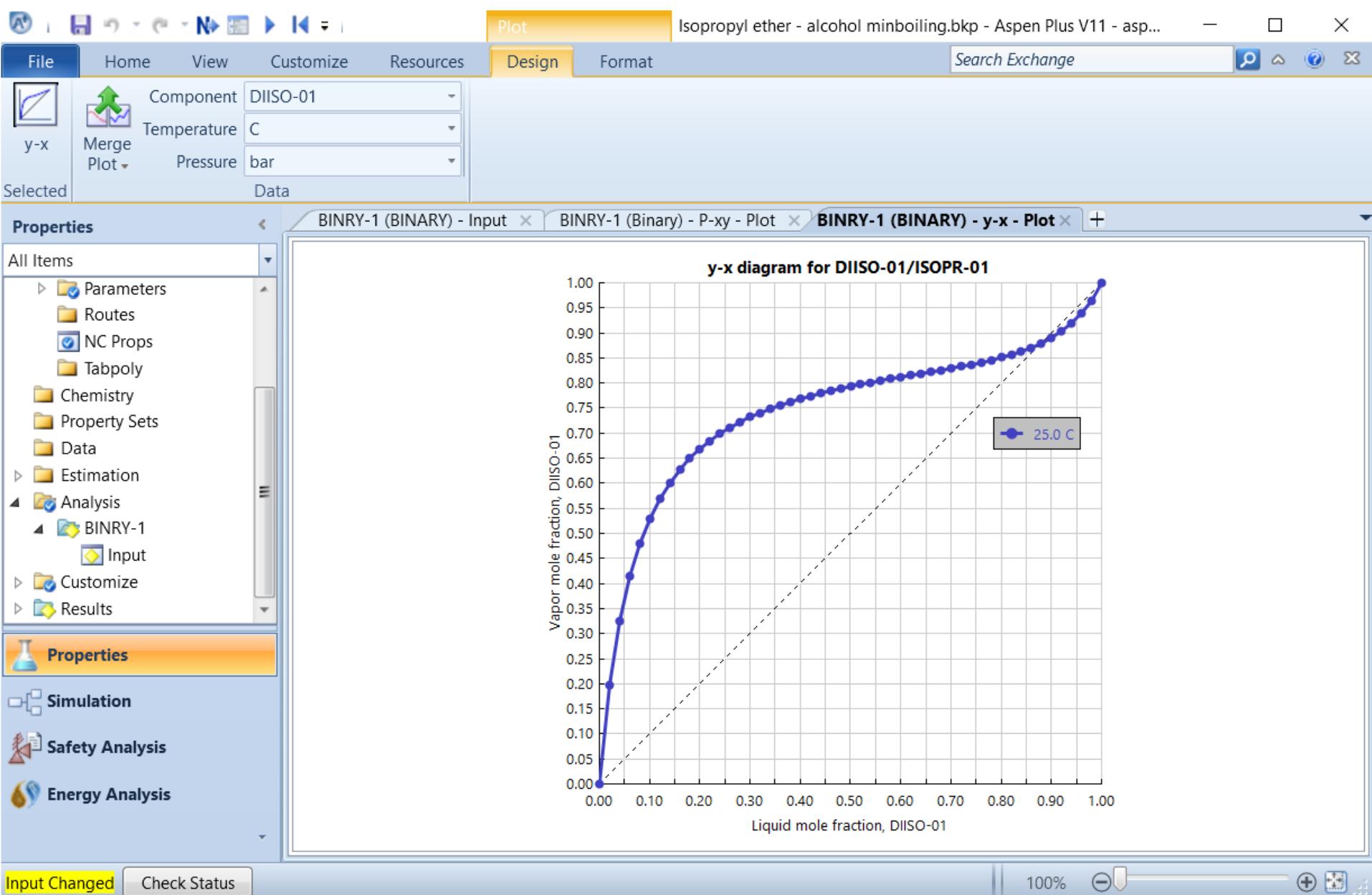
Run Analysis

Results Available Check Status

100% **+** **-**







Isopropyl ether - alcohol minboiling.bkp - Aspen Plus V11 - aspenONE

File Home Economics Batch Dynamics Equation Oriented View Customize Resources Search Exchange

Cut Copy Paste Clipboard Units Next Run Step Stop Reset Control Panel Reconcile Settings Model Summary Input Stream Analysis Heat Exchanger Pressure Relief Stream Summary History Sensitivity Azeotrope Search PRD Rating Utility Costs Report Data Fit Distillation Synthesis Flare System Safety Analysis

Run Summary Analysis

Simulation Main Flowsheet Azeotrope Search +

All Items

- Setup
- Property Sets
- Analysis
- Flowsheet
- Streams
- Blocks
- Utilities
- Reactions
- Convergence
- Flowsheeting Options
- Model Analysis Tools
- EO Configuration
- Results Summary

Properties

Simulation

Safety Analysis

Energy Analysis

Azeotrope Search

Component List

	Name	Description
<input checked="" type="checkbox"/>	DIISO-01	DIISOPROPYL-ET
<input checked="" type="checkbox"/>	ISOPR-01	ISOPROPYL-ALC

Pressure: 101325 N/SQM

Property Model: UNIFAC

Phases: VAP-LIQ

Report Units: Temperature: C

Model Palette

Mixers/Splitters Separators Exchangers Columns Reactors Pressure Changers Manipulators

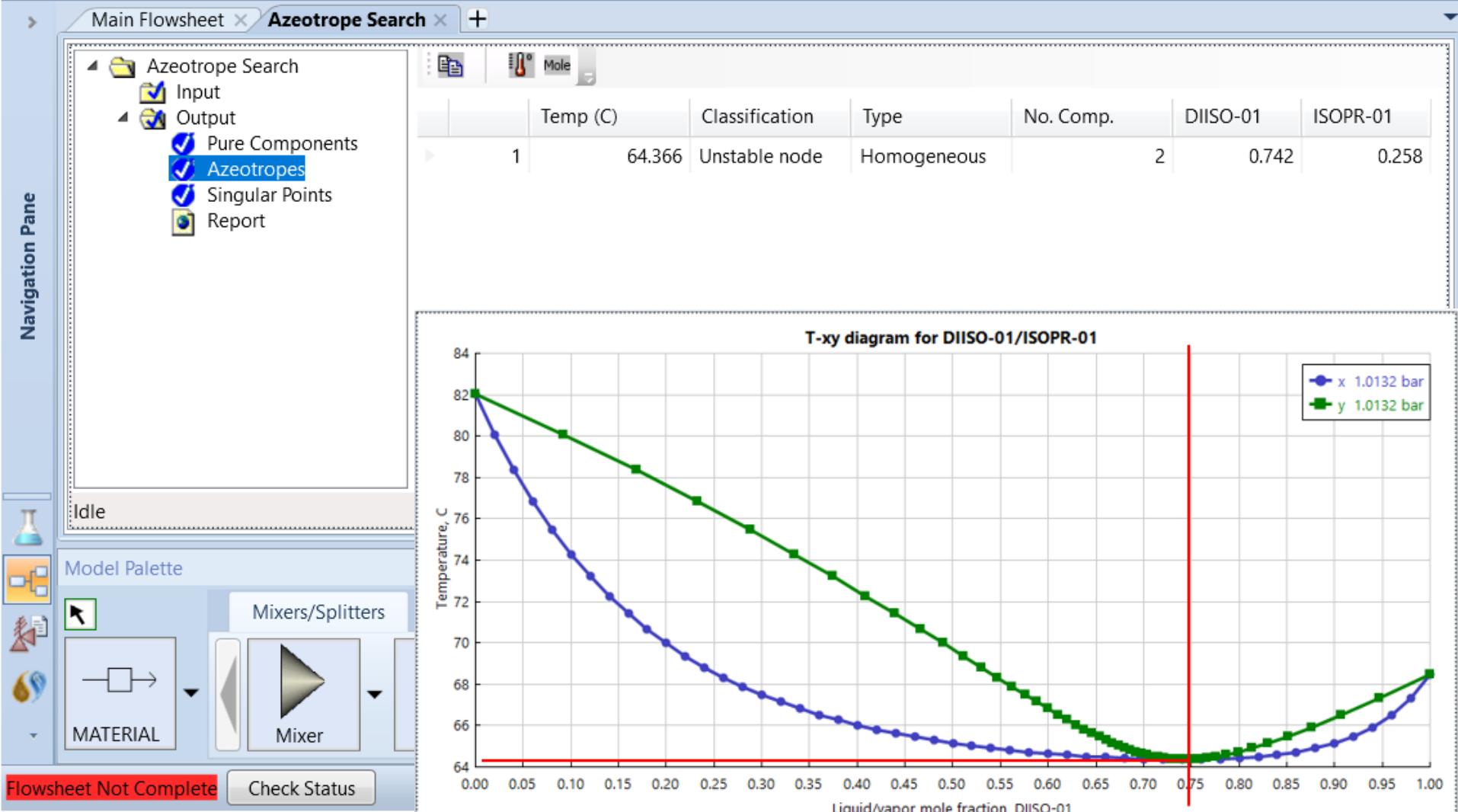
MATERIAL Mixer FSsplit SSsplit

Flowsheet Not Complete Check Status 100% - +

Isopropyl ether - alcohol minboiling.bkp - Aspen Plus V11 - aspenONE

File Home Economics Batch Dynamics Equation Oriented View Customize Resources Search Exchange

Cut Copy Paste Clipboard Units Next Run Step Stop Reset Control Panel Model Summary Input Stream Summary History Utility Costs Report Analysis Pressure Relief PRD Rating Flare System Safety Analysis



ΔΙΑΧΕΙΡΙΣΗ ΤΗΣ ΠΙΕΣΗΣ ΛΕΙΤΟΥΡΓΙΑΣ (PRESSURE SWING)

Στόχοι - Παράδειγμα

- Χρήση εναλλαγής πίεσης για το διαχωρισμό δυαδικού μείγματος που σχηματίζει ένα αζεότροπο σε δύο καθαρά συστατικά.
- Η **αιθανόλη** και το **βενζόλιο** σχηματίζουν ένα **αζεότροπο** και η αζεοτροπική σύσταση είναι ευαίσθητη στην πίεση.
- Επομένως, είναι δυνατό να χρησιμοποιηθεί η εναλλαγή πίεσης για να διαχωριστεί αυτό το δυαδικό μείγμα σε καθαρά συστατικά.

Διατύπωση του προβλήματος

- Να σχεδιαστεί στο Aspen Plus ροοδιάγραμμα με δυο αποστακτικές στήλες, που η πρώτη λειτουργεί υπό πίεση 3 bar και η δεύτερη στο 1 bar.
- Ένας συμπιεστής χρησιμοποιείται για την αύξηση της πίεσης του ρεύματος ανακύκλωσης από 1 σε 3 bar πριν ανακυκλωθεί πίσω στην πρώτη στήλη.
- Εφόσον η σχετική πτητικότητα είναι μεγάλη εκτός από το αζεοτροπικό σημείο, δεν χρειάζεται να προστεθεί τρίτο συστατικό (ως διαλύτης).

Συστατικά

PRESSURE_SWING_V2_20211130.bkp - Aspen Plus V11 - aspenONE

File Home View Customize Resources Search Exchange

Cut METCBAR Setup Na⁺ Chemistry Tools Run
Copy Unit Sets Components Customize Data Source Mode Run
Paste Methods Prop Sets Navigate Summary Analysis

Clipboard Units

Properties

Components - Specifications

All Items

- Setup
- Components
 - Specifications
 - Molecular Structure
 - Assay/Blend

Properties

Simulation

Safety Analysis

Energy Analysis

Find Elec Wizard SFE Assistant User Defined Reorder Review

Component ID	Type	Component name	Alias
ETHANOL	Conventional	ETHANOL	C2H6O-2
BENZENE	Conventional	BENZENE	C6H6

Results Available Check Status

100%

Θερμοδυναμική μέθοδος

PRESSURE_SWING_V2_20211130.bkp - Aspen Plus V11 - aspenONE

File Home View Customize Resources Search Exchange

Cut METCBAR Setup Na⁺ Chemistry Tools TDE NIST Data Source Run Mode Run Summary Analysis

Copy Unit Sets Components Methods Prop Sets Units Navigate

Clipboard

Properties

All Items

- Setup
- Components
- Methods
 - Specifications
 - Selected Methods
 - Parameters
 - Routes
 - NC Props
 - Tabpoly

Properties

Simulation

Safety Analysis

Energy Analysis

Results Available Check Status

Methods - Specifications

Global Flowsheet Sections Referenced Comments

Property methods & options

Method filter: CHEMICAL

Base method: UNIQ-RK

Henry components:

Petroleum calculation options

Free-water method: STEAM-TA

Water solubility: 3

Electrolyte calculation options

Chemistry ID:

Use true components

Method name: UNIQ-RK

Methods Assistant...

Modify

Vapor EOS: ESRK

Data set: 1

Liquid gamma: GMUQUAC

Data set: 1

Liquid molar enthalpy: HLMX31

Liquid molar volume: VLMX01

Heat of mixing

Poynting correction

Use liquid reference state enthalpy

100%

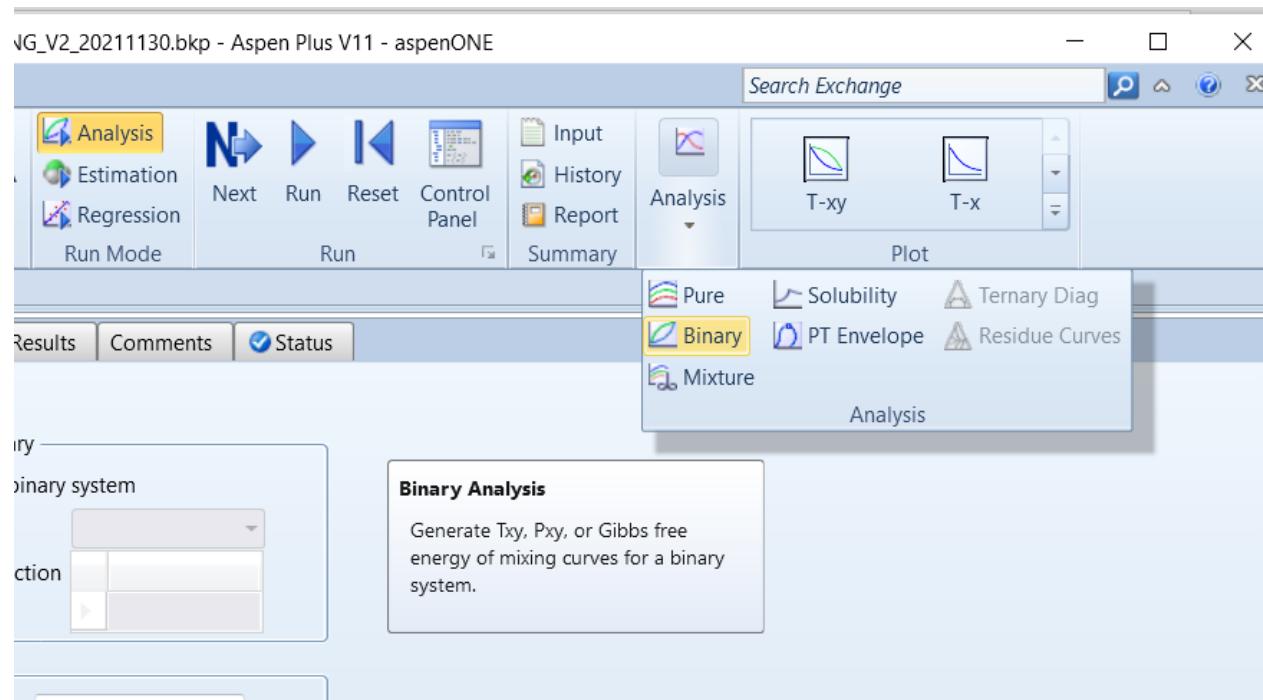
2

Συντελεστές αλληλεπίδρασης (προκύπτουν αυτόματα με το Next ή κουμπί F4)

The screenshot shows the Aspen Plus V11 software interface. The title bar reads "PRESSURE_SWING_V2_20211130.bkp - Aspen Plus V11 - aspenONE". The menu bar includes File, Home, View, Customize, Resources, and a search bar. The toolbar contains various icons for tasks like Setup, Chemistry, Methods Assistant, NIST, DECHEMA, Analysis, etc. The main window displays the "Properties" dialog for "Binary Interaction - UNIQ-1 (T-DEPENDENT)". The left sidebar shows a tree view of items under "All Items", including Methods, Parameters, and Binary Interaction. Under "Binary Interaction", several models are listed with checkboxes: ANDKIJ-1, ANDMIJ-1, HENRY-1, MLQKIJ-1, MUKIJ-1, MULIJ-1, RKTKIJ-1, and UNIQ-1. The "Input" tab is selected in the dialog, which contains fields for Parameter (UNIQ), Help, Data set (1), Swap, Enter Dechema Format, Estimate using UNIFAC, View Regression Information, and Search. Below these are sections for "Temperature-dependent binary parameters" and "Activity coefficient parameters". A table lists binary interaction parameters for the pair ETHANOL-BENZENE, sourced from APV110 VLE-RK, at unit C. The table columns are Component i, Component j, Source, Temperature units, AIJ, AJI, BIJ, and BJI. The values shown are AIJ: -0.5667, AJI: 1.8535, BIJ: 239.442, and BJI: -989.403.

Component i	Component j	Source	Temperature units	AIJ	AJI	BIJ	BJI
ETHANOL	BENZENE	APV110 VLE-RK	C	-0.5667	1.8535	239.442	-989.403

Εκτελέστε ανάλυση δυαδικού μίγματος για να αναζητήσετε αζεότροπα



Δημιουργείται μια δυαδική ανάλυση, BINRY-1, και η Analysis | BINRY-1 | Input | εμφανίζεται το φύλλο δυαδικής ανάλυσης.

Σημειώστε ότι τα περισσότερα από τα πεδία σε αυτό το φύλλο έχουν ήδη συμπληρωθεί αυτόματα.

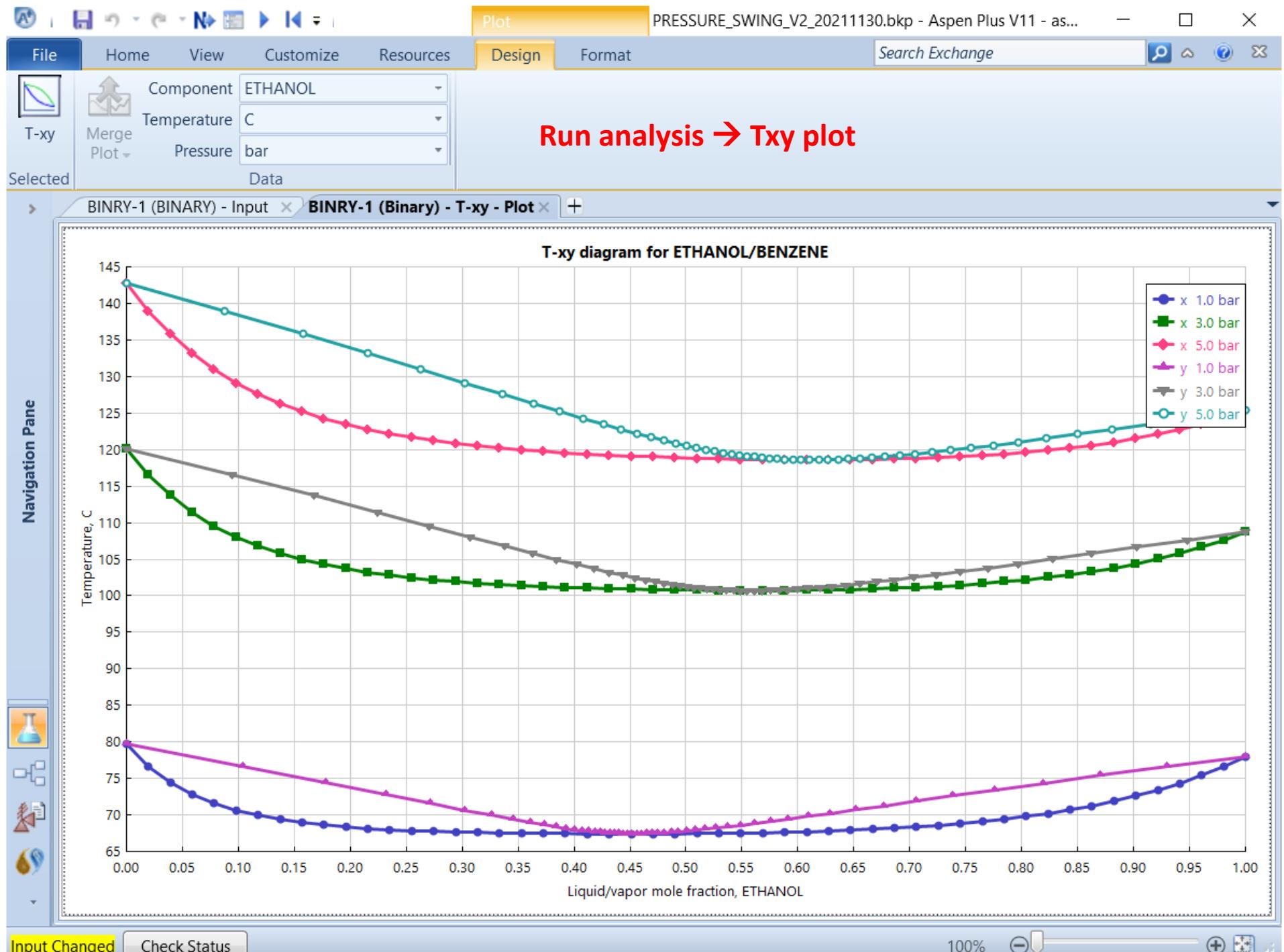
Χρειάζεται μόνο να αλλάξουμε λίστα τιμών (List of values).

Στην περιοχή List of values στο πλαίσιο πίεσης (Pressure), αλλάξτε το 1,01325 σε 1 και προσθέστε δύο ακόμη τιμές: 3 και 5.

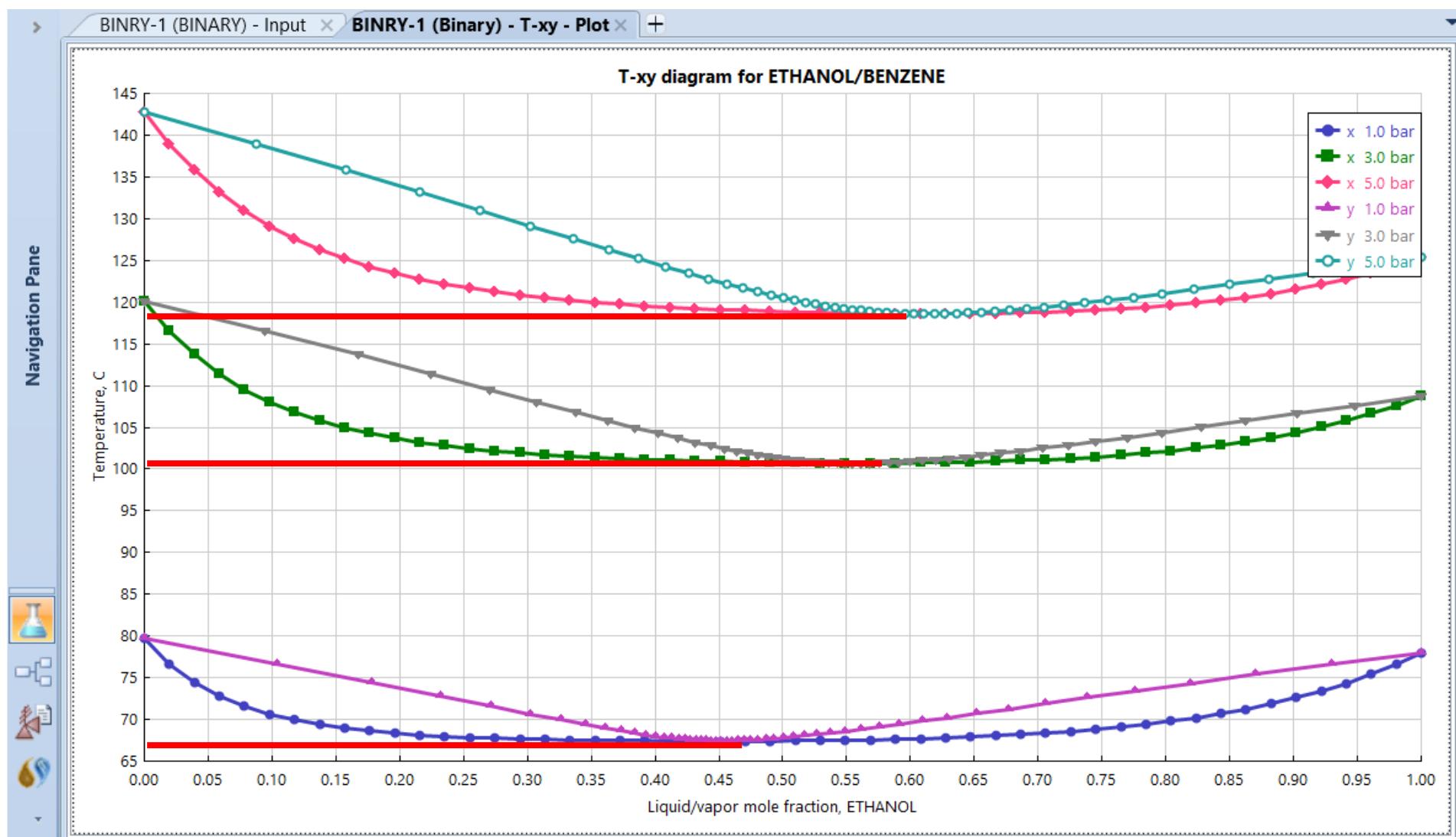
Αυτό το φύλλο θα πρέπει να μοιάζει με το παρακάτω στιγμιότυπο οθόνης:

The screenshot shows the Aspen Plus V11 software interface with the following details:

- File** tab is selected in the top menu bar.
- Home** tab is active in the ribbon.
- Properties** panel on the left shows the navigation tree with **BINRY-1** selected under **Analysis > BINRY-1 > Input**.
- BINRY-1 (BINARY) - Input** properties window is open.
- Analysis type**: Txy
- Components**: Component 1: ETHANOL, Component 2: BENZENE
- Compositions**: Basis: Mole fraction, Vary: ETHANOL, Type: Equidistant, Start point: 0, End point: 1, Number of intervals: 51, Increment: 0.019608
- Pressure**: Units: bar, Type: List of values, Enter Values: 1, 3, 5
- Run Analysis** button is highlighted with a red box.



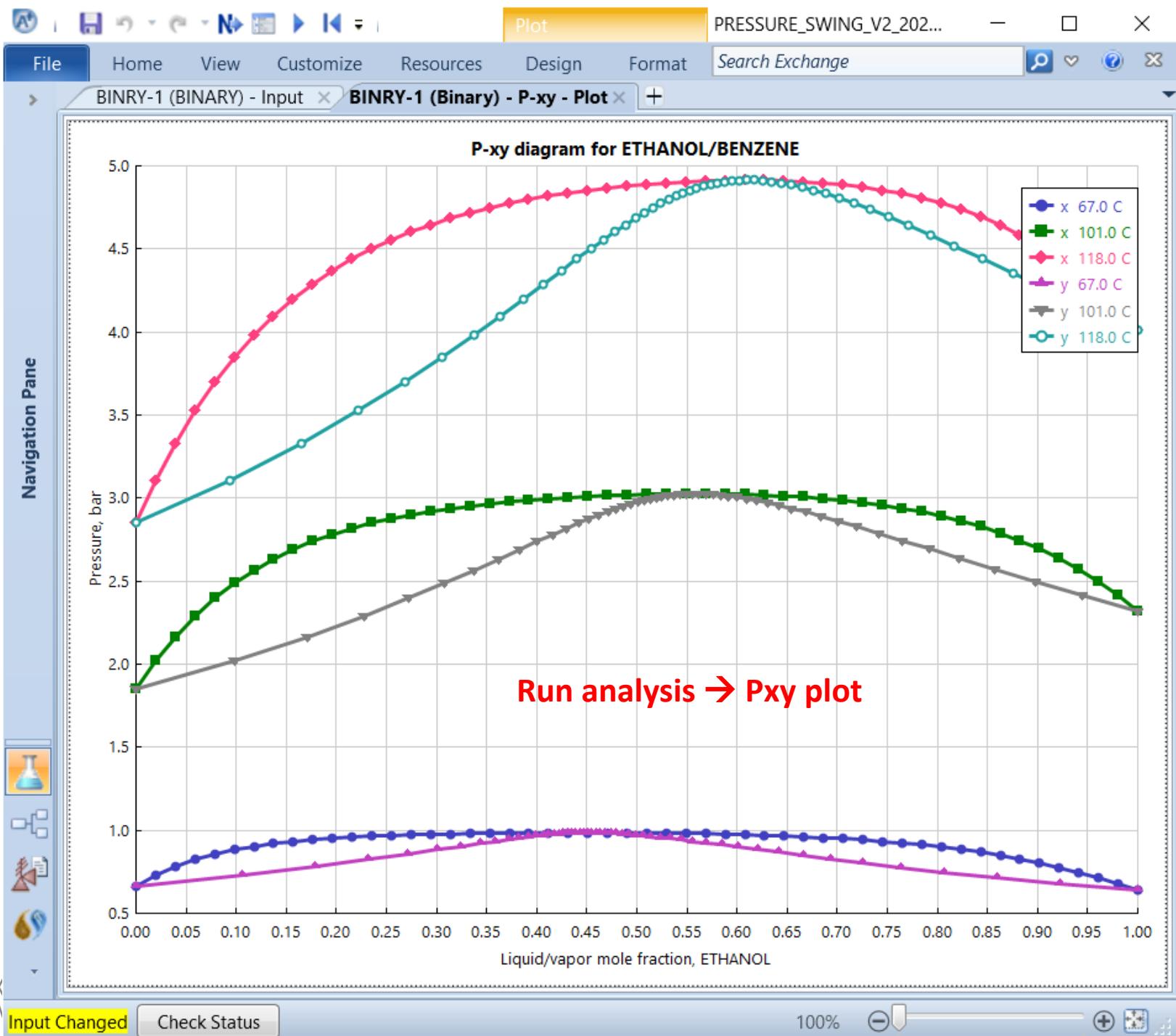
Για διάγραμμα **Pxy** και σύγκριση με το **Txy** εισάγουμε στο πεδίο Temperature τις θερμοκρασίες των αζεότροπων στο Txy που φαίνονται παρακάτω:
~67, ~101 και ~118 °C.



Αυτό το φύλλο θα πρέπει να μοιάζει με το παρακάτω στιγμιότυπο οθόνης:

The screenshot shows the Aspen Plus V11 software interface with the following details:

- Toolbar:** File, Home, View, Customize, Resources, Search Exchange, Cut, Copy, Paste, Units, Navigate, Tools, Data Source, Run Mode, Run, Summary, Analysis, P-xy, P-x, Plot.
- Window Title:** PRESSURE_SWING_V2_20211130.bkp - Aspen Plus V11 - a...
- Current Tab:** BINRY-1 (BINARY) - Input
- Binary Analysis Dialog:**
 - Analysis type:** Pxy
 - Components:** Component 1: ETHANOL, Component 2: BENZENE
 - Pseudo-Binary:** Pseudo-binary system, Entrainer, Entrainer fraction
 - Compositions:** Basis: Mole fraction, Vary: ETHANOL, Type: Equidistant, Start point: 0, End point: 1, Number of intervals: 51, Increment: 0.019608
 - Temperature:** Units: C, Type: List of values, Values: 67, 101, 118
- Run Analysis Button:** A green button labeled "Run Analysis" is highlighted with a red border.
- Status Bar:** Input Changed, Check Status, 100%, zoom controls.
- Navigation Pane:** Shows icons for Home, Recent, Favorites, Help, and Exit.



Διάγραμμα γ-χ

BHMATA:

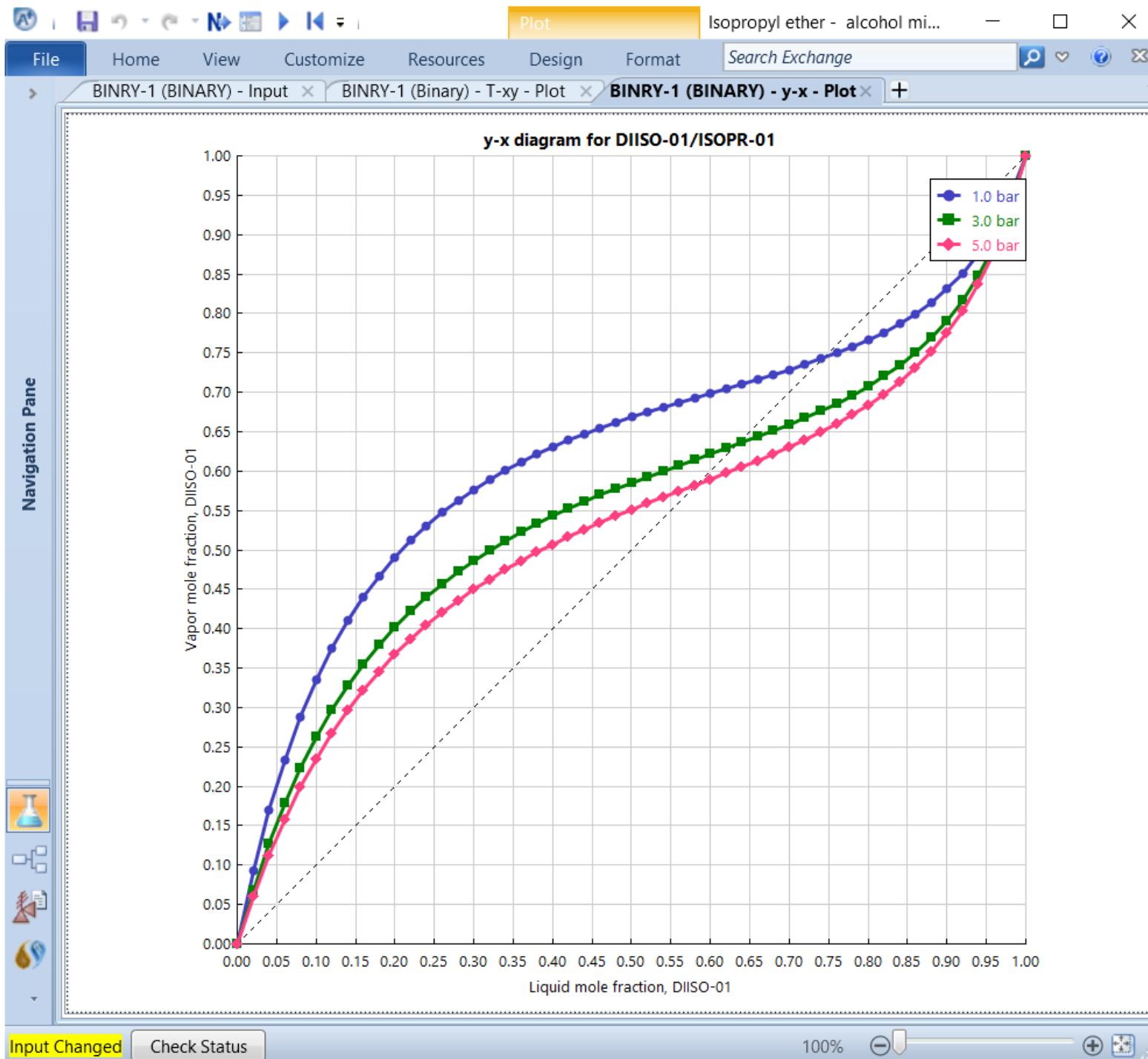
1. Επιλογή Txy
σε Analysis type

2. Run analysis
→ Txy plot

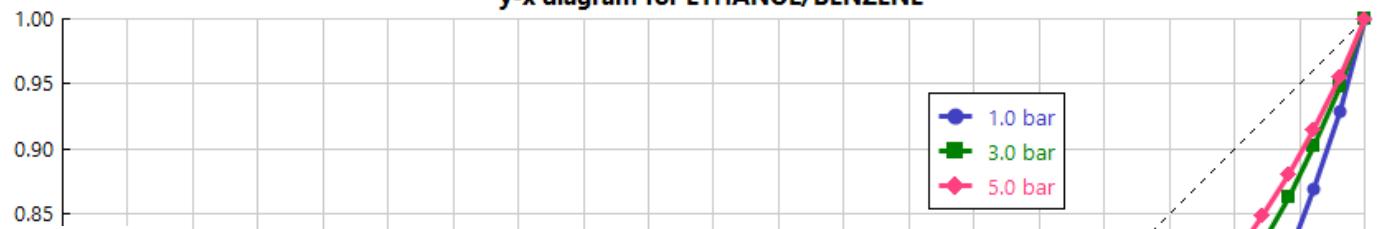
3. Επιλογή → γ-
χ plot

The screenshot shows the HYSIS software interface with the following details:

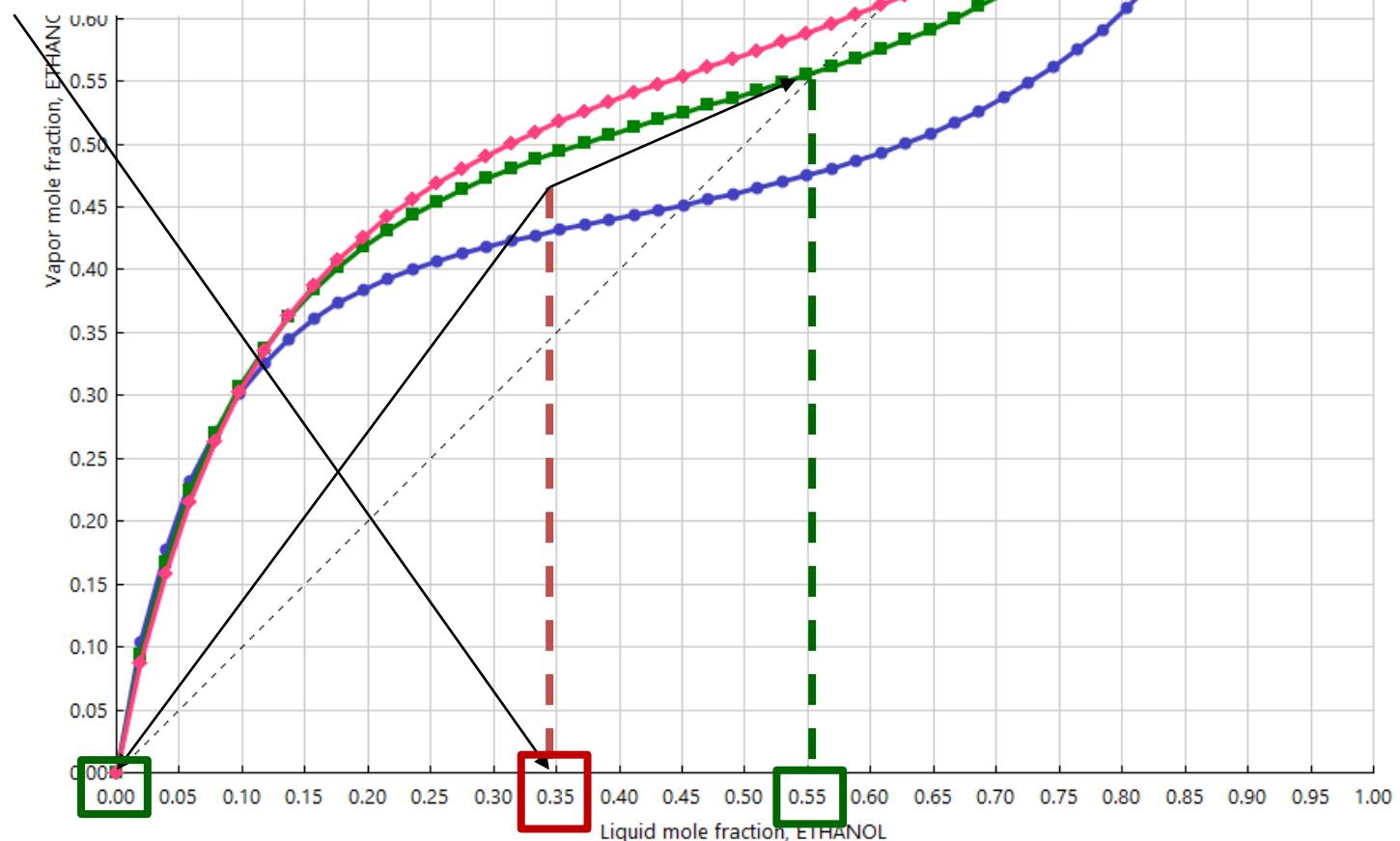
- File Bar:** File, Home, View, Customize, Resources, Search Exchange.
- Toolbars:** METCBAR, Unit Sets, Navigate, Tools, Data Source, Run Mode, Run, Summary, Analysis.
- Properties Panel:** Shows "All Items" expanded, with "BINRY-1 (BINARY) - Input" selected.
- Analysis Type Selection:** The "Analysis type" dropdown is set to "Txy" (highlighted with a red box).
- Components:** Component 1 is set to "ETHANOL" and Component 2 to "BENZENE".
- Compositions:** Basis is "Mole fraction", Vary is "ETHANOL", and the "Start point" is "0".
- Intervals:** Number of intervals is "51".
- Pressure:** Units are "bar".
- Plot Options:** A context menu is open over the "y-x" icon in the toolbar, showing options like "T-xy", "T-x", "Activity Coeff.", and "K-values".
- Status Bar:** Input Changed, Check Status, 100% zoom.



y-x diagram for ETHANOL/BENZENE

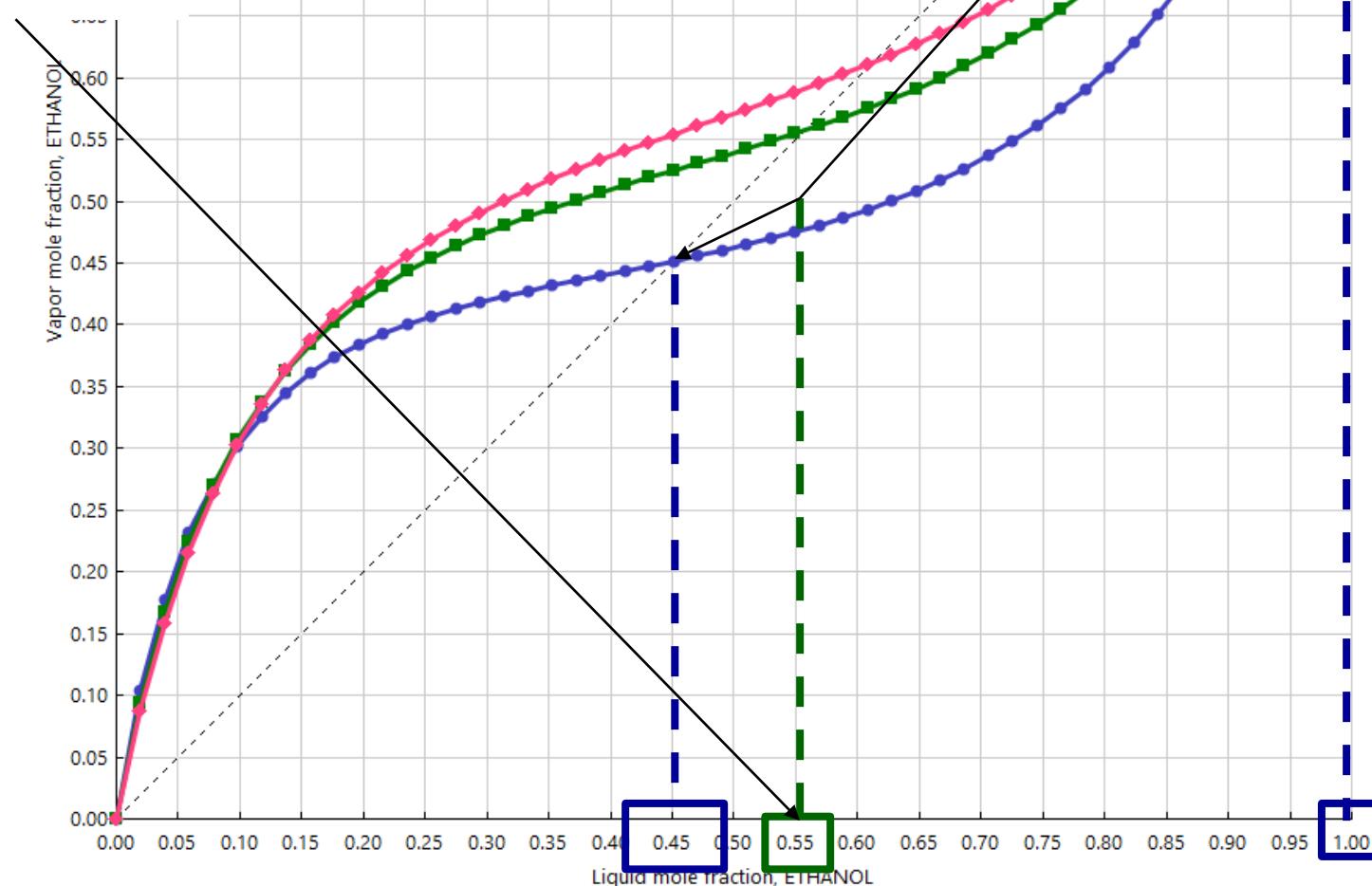


Έστω
τροφοδοσία
στην πρώτη
στήλη (3 bar)
0.35% ETH

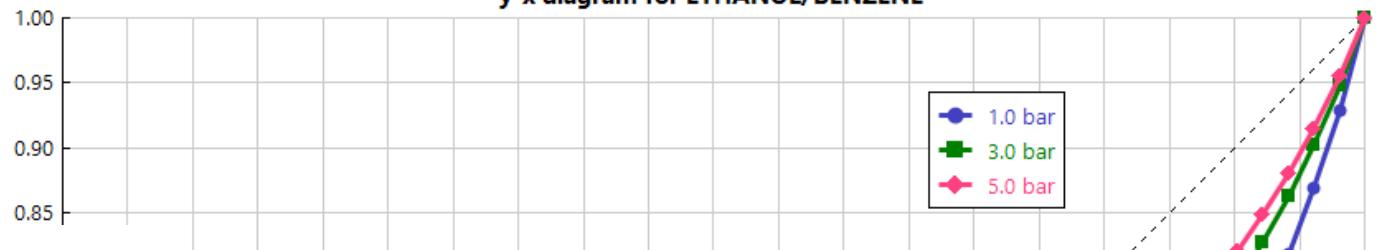


y-x diagram for ETHANOL/BENZENE

Τροφοδοσία
στην δεύτερη
στήλη (1 bar)
0.558% ETH

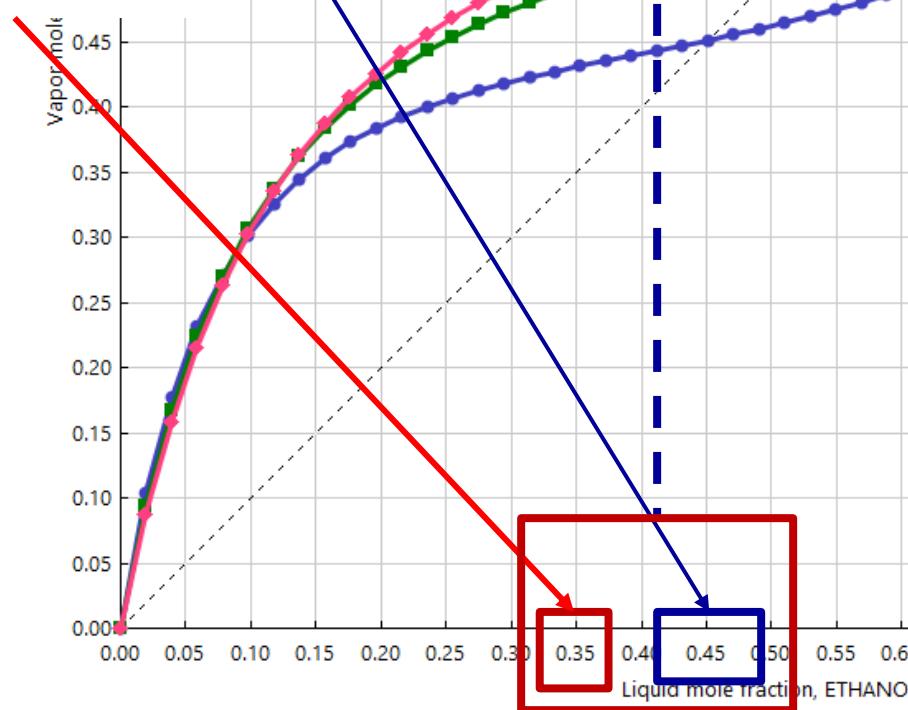


y-x diagram for ETHANOL/BENZENE

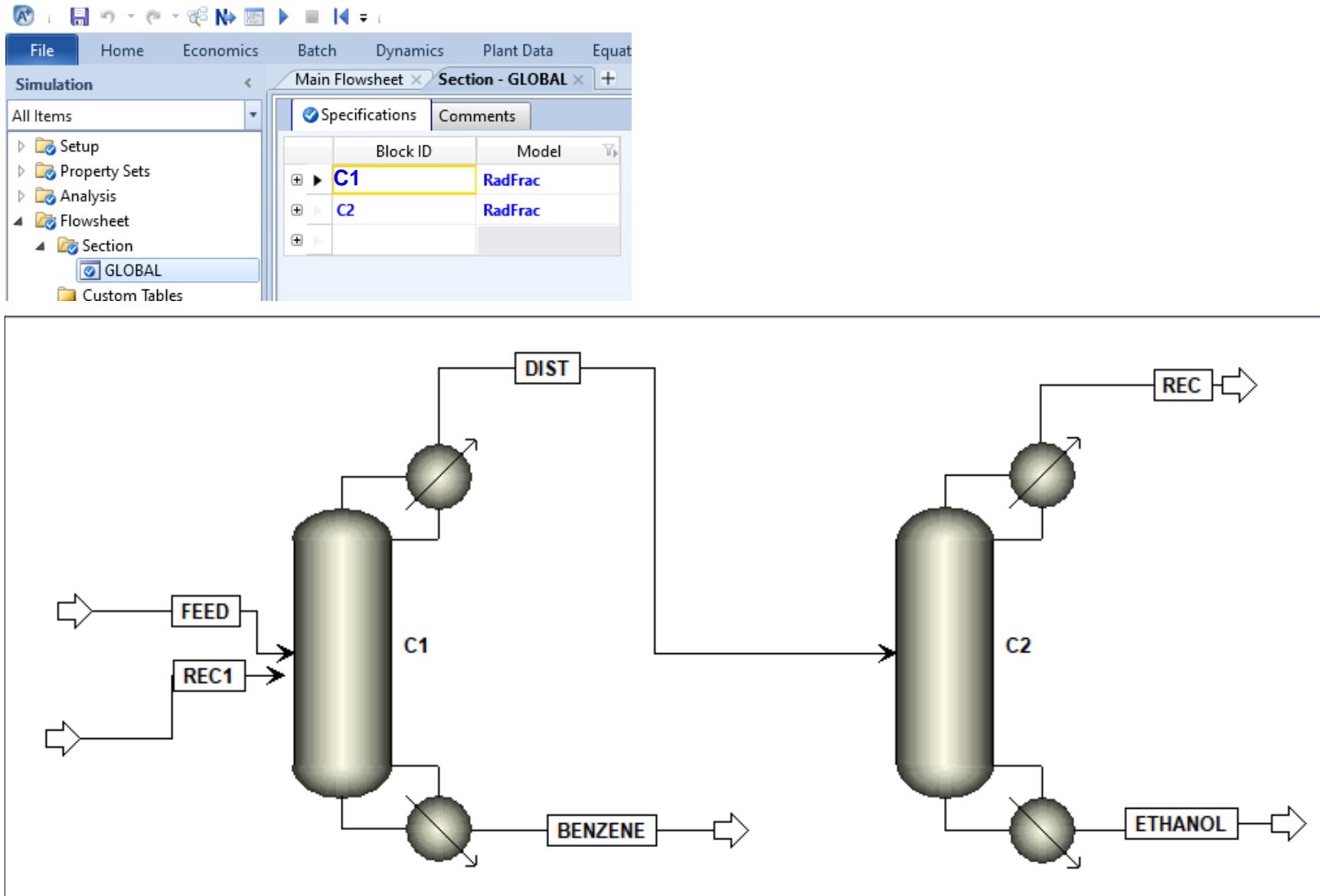


Ανακύκλωση
στην πρώτη
στήλη (3 bar)
0.452% ETH

Και ανάμιξη με
την αρχική
τροφοδοσία



Αρχικό ροοδιάγραμμα



Ρεύμα τροφοδοσίας (FEED)

Simulation Main Flowsheet Section - GLOBAL FEED (MATERIAL)

Mixed CI Solid NC Solid Flash Options EO Options Costing Comments

Specifications

Flash Type Pressure Vapor Fraction

State variables

Temperature	C
Pressure	3 bar
Vapor fraction	0.5
Total flow basis	Mole
Total flow rate	100 kmol/hr
Solvent	

Composition

Mole-Frac

Component	Value
ETHANOL	0.5
BENZENE	0.5

Reference Temperature

Volume flow reference temperature

Component concentration reference temperature

Total 1

All Items

- Setup
- Property Sets
- Analysis
- Flowsheet
- Streams
 - BENZENE
 - DIST
 - ETHANOL
 - FEED
 - Input
 - Results
 - EO Variables
 - REC
 - REC1
- Blocks
 - Utilities
 - Reactions
- Convergence
- Flowsheeting Options

Υπολογισμός σύστασης ρεύματος ανακύκλωσης

- Ενεργοποίηση του Find azeotropes
- Επιλογή συστατικών κ' πίεσης λειτουργίας 2^{ης} στήλης (1 bar)
- Υπολογισμός αζεότροπου για το μίγμα ETHANOL-BENZENE

Επιλογή συστατικών κ' πίεσης (1 bar) λειτουργίας 2^{ης} στήλης

PRESSURE_SWING_V4_NO_Recycle_mixer_20211207dummy.bkp - Aspen Plus V11 - aspenONE

File Home Economics Batch Dynamics Equation Oriented View Customize Resources Search Exchange

Cut Copy Paste Clipboard Units Next Run Step Stop Reset Run

Control Panel Model Summary Input Stream Analysis Heat Exchanger

Reconcile Stream Summary History Sensitivity Azeotrope Search

Settings Utility Costs Report Data Fit Distillation Synthesis

Summary Analysis

Azeotrope Search Main Flowsheet DIST (MATERIAL) - Results MIXDFEED (MATERIAL) - Results Control Panel FEED (MATERIAL)

Navigation Pane

- Azeotrope Search
 - Input
 - Output
 - Pure Components
 - Azeotropes
 - Singular Points
 - Report

Component List

Name	Description
ETHANOL	ETHANOL
BENZENE	BENZENE

Pressure
1 BAR

Property Model
Model: UNIQ-RK
Phases: VAP-LIQ

Report Units
Temperature: C

Model Palette

Required Input Complete Check Status

100% - +

The screenshot displays the Aspen Plus software interface for a distillation model named 'PRESSURE_SWING_V4_NO_Recycle_mixer_20211207dummy.bkp'. The main window shows the 'Azeotrope Search' results. In the navigation pane, the 'Pure Components' option under 'Azeotrope Search' is highlighted with a red box. The 'Component List' table shows two components: ETHANOL and BENZENE. On the right side of the screen, a red box highlights the 'Pressure' setting at 1 BAR. The 'Property Model' section indicates the use of the UNIQ-RK model and the VAP-LIQ phase. The bottom status bar shows 'Required Input Complete' and 'Check Status'.

Υπολογισμός αζεότροπου για το μίγμα ETHANOL-BENZENE

PRESSURE_SWING_V4_NO_Recycle_mixer_20211207dummy.bkp - Aspen Plus V11 - a...

File Home Economics Batch Dynamics Equation Oriented View Customize Resources Search Exchange

Cut Copy Paste Clipboard Units Next Run Step Stop Reset Control Panel Model Summary Input Stream Summary History Utility Costs Report Analysis Pressure Relief PRD Rating Flare System Safety Analysis

Azeotrope Search Main Flowsheet DIST (MATERIAL) - Results MIXDFEED (MATERIAL) - Results Control Panel +

Navigation Pane

Azeotrope Search

- Input
- Output
 - Pure Components
 - Azeotropes**
 - Singular Points
 - Report

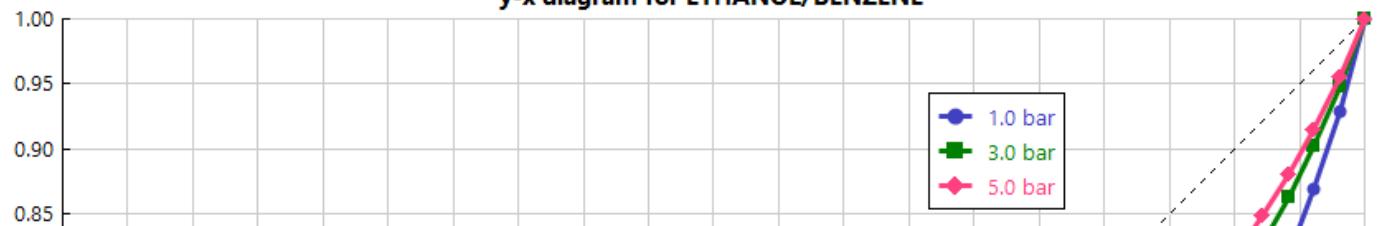
	Temp (C)	Classification	Type	No. Comp.	ETHANOL	BENZENE
1	67.413	Unstable node	Homogeneous	2	0.452	0.548

Idle

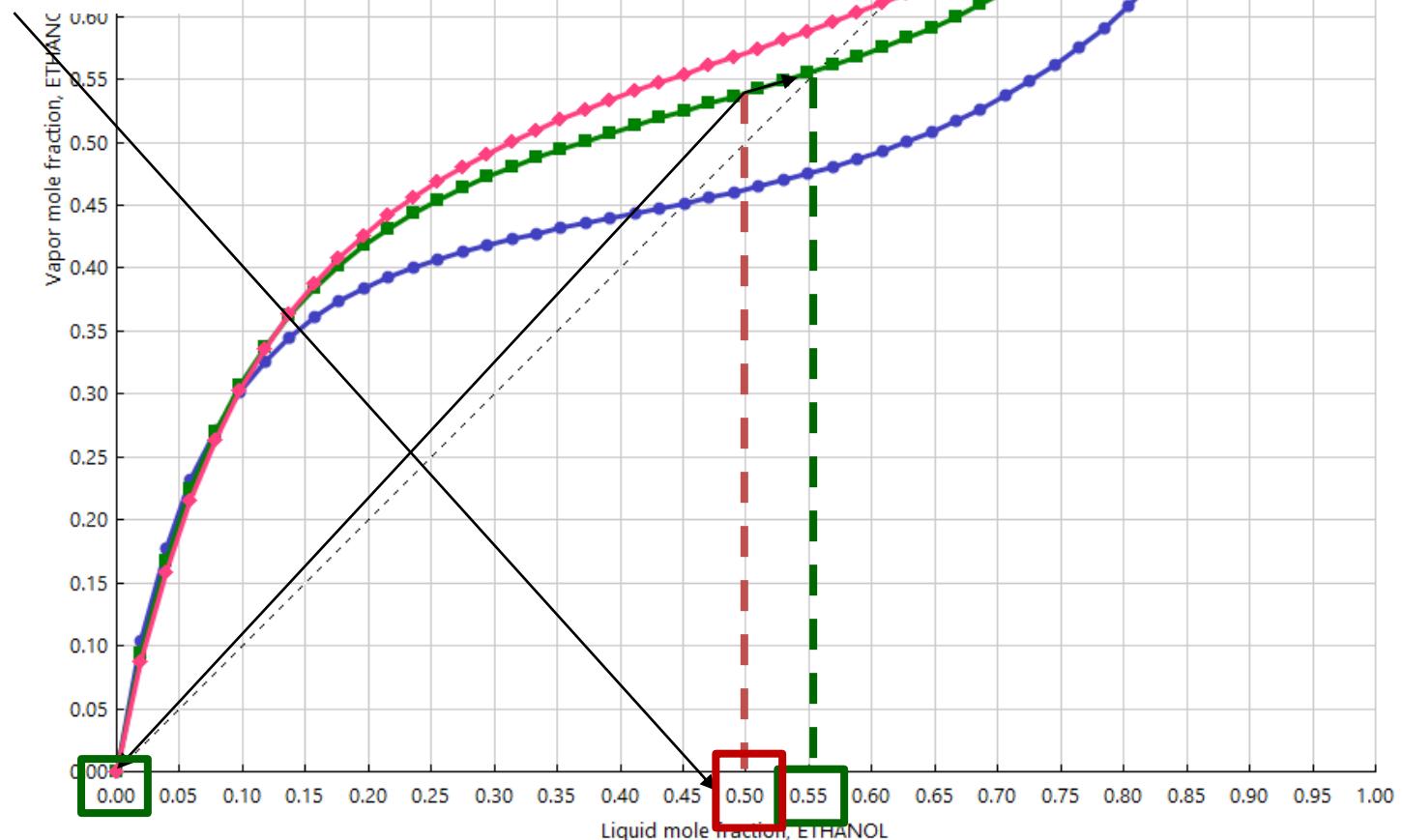
Εργαστήριο προσωμοιωτή χημικών διεργασιών Aspen Plus

49

y-x diagram for ETHANOL/BENZENE

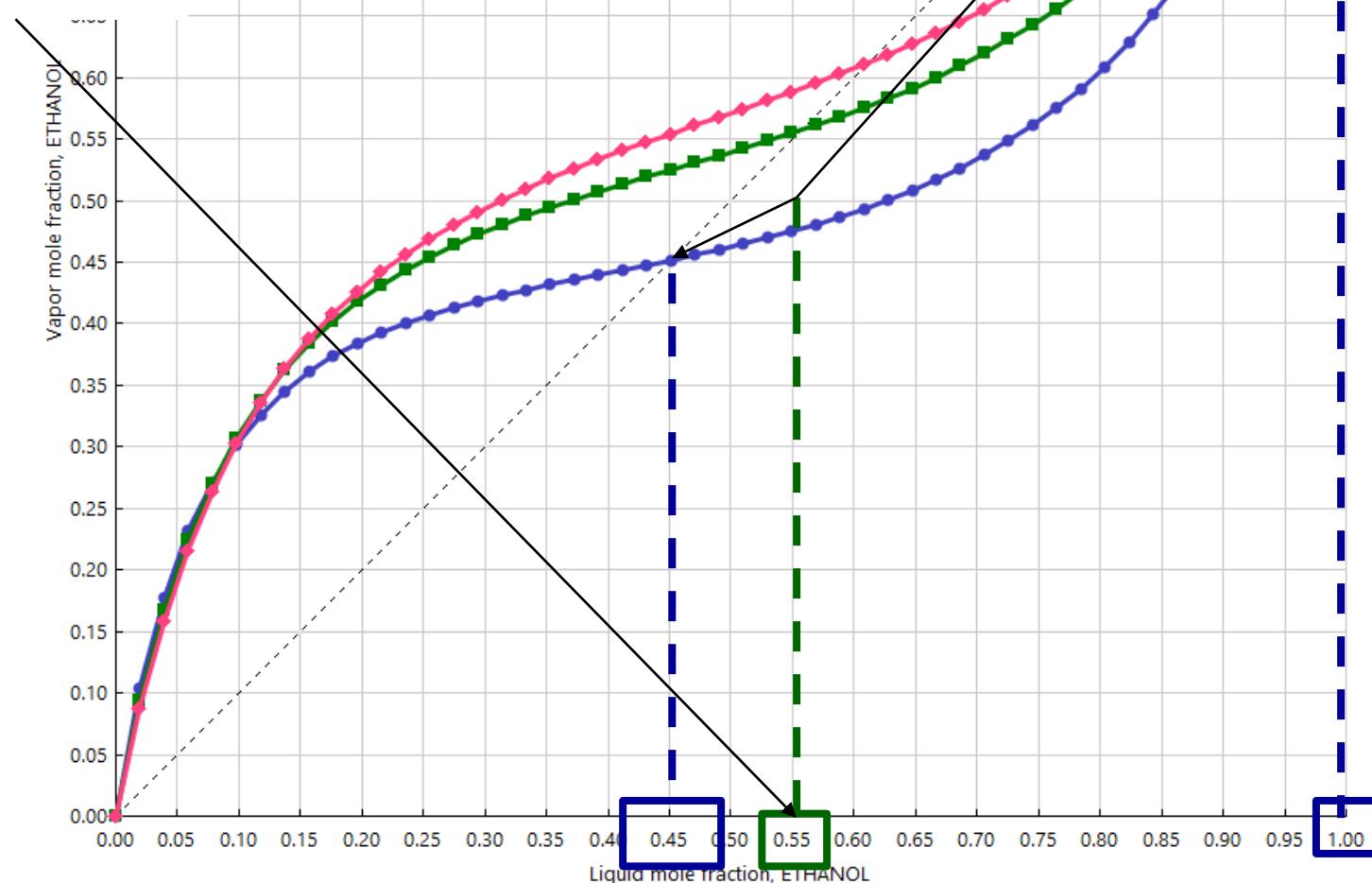


Έστω
τροφοδοσία
στην πρώτη
στήλη (3 bar)
0.50% ETH



y-x diagram for ETHANOL/BENZENE

Τροφοδοσία
στην δεύτερη
στήλη (1 bar)
0.558% ETH



y-x diagram for ETHANOL/BENZENE

1.00

0.95

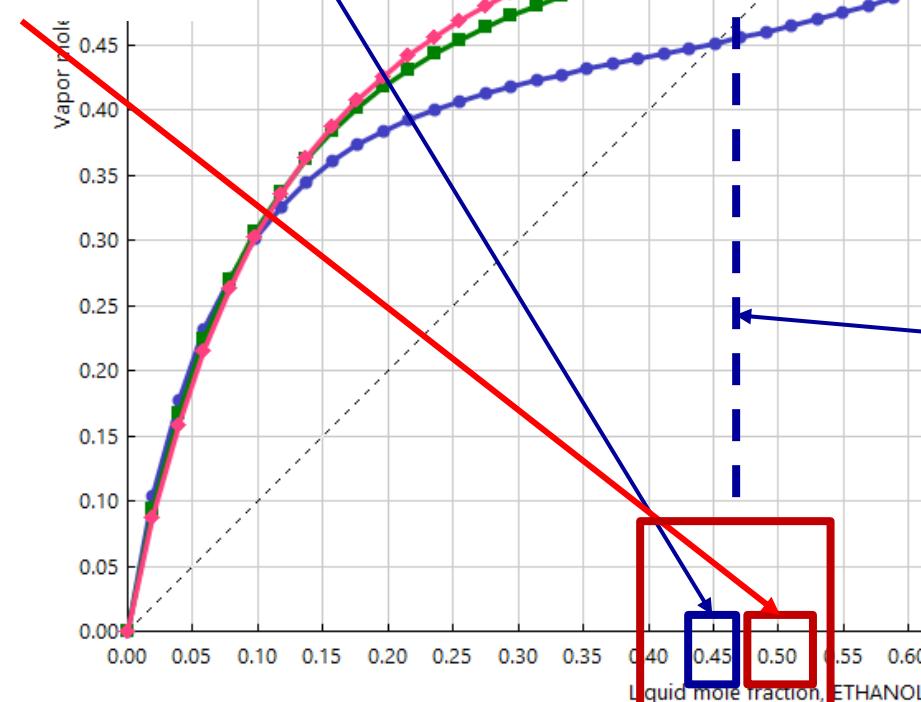
0.90

0.85

- 1.0 bar
- 3.0 bar
- ◆ 5.0 bar

Ανακύκλωση
στην πρώτη
στήλη (3 bar)
0.452% ETH

Και ανάμιξη με
την αρχική
τροφοδοσία



Mole Fractions
για ροή 200 kmol/hr:

ETHANOL 0.468

BENZENE 0.532

Ρεύμα MIXDFEED
File:
PRESSURE_SWING_V4
_NO_Recycle_mixer_20
211207dummy.bkp

Ψεύμα REC1

Screenshot of a process simulation software interface showing a material specification dialog.

The top menu bar includes: File, Home, Econom, Batch, Dynamic, Equatior, View, Customi, Resource, Search Exchange, and various tool icons.

The toolbar includes: Cut, Copy, Paste, Clipboard, Units (dropdown), Next, Run, Step, Stop, Reset, Control Panel, Reconcile, Summary, Analysis, Pressure Relief, PRD Rating, Flare System, and Safety Analysis.

The navigation pane shows tabs: REC1 (MATERIAL) (selected), Azeotrope Search, Main Flowsheet, DIST (MATERIAL) - Results, and a plus sign icon.

The main dialog is titled "REC1 (MATERIAL)". It has tabs: Mixed (selected), CI Solid, NC Solid, Flash Options, EO Options, Costing, and Comments.

The "Specifications" section includes:

- Flash Type: Pressure (dropdown)
- Vapor Fraction (dropdown)
- State variables:
 - Temperature: C
 - Pressure: 3 bar
 - Vapor fraction: 1
 - Total flow basis: Mole (dropdown)
 - Total flow rate: 200 kmol/hr (highlighted with a red box)
 - Solvent
- Reference Temperature
- Volume flow reference temperature

The "Composition" section includes:

- Mole-Frac (dropdown)
- Table:

Component	Value
ETHANOL	0.452
BENZENE	0.548
- Total: 1

Bottom status bar: Ready to execute block B1, Check Status, 100%, zoom controls, and page number 3.

1^Η ΣΤΗΛΗ

Παραμετροποίηση 1ης στήλης

The screenshot shows a process simulation software interface with the following details:

- Top Bar:** File, Home, Econor, Batch, Dynam, Plant C, Equatio, View, Custor, Resour, Column Design, Search Exchange.
- Simulation Tab:** Main Flowsheet, Section - GLOBAL, FEED (MATERIAL).
- Left Sidebar:** All Items, Analysis, Flowsheet, Streams, Blocks, C1, Specifications (Setup selected), Design Specifications, Vary, Efficiencies, Properties, Reactions, Block Options, User Subroutine.
- Properties Tab:** Simulation (selected), Safety Analysis, Energy Analysis.
- Column Design Tab:** C1 Specifications - Setup dialog open.
- Setup Options:**
 - Calculation type: Equilibrium (selected), 30 stages, Stage Wizard.
 - Condenser: Partial-Vapor.
 - Reboiler: Kettle.
 - Valid phases: Vapor-Liquid.
 - Convergence: Custom.
- Operating Specifications:**
 - Reflux ratio: Mole (selected), 3.
 - Bottoms rate: Mole (selected), 50 kmol/hr.
 - Free water reflux ratio: 0.
- Buttons:** Design and specify column internals, Model Palette.
- Bottom Bar:** Required Input Complete, Check Status, 100% zoom, zoom controls.

Σύνδεση ρευμάτων σε 1^η στήλη

The screenshot shows the HYSIM software interface with the following details:

- Top Bar:** File, Home, Econ, Batch, Dynal, Plant, Equat, View, Custo, Resol, Column Design, Search Exchange.
- Section Header:** C1 Specifications - Setup, Main Flowsheet, Section - GLOBAL, FEED (MATERIAL).
- Left Sidebar (Simulation):** All Items, Analysis, Flowsheet, Streams, Blocks (C1, Specifications, Setup, Specification Su, Design Specifica, Vary, Efficiencies, Properties, Reactions, Block Options), Properties, Simulation (highlighted in orange), Safety Analysis, Energy Analysis.
- Main Content Area:**
 - Feed streams:** A table with columns Name, Stage, Convention. It shows FEED at Stage 10 with Convention "Above-Stage" and REC1 at Stage 10 with Convention "Above-Stage".
 - Product streams:** A table with columns Name, Stage, Phase, Basis, Flow, Units. It shows BENZENE at Stage 30 as Liquid (Basis Mole, Flow kmol/hr) and DIST at Stage 1 as Vapor (Basis Mole, Flow kmol/hr).
 - Pseudo streams:** A table with columns Name, Pseudo Stream Type, Stage, Internal Phase, Reboiler Phase, Reboiler Conditions, Pumparot ID.
- Bottom Status Bar:** Required Input Complete, Check Status, 100%, zoom controls, page number 6.

Πίεση λειτουργίας 1ης στήλης

The screenshot shows the HYSIM software interface with the following details:

- Toolbar:** Standard Windows-style toolbar with icons for File, Home, Econ, Batch, Dynal, Plant, Equat, View, Custo, Resol, Column Design, and Search Exchange.
- Menu Bar:** Column, PRESSURE_SWING_V3_NO..., Minimize, Maximize, Close.
- Left Panel (Simulation Tree):**
 - All Items
 - Analysis
 - Flowsheet
 - Streams
 - Blocks
 - C1
 - Specifications
 - Setup
 - Specification Su
 - Design Specifica
 - Vary
 - Efficiencies
 - Properties
 - Reactions
 - Block Options
- Central Panel (C1 Specifications - Setup):**
 - Tab Bar:** Configuration, Streams, Pressure, Condenser, Reboiler, 3-Phase, Comments. The Pressure tab is selected.
 - View:** Top / Bottom
 - Top stage / Condenser pressure:** Stage 1 / Condenser pressure: 3 bar
 - Stage 2 pressure (optional):**
 - Stage 2 pressure: bar
 - Condenser pressure drop: bar
 - Pressure drop for rest of column (optional):**
 - Stage pressure drop: bar
 - Column pressure drop: bar
- Bottom Panel:** Properties, Simulation (highlighted), Safety Analysis, Energy Analysis.
- Bottom Status Bar:** Required Input Complete, Check Status, 100%, zoom controls, and a page number '7'.

Επίτευξη προδιαγραφών (Design Spec) 1ης στήλης (1)

The screenshot shows the HYSIS software interface with the following details:

- Toolbar:** Includes standard icons for File, Home, Econ, Batch, Dynal, Plant, Equat, View, Custc, Resol, Column Design, and a search bar.
- Simulation Tab:** Active tab in the ribbon.
- Left Panel:** Shows the "All Items" tree view. Under "Blocks", "C1" is expanded, showing "Specifications" which contains "Setup", "Specification Su", "Design Specifica", "Vary", "Efficiencies", "Properties", and "Reactions".
- Central Window:** Titled "C1 Specifications Design Specifications".
 - Design Specifications Tab:** Active tab, showing a table with one row:

ID	Active	Status
1	<input checked="" type="checkbox"/>	
 - Results Tab:** Available but not active.
 - Buttons:** "New" and "Edit".
- Properties Palette:** Shows "Simulation" selected.
- Safety Analysis and Energy Analysis:** Other analysis options available.
- Model Palette:** Standard palette for HYSIS.
- Bottom Bar:** Shows "Required Input Complete" and "Check Status" buttons, and a zoom slider set to 100%.

Επίτευξη προδιαγραφών (Design Spec) 1ης στήλης (2)

The screenshot shows the HYSIS software interface with the following details:

- Top Bar:** Column, PRESSURE_SWING_V3_NO..., Minimize, Close.
- Toolbar:** File, Home, Econ, Batch, Dynal, Plant, Equat, View, Custc, Resol, Column Design, Search Exchange.
- Simulation Tree:** All Items, Analysis, Flowsheet, Streams, Blocks, C1, Specifications, Design Specifications (selected), 1, Vary, Efficiencies, Properties, Reactions.
- Properties Panel:** Simulation (selected), Safety Analysis, Energy Analysis.
- Model Palette:** Required Input Complete, Check Status.
- Current Window:** C1 Specifications Design Specifications - 1
- Content:**
 - Buttons:** Specifications (checked), Components (checked), Feed/Product Streams (checked), Options, Results.
 - Description:** Mole purity, 0.999, PRODUCT
 - Design specification:** Type: Mole purity
 - Specification:** Target: 0.999
 - Stream type:** Product (radio button selected), Internal, Decanter.

Επίτευξη προδιαγραφών (Design Spec) 1ης στήλης (3)

The screenshot shows the HYSIS software interface with the following details:

- Top Bar:** Column, PRESSURE_SWING_V3_NO..., File, Home, Econ, Batch, Dynal, Plant, Equat, View, Custo, Resol, Column Design, Search Exchange.
- Left Sidebar (Simulation):** All Items, Analysis, Flowsheet, Streams, Blocks, C1, Specifications (Setup, Specification Su, Design Specifica 1, Vary, Efficiencies, Properties, Reactions).
- Central Window:** C1 Specifications Design Specifications - 1 x Main Flowsheet x Section - GLOBAL x
- Component Selection Tab:** Specifications, Components, Feed/Product Streams, Options, Results. The Components tab is selected.
- Components Panel:** Components section with Available components (ETHANOL) and Selected components (BENZENE). Transfer buttons: >, >>, <, <<.
- Base Components Panel:** Available components (empty).
- Bottom Status Bar:** Required Input Complete, Check Status, 100%, zoom controls, 0.

Επίτευξη προδιαγραφών (Design Spec) 1ης στήλης (4)

The screenshot shows the HYSIS software interface with the following details:

- Top Bar:** Column, PRESSURE_SWING_V3_NO..., File, Home, Econ, Batch, Dynal, Plant, Equat, View, Custo, Resol, Column Design, Search Exchange.
- Left Sidebar:** Simulation, All Items, Analysis, Flowsheet, Streams, Blocks, C1, Specifications, Setup, Specification Su, Design Specifica, 1 (selected), Vary, Efficiencies, Properties, Reactions.
- Central Window:** C1 Specifications Design Specifications - 1, Main Flowsheet, Section - GLOBAL.
 - Specifications Tab:** Checked.
 - Components Tab:** Checked.
 - Feed/Product Streams Tab:** Checked.
 - Options Tab:** Unchecked.
 - Results Tab:** Unchecked.
- Product streams section:** DIST and BENZENE are listed as product streams.
- Feed/Product streams as base streams section:** An empty box for listing feed/product streams as base streams.
- Bottom Status Bar:** Required Input Complete, Check Status, 100%, zoom controls.

Επίτευξη προδιαγραφών (Vary) 1^{ης} στήλης

The screenshot shows the HYSIS software interface with the following details:

- Toolbar:** Includes icons for File, Home, Econ, Batch, Dynal, Plant, Equat, View, Custo, Resol, Column Design, and a search bar.
- Simulation Tab:** Active tab in the ribbon.
- Column Tab:** Active tab in the ribbon.
- Current Window:** "C1 Specifications Vary - 1" (Main Flowsheet, Section - GLOBAL, FEED (MATERIAL)).
- Left Panel (All Items):** Shows a tree structure:
 - All Items
 - Analysis
 - Flowsheet
 - Streams
 - Blocks
 - C1
 - Specifications
 - Setup
 - Specification Su
 - Design Specifica
 - Vary
 - 1
 - Efficiencies
 - Properties
 - Reactions
- Properties Panel:** Shows tabs for Properties, Simulation (selected), Safety Analysis, and Energy Analysis.
- Model Palette:** Located at the bottom left.
- Bottom Status Bar:** Shows "Required Input Complete" and "Check Status".
- Right Panel (C1 Specifications Vary - 1):** Contains the following fields:
 - Specifications Tab:** Active tab.
 - Description:** Bottoms rate, 0.01, 100.
 - Adjusted variable:** Type: Bottoms rate.
 - Upper and lower bounds:** Lower bound: 0.01 kmol/hr, Upper bound: 100 kmol/hr.
 - Optional:** Maximum step size: [empty field].

Επιλογές σύγκλισης 1^{ης} στήλης

The screenshot shows the Aspen Plus software interface with the following details:

- Top Bar:** File, Home, Econ, Batch, Dynal, Plant, Equat, View, Custc, Resol, Column Design, Search Exchange.
- Column Tab:** Column, PRESSURE_SWING_V3_NO...
- Simulation Tab:** C1 Convergence - Convergence, Main Flowsheet, Section - GLOBAL, FEED (MATERIAL).
- Left Panel (All Items):** Configuration, Column Internals, Rate-Based Modeling, Analysis, Convergence (selected), Estimates, Convergence, Dynamics, EO Modeling, Results, Profiles, Stream Results, Summary.
- Convergence Settings (Main Area):**
 - Basic:** Algorithm (Newton, 200 iterations), Error tolerance.
 - Methods:** Initialization method (Standard), Damping level (None), Liquid-liquid phase splitting method (Gibbs), Solids handling (Overall), Salt precipitation handling (Include).
- Properties Panel:** Simulation (selected), Safety Analysis, Energy Analysis.
- Model Palette:** Required Input Complete, Check Status, 100% zoom.
- Page Number:** 3

2^H ΣΤΗΛΗ

Παραμετροποίηση 2ης στήλης

SIMULIA Simulation C2 Specifications - Setup Main Flowsheet Section - GLOBAL FEED (MATERIAL)

All Items

- Setup
- Property Sets
- Analysis
- Flowsheet
- Streams
- Blocks
 - C1
 - C2
 - Specifications
 - Setup
 - Specification S...
 - Design Specifica...
 - Vary
 - Efficiencies

Configuration Streams Pressure Condenser Reboiler 3-Phase Comments

Setup options

Calculation type: Equilibrium
Number of stages: 30 Stage Wizard

Condenser: Partial-Vapor
Reboiler: Kettle
Valid phases: Vapor-Liquid
Convergence: Custom

Operating specifications

Reflux ratio: Mole 3
Bottoms rate: Mole 50 kmol/hr

Free water reflux ratio: 0 Feed Basis

Design and specify column internals

Model Palette

Required Input Complete Check Status 100%

Σύνδεση ρευμάτων σε 2^η στήλη

The screenshot shows the HYSIM software interface with the following details:

- Top Bar:** File, Home, Economi, Batch, Dynamic, Equatior, View, Customi, Resource, Column Design, Search Exchange.
- Left Sidebar:** Simulation (selected), All Items, Setup, Property Sets, Analysis, Flowsheet, Streams, Blocks, C1, C2, Specifications (selected), Setup, Specification Su..., Design Specifica..., Vary, Efficiencies.
- Central Area:**
 - C2 Specifications - Setup** tab is active.
 - Feed streams:** DIST is listed with Stage 10 and Convention Above-Stage.
 - Product streams:** REC is listed with Stage 1, Phase Vapor, Basis Mole, Flow kmol/hr; ETHANOL is listed with Stage 30, Phase Liquid, Basis Mole, Flow kmol/hr.
 - Pseudo streams:** A table header is shown with columns: Name, Pseudo Stream Type, Stage, Internal Phase, Reboiler Phase, Reboiler Conditions, Pumparound ID, P.
- Bottom Bar:** Required Input Complete, Check Status, 100%, zoom slider.

Πίεση λειτουργίας 2ης στήλης

SIMULIA software interface showing the setup for a pressure swing column.

The main window title is "PRESSURE_SWING_V3_NO_Rec..." and the tab selected is "Column".

The left sidebar shows the "Simulation" tree structure:

- All Items
 - Setup
 - Property Sets
 - Analysis
 - Flowsheet
 - Streams
 - Blocks
 - C1
 - C2
 - Specifications
 - Setup
 - Specification S...
 - Design Specifica...
 - Vary
 - Efficiencies

The "Properties" and "Model Palette" tabs are also visible.

The central workspace displays the "C2 Specifications - Setup" dialog. The tabs at the top are:

- Configuration (checked)
- Streams
- Pressure (checked)
- Condenser (checked)
- Reboiler
- 3-Phase
- Comments

The "View" dropdown is set to "Top / Bottom".

The configuration settings include:

- Top stage / Condenser pressure: Stage 1 / Condenser pressure set to 1 bar.
- Stage 2 pressure (optional):
 - Stage 2 pressure: Set to 0 bar.
 - Condenser pressure drop: Set to 0 bar.
- Pressure drop for rest of column (optional):
 - Stage pressure drop: Set to 0 bar.
 - Column pressure drop: Set to 0 bar.

At the bottom of the dialog, there is a "Model Palette" tab.

The status bar at the bottom shows "Required Input Complete" and "Check Status".

Επίτευξη προδιαγραφών (Design Spec) 2^{ης} στήλης (1)

The screenshot shows the HYSIS software interface with the following details:

- Toolbar:** Includes standard icons for File, Home, Economics, Batch, Dynamics, Equation Oriented, View, Customize, Resources, Column Design, and Search Exchange.
- Menu Bar:** File, Home, Economics, Batch, Dynamics, Equation Oriented, View, Customize, Resources, Column Design, Search Exchange.
- Simulation Tab:** Active tab.
- Design Specifications Dialog:** C2 Specifications Design Specifications
- Buttons:** New, Edit.
- Table:** Shows a single row with ID 1, Active checked, and Status Mole purity, 0.999, PRO.
- Properties Panel:** Shows checkboxes for Setup, Specification Su, Design Specifications, Vary, Efficiencies, Properties, Reactions, Block Options, User Subroutine, Configuration, Column Internals, Rate-Based Modeling, and Analysis.
- Simulation Panel:** Selected.
- Safety Analysis and Energy Analysis Panels:** Available but not selected.
- Model Palette:** At the bottom left.
- Status Bar:** Required Input Complete, Check Status, 100%, zoom controls.

Επίτευξη προδιαγραφών (Design Spec) 2ης στήλης (2)

PRESSURE_SWING_V3_NO_Re...

Column

File Home Economi Batch Dynamic Equation View Customi: Resource Column Design Search Exchange

Simulation

All Items

Setup Property Sets Analysis Flowsheet Streams Blocks C1 C2 Specifications Specification Su Design Specifica 1 Vary

Properties

Simulation

Safety Analysis

Energy Analysis

C2 Specifications Design Specifications - 1

Main Flowsheet Section - GLOBAL FEED (MATERIAL)

Specifications Components Feed/Product Streams Options Results

Description Mole purity, 0.999, PRODUCT

Design specification

Type Mole purity

Specification

Target 0.999

Stream type

Product Internal Decanter

Model Palette

Required Input Complete Check Status 100% + -

Επίτευξη προδιαγραφών (Design Spec) 2ης στήλης (3)

The screenshot shows the 'C2 Specifications Design Specifications - 1' window in the 'Column Design' tab of the Aspen Plus software. The window has tabs for 'Specifications', 'Components', 'Feed/Product Streams', 'Options', and 'Results'. The 'Components' tab is active.

The 'Components' section contains two main areas:

- Available components:** Shows a list of components. In the left column, 'BENZENE' is listed. In the right column, 'ETHANOL' is listed.
- Selected components:** Shows a list of components. In the left column, 'BENZENE' is listed. In the right column, 'ETHANOL' is listed.

Below each list of available components are four buttons:

- >
- >>
- <
- <<

To the right of the available components lists are 'Base components' sections. Each section contains an empty list and four buttons:

- >
- >>
- <
- <<

The left sidebar shows a tree view of 'All Items' under 'Blocks', with 'C2 Specifications' selected. The bottom navigation bar includes 'Model Palette', 'Required Input Complete', 'Check Status', '100%', and zoom controls.

Επίτευξη προδιαγραφών (Design Spec) 2^{ης} στήλης (4)

The screenshot shows the Aspen Plus software interface. The main window title is "C2 Specifications Design Specifications - 1". The top menu bar includes File, Home, Economics, Batch, Dynamics, Equation Oriented, View, Customize, Resources, Column Design, and Search Exchange. The left sidebar displays a tree view of project items under "All Items", including Setup, Property Sets, Analysis, Flowsheet, Streams, Blocks (C1, C2), Specifications (Setup, Specification Summary, Design Specifications 1, Vary), and a Model Palette tab at the bottom.

The central workspace shows two product streams: "REC" and "ETHANOL". The "REC" stream is highlighted with a blue border. Below the streams, there is a section for "Feed/Product streams as base streams" which is currently empty.

The bottom navigation bar includes tabs for "Model Palette", "Required Input Complete", "Check Status", and zoom controls (100%, - +).

Επίτευξη προδιαγραφών (Vary) 2^{ης} στήλης

Screenshot of the Aspen Plus software interface showing the 'C2 Specifications Vary - 1' dialog box.

The dialog box displays the following settings:

- Description:** Bottoms rate, 0.01, 100.
- Adjusted variable:** Type: Bottoms rate
- Upper and lower bounds:**
 - Lower bound: 0.01 kmol/hr
 - Upper bound: 100 kmol/hr
- Optional:** Maximum step size

The left sidebar shows the project structure under 'All Items':

- Analysis
- Flowsheet
- Streams
- Blocks
 - C1
 - C2
 - Specifications
 - Setup
 - Specification Su
 - Design Specifica
 - 1
 - Vary
 - 1
 - Efficiencies

The 'Simulation' tab is selected in the ribbon.

Bottom status bar: Required Input Complete, Check Status, 100%, zoom controls.

Επιλογές σύγκλισης 2^{ης} στήλης

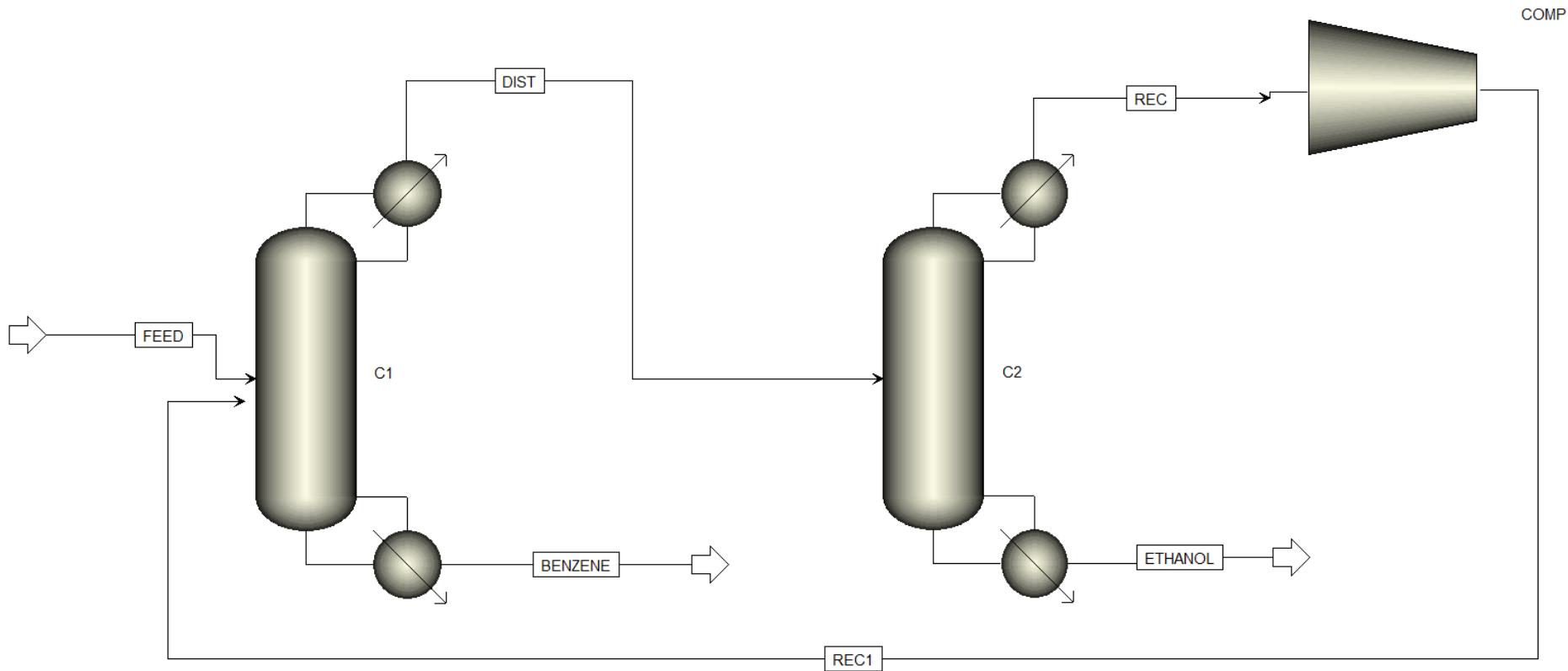
The screenshot shows the Aspen Plus software interface with the following details:

- Top Bar:** File, Home, Economics, Batch, Dynamics, Equation Oriented, View, Customize, Resources, Column Design, Search Exchange.
- Simulation Tab:** C2 Convergence - Convergence, Main Flowsheet, Section - GLOBAL, FEED (MATERIAL), REC1 (MATERIAL).
- Left Sidebar (All Items):** Vary, Efficiencies, Properties, Reactions, Block Options, User Subroutine, Configuration, Column Internals, Rate-Based Modeling, Analysis, Convergence (selected), Estimates, Convergence.
- Convergence Settings (Main Area):**
 - Basic:** Algorithm (Newton, 200 iterations), Error tolerance.
 - Methods:** Initialization method (Standard), Damping level (None), Liquid-liquid phase splitting method (Gibbs), Solids handling (Overall), Salt precipitation handling (Include).
- Bottom Left:** Properties, Simulation (selected), Safety Analysis, Energy Analysis.
- Bottom Center:** Model Palette.
- Bottom Status Bar:** Required Input Complete, Check Status, 100%, zoom controls.

Text in Red: Τρέχουμε την προσομοίωση

ΑΝΑΚΥΚΛΩΣΗ

Προσθήκη συμπιεστή για επίτευξη πίεσης 3 bar σε ρεύμα ανακύκλωσης και σύνδεση ρευμάτων



Ισεντροπικός συμπιεστής

PRESSURE_SWING_V5_final_20211130.bkp - Aspen Plus V11 - aspenONE

File Home Economics Batch Dynamics Equation Oriented View Customize Resources Search Exchange

Simulation COMP (Compr) - Setup Main Flowsheet Control Panel FEED (MATERIAL) - Results (Default)

All Items

- Setup
- Property Sets
- Analysis
- Flowsheet
- Streams
- Blocks
 - C1
 - C2
 - COMP
 - Setup
 - Performance Curves

Properties

Simulation

Safety Analysis

Energy Analysis

Model and type

Model: Compressor (selected)
Type: Isentropic

Outlet specification

Discharge pressure: 3 bar
Pressure increase: bar
Pressure ratio:
Power required: kW
Use performance curves to determine discharge conditions

Efficiencies

Isentropic: [empty field]
Polytropic: [empty field]
Mechanical: [empty field]

Model Palette

Results Available (problem not yet run) Check Status 100%

F4 - Αποτελέσματα

Simulation Main Flowsheet Setup - Report Options Control Panel BENZENE (MATERIAL) - Results (Default)

Material	Vol.% Curves	Wt. % Curves	Petroleum	Polymers	Solids	Status
Pressure	bar			BENZENE	3	1
Molar Vapor Fraction					0	0
Molar Liquid Fraction					1	1
Molar Solid Fraction					0	0
Mass Vapor Fraction					0	0
Mass Liquid Fraction					1	1
Mass Solid Fraction					0	0
Molar Enthalpy	cal/mol		15016.6		-64497.4	
Mass Enthalpy	cal/gm		192.32		-1399.04	
Molar Entropy	cal/mol-K		-50.6659		-77.544	
Mass Entropy	cal/gm-K		-0.648884		-1.68204	
Molar Density	mol/cc		0.00984439		0.0159248	
Mass Density	gm/cc		0.768666		0.73415	
Enthalpy Flow	cal/sec		208544		-895801	
Average MW			78.0816		46.1011	
+ Mole Flows	kmol/hr		49.9952		50.0002	
- Mole Fractions						
ETHANOL			0.001		0.999	
BENZENE			0.999		0.001	
+ Mass Flows	kg/hr		3903.71		2305.06	

ΕΤΕΡΟΓΕΝΗΣ ΑΖΕΟΤΡΟΠΙΚΗ ΑΠΟΣΤΑΞΗ

Στόχοι - Παράδειγμα

- Σχεδιάστε μια συστοιχία διαχωρισμού για την παραγωγή άνυδρης αιθανόλης χρησιμοποιώντας κυκλοεξάνιο ως διαλύτη
- Συμπεριλάβετε την ανακύκλωση του κυκλοεξανίου και του αζεοτροπικού μείγματος έτσι ώστε η ανάκτηση της αιθανόλης να είναι $>99,9\%$ και η ανάκτηση του κυκλοεξανίου είναι σχεδόν 100 %
- Πειραματιστείτε με το εργαλείο σύνθεσης απόσταξης που περιλαμβάνεται στο Aspen Plus
- Επιτυχής σύγκλιση ενός φύλλου ροής με πολλαπλές ροές ανακύκλωσης
- Χειρισμός μεθόδων σύγκλισης στο RadFrac για βελτίωση της σύγκλισης

Ιστορικό

- Η παραγωγή αιθανόλης μέσω ζύμωσης λαμβάνει χώρα στο νερό, το οποίο αργότερα πρέπει να διαχωριστεί για να παραχθεί άνυδρη αιθανόλη (99,95% αιθανόλη).
- Υπάρχει ένα αζεότροπο στο σύστημα αιθανόλης-νερού σε περίπου 95 mol% αιθανόλης που αποτελεί εμπόδιο στο διαχωρισμό.
- Το κυκλοεξάνιο είναι ένας από τους διαλύτες που χρησιμοποιούνται για την παραγωγή άνυδρης αιθανόλης για τρόφιμα και φαρμακευτική χρήση.
- Χρησιμοποιείται ως μέσο εκχύλισης: το τριμερές μείγμα σχηματίζει ένα τριαδικό αζεότροπο με διαφορετική συγκέντρωση αιθανόλης, το οποίο επιτρέπει στην αιθανόλη να εμπλουτίζεται στο άλλο ρεύμα.
- Το αζεοτροπικό υγρό διαχωρίζεται για την ανάκτηση του κυκλοεξανίου και της αιθανόλης που εξέρχεται από τη στήλη στο αζεοτροπικό μίγμα.

Διατύπωση του προβλήματος

- Η τροφοδοσία προς την συστοιχία διαχωρισμού είναι ένα ρεύμα με ροή 100 kmol/hr με 87 mol-% αιθανόλη και 13 mol-% νερό.
 - Κυκλοεξάνιο προστίθεται στη στήλη και > 99,95 mol-% αιθανόλης εξέρχεται από τον πυθμένα της στήλης.
 - Το απόσταγμα αποστέλλεται σε ένα δοχείο διαχωρισμού φάσεων.
 - Το πλούσιο σε κυκλοεξάνιο ρεύμα ανακυκλώνεται απευθείας στην πρώτη στήλη
 - Το πλούσιο σε νερό και αιθανόλη ρεύμα αποστέλλεται σε μια δεύτερη στήλη από την οποία εξέρχεται σχεδόν καθαρό νερό από τον πυθμένα.
 - Το απόσταγμα της δεύτερης στήλης ανακυκλώνεται στην πρώτη στήλη.
- Σχεδιάστε το σύστημα διαχωρισμού έτσι ώστε το ρεύμα προϊόντος αιθανόλης να πληροί τις προδιαγραφές καθαρότητας, να έχει > 99,9 mol% ανάκτηση και το ρεύμα εκροής νερού είναι ουσιαστικά καθαρό νερό.

Συστατικά

Dist-011_Azeotropic_Distillation_mixings20211207.bkp - Aspen Plus V11 - aspenONE

File Home View Customize Resources Search Exchange

Cut Copy Paste Clipboard METCBAR Setup Na⁺ Chemistry Methods Assistant TOE NIST Analysis Unit Sets Components Customize DECHEMA DIPPR Estimation Methods Prop Sets Retrieve Parameters Data Source Run Mode Draw Structure Clean Parameters Tools Run Summary Analysis Navigate

Properties

All Items

Setup Components Methods Chemistry Property Sets Data Estimation Analysis Customize Results

Properties Simulation Safety Analysis Energy Analysis

Components - Specifications

Selection Petroleum Nonconventional Enterprise Database Comments

Select components

Component ID	Type	Component name	Alias
ETHANOL	Conventional	ETHANOL	C2H6O-2
WATER	Conventional	WATER	H2O
C6H12-1	Conventional	CYCLOHEXANE	C6H12-1

Find Elec Wizard SFE Assistant User Defined Reorder Review

Results Available Check Status 100% - +

Θερμοδυναμική μέθοδος

The screenshot shows the Aspen Plus V11 software interface. The title bar reads "Dist-011_Azeotropic_Distillation_mixings20211207.bkp - Aspen Plus V11 - aspenONE". The menu bar includes File, Home, View, Customize, Resources, and a search bar "Search Exchange". The toolbar contains icons for Cut, Copy, Paste, Clipboard, METCBAR, Unit Sets, Components, Methods, Setup, Na⁺ Chemistry, Customize, Prop Sets, Draw Structure, Clean Parameters, Retrieve Parameters, Methods Assistant, DECHEMA, DIPPR, Data Source, Analysis, Estimation, Regression, Run Mode, Summary, and Analysis.

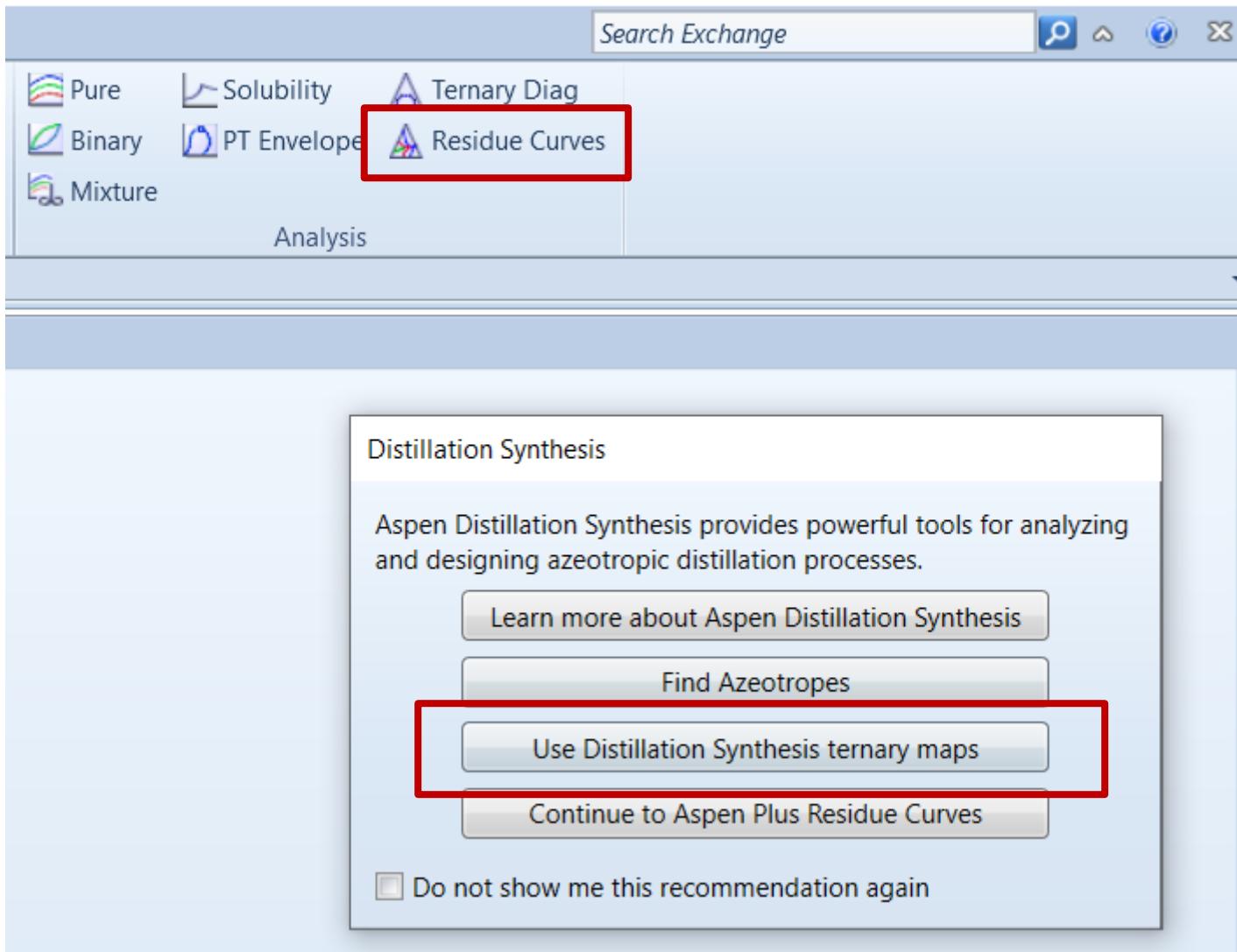
The main window displays the "Methods - Specifications" dialog box. On the left is a tree view under "Properties" showing categories like All Items, Setup, Components, Methods (selected), Specifications, Selected Methods, Parameters, Routes, NC Props, Tabpoly, Chemistry, Properties, Simulation, Safety Analysis, and Energy Analysis. The "Specifications" node is highlighted.

The "Methods - Specifications" dialog has tabs for Global, Flowsheet Sections, Referenced, and Comments. The Global tab is selected, showing settings for Property methods & options, Method filter set to CHEMICAL, Base method set to UNIQ-RK, Henry components dropdown, Petroleum calculation options (Free-water method set to STEAM-TA, Water solubility set to 3), Electrolyte calculation options (Chemistry ID dropdown, Use true components checked), Method name set to UNIQ-RK, and Modify options for Vapor EOS (set to ESRK), Data set (set to 1), Liquid gamma (set to GMUQUAC), Data set (set to 1), Liquid molar enthalpy (set to HLMX31), Liquid molar volume (set to VLMX01), and Heat of mixing (checked).

Πατάμε F4. Παρατηρούμε ότι εμφανίζεται το Methods | Parameters | Binary Interaction | UNIQ-1 | Input sheet και οι binary parameters συμπληρώνονται αυτόματα.

Τριαδικό διάγραμμα

1 - aspenONE



Τριαδικό διάγραμμα – πίεση 1 bar

Dist-011_Azeotropic_Distillation_mixings20211207.bkp - Aspen Plus V11 - aspenONE

File Home View Customize Resources Search Exchange

Cut Copy Paste Clipboard METCBAR Setup Components Methods Chemistry Na⁺ Chemistry Draw Structure Methods Assistant Clean Parameters Retrieve Parameters TDE NIST DECHEMA DIPPR Data Source Run Mode Run Summary Analysis Units Navigate

Methods - Specifications Distillation Synthesis

Navigation Pane

Explorer Plot Input

- Distillation Synthesis Analysis
 - Input
 - Output
 - Pure Components
 - Azeotropes
 - Singular Points
 - Report
 - Ternary Plot

Components

- Component 1: ETHANOL
- Component 2: WATER
- Component 3: C6H12-1

Property Model

- VLE Model: UNIQ-RK
- LLE Model: UNIQ-RK
- Phases: VAP-LIQ-LIQ

Pressure: 1 BAR

Basis:

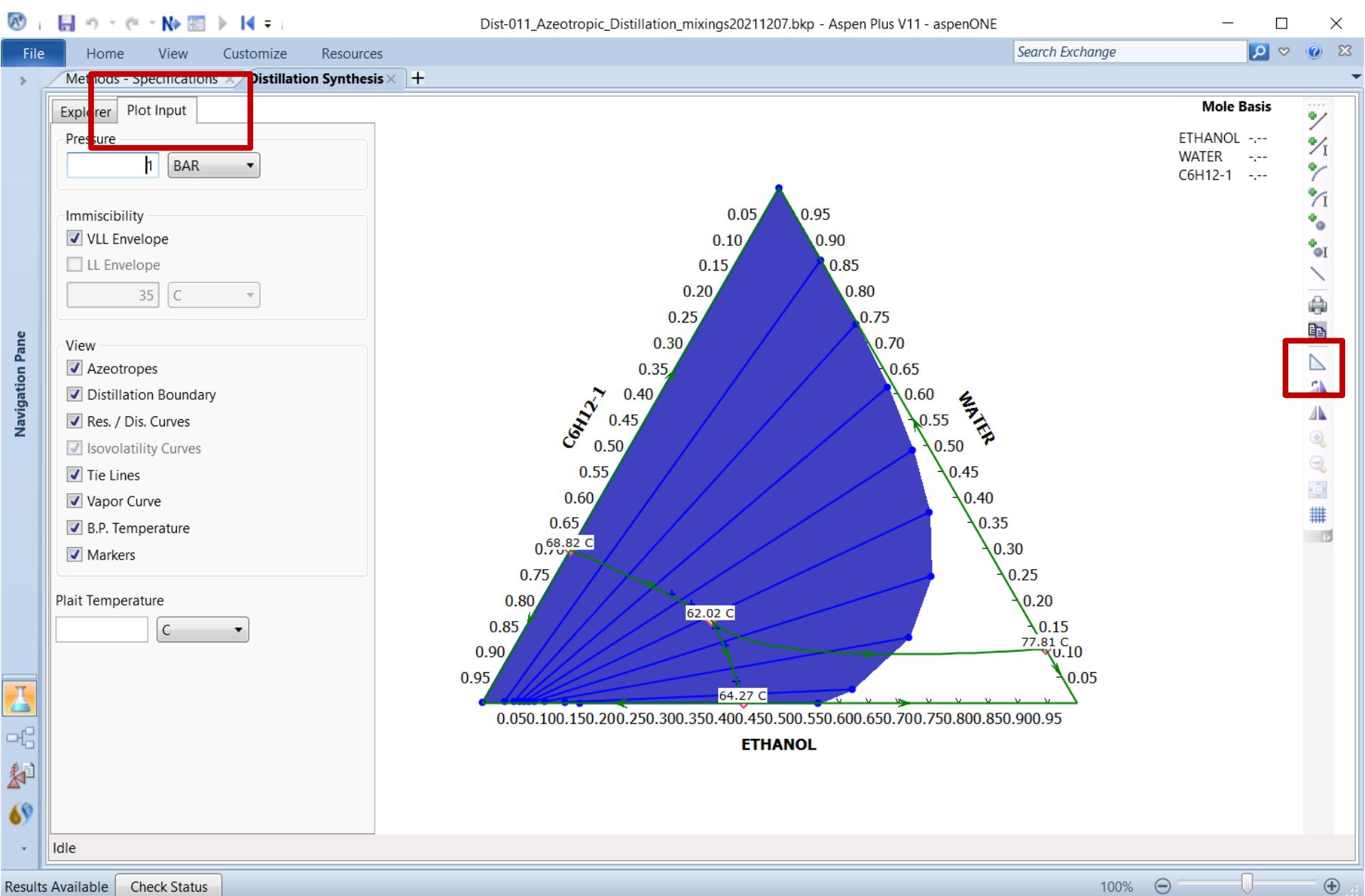
- Mass Fraction Temp Units
- Mole Fraction C

Calculate

- Residue curve
- Distillationcurve
- Azeotropes
- Distillation Boundary
- Vapor-Liquid-Liquid Envelope
- Liquid-Liquid Envelope
- Isovolatility Curve

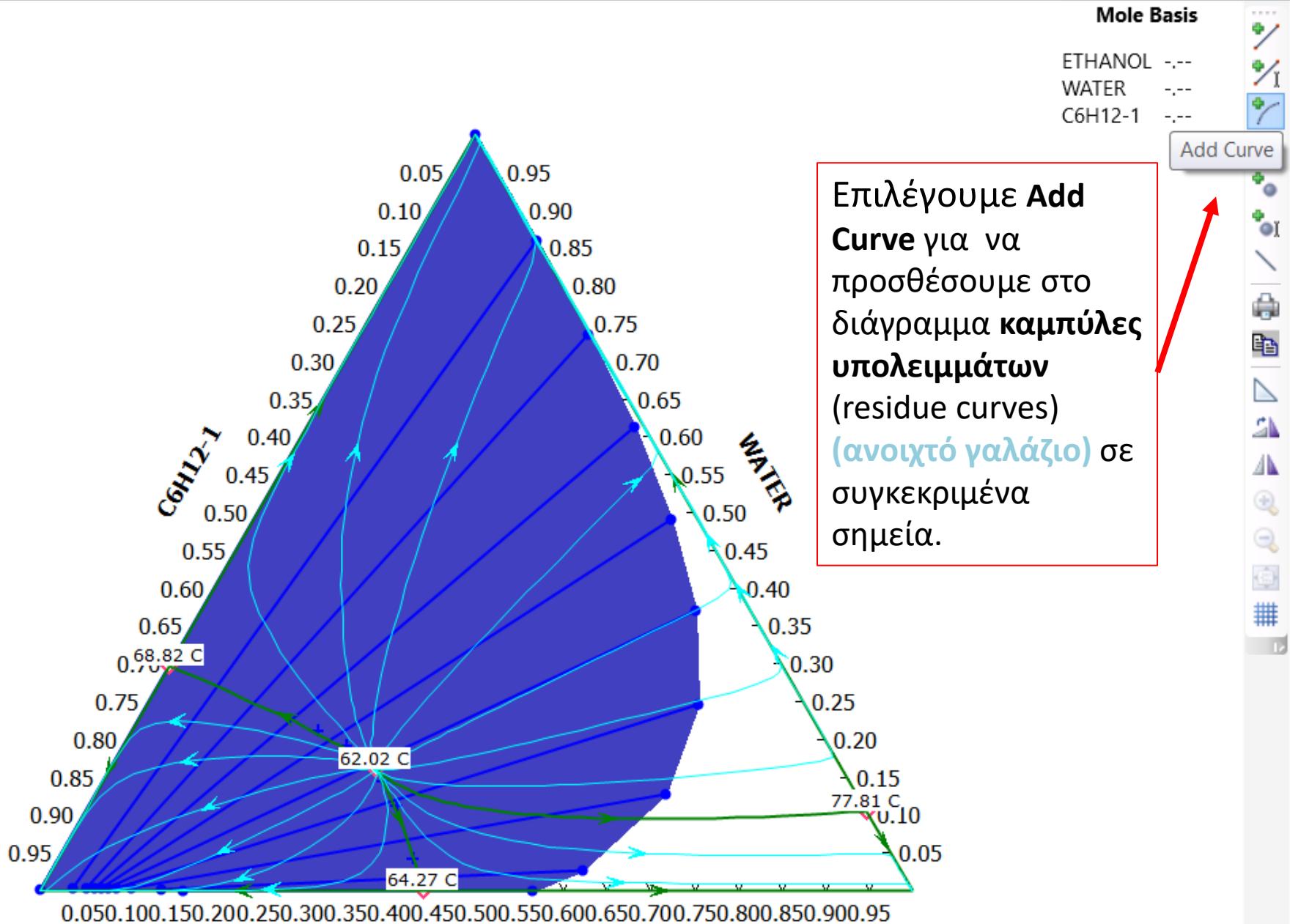
Results Available Check Status 100%

Διάγραμμα και αλλαγή συντεταγμένων



Επεξηγήσεις

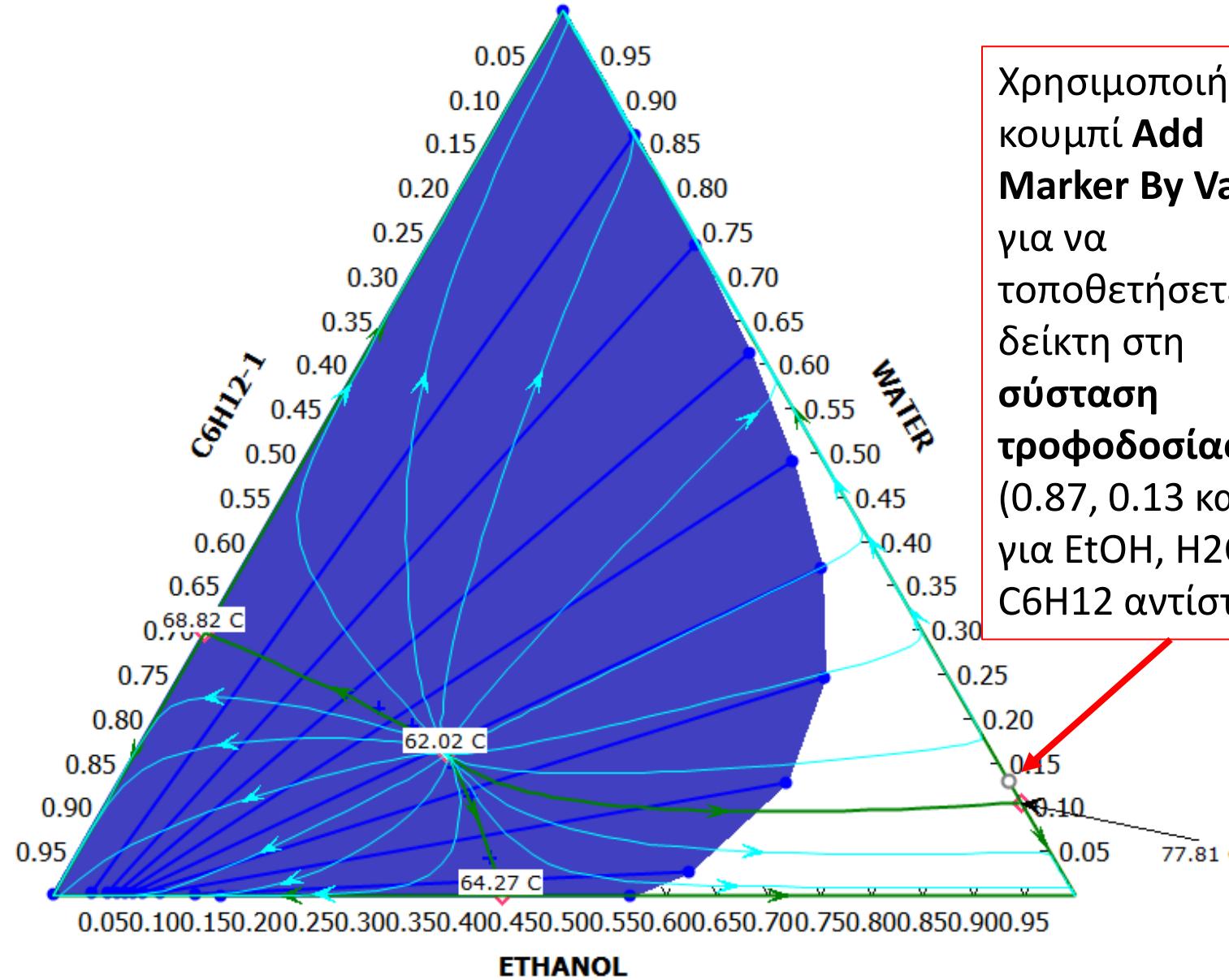
- Οι πράσινες γραμμές είναι τα όρια για τις περιοχές απόσταξης.
- Τα βέλη δείχνουν προς μείγματα υψηλότερου σημείου βρασμού.
- Τα κόκκινα διαμάντια είναι αζεότροπα.
- Η σκούρα μπλε γραμμή είναι ο φάκελος LLE.
- Οι ελαφρώς ανοιχτότερες μπλε γραμμές είναι γραμμές δεσμών για το διαχωρισμό LLE.



Επεξηγήσεις

- Όλες οι καμπύλες υπολειμμάτων δείχνουν προς τις κορυφές, οι οποίες αντιπροσωπεύουν καθαρά συστατικά.
- Μια στήλη απόσταξης θα εμπλουτίσει ένα μόνο συστατικό στον πυθμένα και το εμπλουτισμένο συστατικό εξαρτάται από την περιοχή απόσταξης στην οποία βρίσκεται η σύσταση τροφοδοσίας.
- Σκοπεύουμε να εμπλουτίσουμε την αιθανόλη από το κάτω μέρος της πρώτης στήλης.

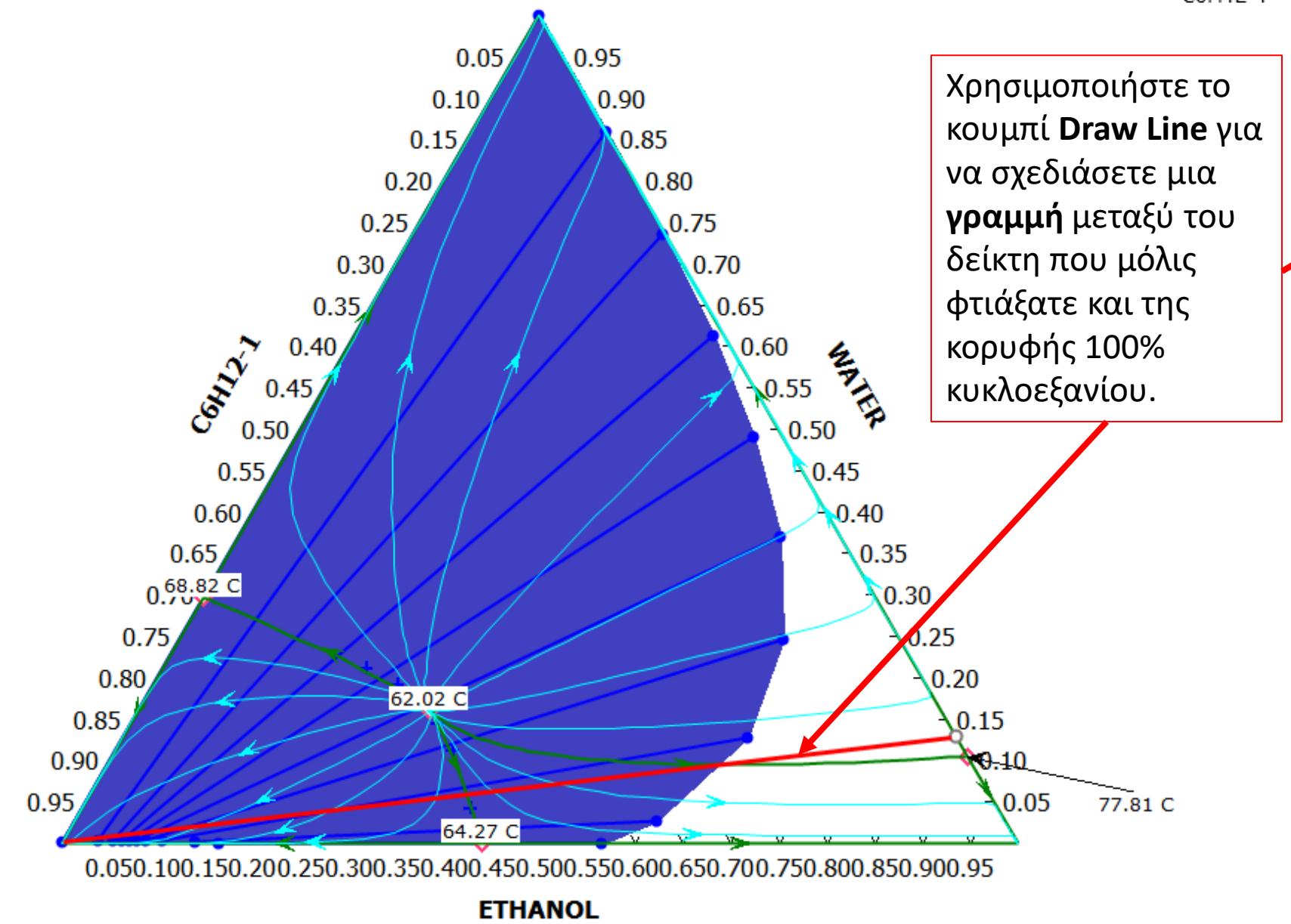
ETHANOL
WATER
C6H12-1



Χρησιμοποιήστε το κουμπί Add Marker By Value για να τοποθετήσετε έναν δείκτη στη σύσταση τροφοδοσίας (0.87, 0.13 και 0.0, για EtOH, H₂O και C₆H₁₂ αντίστοιχα).

Add Marker By Value

ETHANOL -.--
WATER -.--
C6H12-1 -.--



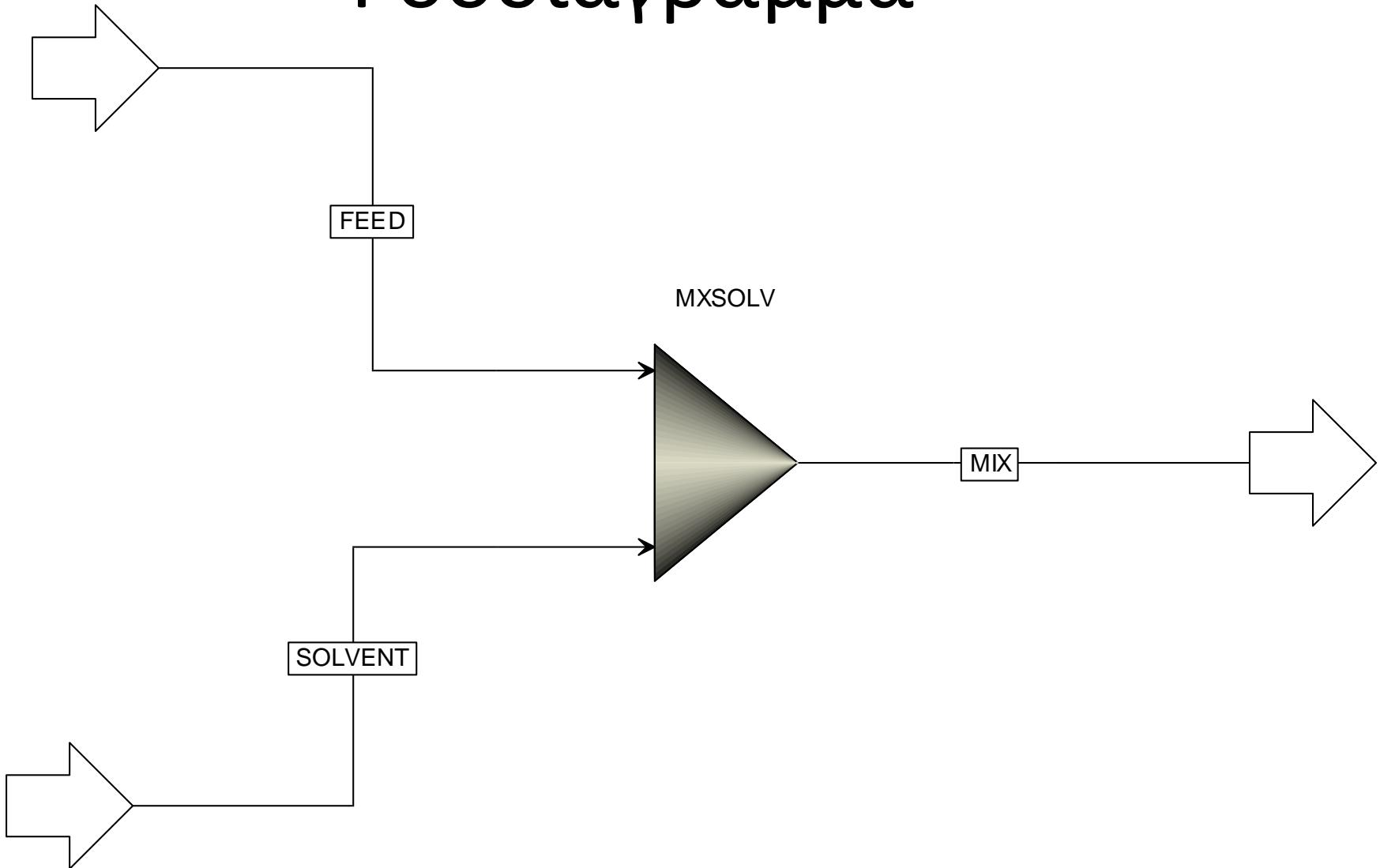
Χρησιμοποιήστε το κουμπί **Draw Line** για να σχεδιάσετε μια γραμμή μεταξύ του δείκτη που μόλις φτιάξατε και της κορυφής 100% κυκλοεξανίου.

Draw Line

Ροή κυκλοεξανίου

- Ένας συνδυασμός ενός καθαρού ρεύματος κυκλοεξανίου και του ρεύματος τροφοδοσίας θα έχει μια σύνθεση κάπου κατά μήκος αυτής της γραμμής, ανάλογα με την αναλογία των ροών.
 - Ένα τμήμα αυτής της γραμμής διέρχεται από την περιοχή που εμπλουτίζει την αιθανόλη στον πυθμένα.
- Υπολογίστε τη σύσταση της προσθήκης 50 kmol/ώρα κυκλοεξανίου στο ρεύμα τροφοδοσίας και προσθήκης 100 kmol/ώρα κυκλοεξανίου στο ρεύμα τροφοδοσίας.
- ✓ Θυμηθείτε, το ρεύμα τροφοδοσίας έχει ρυθμό ροής 100 kmole/hr.

Ροοδιάγραμμα



Ρεύμα τροφοδοσίας

Feed_stream_Hexane_mixings_20211207.bkp - Aspen Plus V11 - aspenONE

File Home Economics Batch Dynamics Equation Oriented View Customize Resources Search Exchange

Simulation Main Flowsheet FEED (MATERIAL) SOLVENT (MATERIAL) Control Panel

All Items

- Setup
- Property Sets
- Analysis
- Flowsheet
- Streams
 - FEED
 - Input
 - Results
 - EO Variables
 - MIX
 - SOLVENT
 - Blocks
 - Utilities
 - Reactions

Properties

Simulation

Safety Analysis

Energy Analysis

Input Changed Check Status 100% +

FEED (MATERIAL)

Mixed CI Solid NC Solid Flash Options EO Options Costing Comments

Specifications

Flash Type: Pressure Vapor Fraction

State variables:

- Temperature: C
- Pressure: 1 bar
- Vapor fraction: 0.3
- Total flow basis: Mole
- Total flow rate: kmol/hr
- Solvent:

Composition:

Mole-Flow kmol/hr

Component	Value
ETHANOL	87
WATER	13
C6H12-1	

Reference Temperature

Volume flow reference temperature: C

Component concentration reference temperature: C

Total: 100

Ρεύμα διαλύτη – 50 kmol/hr C₆H₁₂

Feed_stream_Hexane_mixings_20211207.bkp - Aspen Plus V11 - aspenONE

File Home Economics Batch Dynamics Equation Oriented View Customize Resources Search Exchange

Simulation Main Flowsheet FEED (MATERIAL) SOLVENT (MATERIAL) Control Panel

All Items

- Setup
- Property Sets
- Analysis
- Flowsheet
- Streams
 - FEED
 - Input
 - Results
 - EO Variables
 - MIX
 - SOLVENT
- Blocks
- Utilities
- Reactions

Properties

Simulation

Safety Analysis

Energy Analysis

Input Changed Check Status 100%

SOLVENT (MATERIAL)

Mixed CI Solid NC Solid Flash Options EO Options Costing Comments

Specifications

Flash Type: Temperature Pressure

State variables:

- Temperature: 25 C
- Pressure: 1 bar
- Vapor fraction: (empty)
- Total flow basis: Mole
- Total flow rate: 50 kmol/hr
- Solvent: (empty)

Composition: Mole-Frac

Component	Value
ETHANOL	
WATER	
C ₆ H ₁₂ -1	1
Total	1

Σύσταση μίγματος - 50 kmol/hr C6H12

Screenshot of a simulation software interface showing the results of a mixture composition analysis.

The main window displays the "MIX (MATERIAL) - Results (Default)" tab under the "Control Panel".

The left sidebar shows the "All Items" tree structure, with the "Results" node under the "MIX" folder selected.

The results table lists various properties and their values:

Property	Units	Value
Molar Entropy	cal/mol-K	-90.6282
Mass Entropy	cal/gm-K	-1.60873
Molar Density	mol/cc	0.000196363
Mass Density	gm/cc	0.0110621
Enthalpy Flow	cal/sec	-2.24317e+06
Average MW		56.3351
+ Mole Flows	kmol/hr	150
- Mole Fractions		
ETHANOL		0.58
WATER		0.0866667
C6H12-1		0.333333
+ Mass Flows	kg/hr	8450.27
+ Mass Fractions		
Volume Flow	l/min	12731.6
+ Vapor Phase		

At the bottom, the status bar indicates "Results Available" and "Check Status".

Ρεύμα διαλύτη – 100 kmol/hr

Feed_stream_Hexane_mixings_20211207.bkp - Aspen Plus V11 - aspenONE

File Home Economics Batch Dynamics Equation Oriented View Customize Resources Search Exchange

Simulation Control Panel SOLVENT (MATERIAL) - Input Main Flowsheet FEED (MATERIAL) SOLVENT (MATERIAL)

All Items

- Setup
- Property Sets
- Analysis
- Flowsheet
- Streams
 - FEED
 - MIX
 - SOLVENT
 - Input
 - Results
 - EO Variables
- Blocks
- Utilities
- Reactions

Properties

Simulation

Safety Analysis

Energy Analysis

Control Panel

SOLVENT (MATERIAL) - Input

Mixed CI Solid NC Solid Flash Options EO Options Costing Comments

Specifications

Flash Type: Temperature Pressure

State variables:

- Temperature: 25 C
- Pressure: 1 bar
- Vapor fraction
- Total flow basis: Mole
- Total flow rate: 100 kmol/hr
- Solvent

Composition: Mole-Frac

Component	Value
ETHANOL	
WATER	
C6H12-1	1

Reference Temperature

Volume flow reference temperature: C

Component concentration reference temperature: C

Total: 1

Results Available Check Status 100% +

The screenshot shows the Aspen Plus software interface with the following details:

- File Bar:** File, Home, Economics, Batch, Dynamics, Equation Oriented, View, Customize, Resources, Search Exchange.
- Simulation Tab:** Control Panel, SOLVENT (MATERIAL) - Input, Main Flowsheet, FEED (MATERIAL), SOLVENT (MATERIAL).
- Left Sidebar (All Items):** Setup, Property Sets, Analysis, Flowsheet, Streams (FEED, MIX, SOLVENT), Blocks, Utilities, Reactions.
- Properties Tab:** Properties, Simulation, Safety Analysis, Energy Analysis.
- Control Panel (SOLVENT (MATERIAL) - Input):**
 - Mixed** (selected), CI Solid, NC Solid, Flash Options, EO Options, Costing, Comments.
 - Specifications:** Flash Type (Temperature, Pressure), State variables (Temperature: 25 C, Pressure: 1 bar, Vapor fraction, Total flow basis: Mole, Total flow rate: 100 kmol/hr, Solvent).
 - Composition:** Mole-Frac table with rows for ETHANOL, WATER, and C6H12-1 (value 1).
 - Reference Temperature:** Volume flow reference temperature (C), Component concentration reference temperature (C).
- Bottom Status Bar:** Results Available, Check Status, 100%, zoom controls.

Σύσταση μίγματος - 100 kmol/hr C6H12

Screenshot of a simulation software interface showing the results of a mixture composition analysis.

The main window title is "Control Panel > MIX (MATERIAL) - Results (Default)".

The left sidebar shows the "All Items" tree structure:

- Setup
- Property Sets
- Analysis
- Flowsheet
- Streams
 - FEED
 - MIX
 - Input
 - Results** (selected)
 - EO Variables
 - SOLVENT
 - Blocks
 - Utilities
 - Reactions
- Properties
- Simulation (highlighted)
- Safety Analysis
- Energy Analysis

The results table displays the following data:

Material	Units	Value
Molar Entropy	cal/mol-K	-104.579
Mass Entropy	cal/gm-K	-1.65233
Molar Density	mol/cc	0.000386975
Mass Density	gm/cc	0.0244923
Enthalpy Flow	cal/sec	-2.76174e+06
Average MW		63.2917
+ Mole Flows	kmol/hr	200
- Mole Fractions		
ETHANOL		0.435
WATER		0.065
C6H12-1		0.5
+ Mass Flows	kg/hr	12658.3
+ Mass Fractions		
Volume Flow	l/min	8613.82
+ Vapor Phase		

At the bottom, there are status indicators: "Results Available" and "Check Status".

Mole Basis

ETHANOL
WATER
C6H12-1

Χρησιμοποιήστε το κουμπί **Add Marker By Value** για να τοποθετήσετε δείκτες σε αυτά τα δύο σημεία.

Add Marker By Value



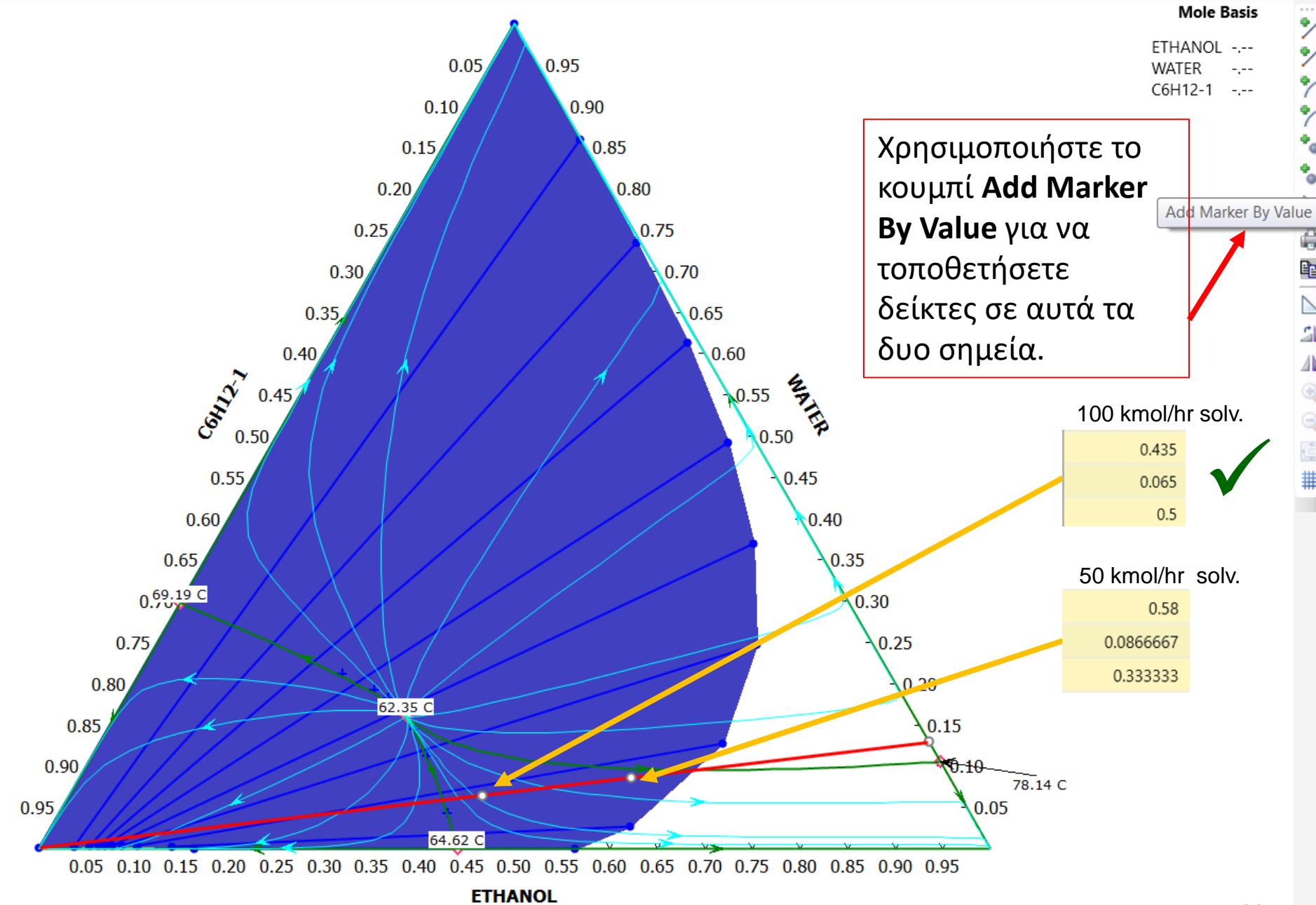
100 kmol/hr solv.

0.435
0.065
0.5



50 kmol/hr solv.

0.58
0.0866667
0.333333



Επιλογές

- Και τα δύο σημεία βρίσκονται στη σωστή περιοχή απόσταξης, αλλά ο δείκτης προσθήκης 100 kmol/hr βρίσκεται πιο μακριά στην περιοχή.
- Εξαιτίας αυτού, η αρχική τροφοδοσία του διαλύτη στη στήλη θα είναι 100 kmol/hr.
- Χρησιμοποιήστε αυτό το εργαλείο σε όλη την κατασκευή της προσομοίωσης για να κατανοήσετε τι κάνουν το δοχείο διαχωρισμού φάσεων ή οι στήλες απόσταξης.
- Τώρα, κλείστε το παράθυρο Σύνθεση Απόσταξης.

ΠΡΟΣΟΜΟΙΩΣΗ 1

ΑΡΧΕΙΟ: SIM_1_NO_RECYCLES_20211207.BKP

Επιλογές αναφοράς αποτελεσμάτων

The screenshot shows the Aspen Plus software interface with the following details:

- Left Panel (Simulation Tree):** Shows the "All Items" tree structure. The "Report Options" item under the "Setup" category is currently selected.
- Top Bar:** Displays the project name "Main Flowsheet x COL-MAIN (RadFrac) x Control Panel x" and the current tab "Setup - Report Options".
- Report Options Dialog:** The "Stream" tab is selected.
 - Description:** A note states: "These options only affect the report file (*.rep). To customize the Material sheet of stream results forms, use the Stream Summary tab of the ribbon available when the Material sheet is open."
 - Checkboxes:** Two checkboxes are checked: "Generate a standard stream report" and "Include stream descriptions".
 - Items to be included in stream report:** Three groups of checkboxes:
 - Flow basis:** Mole (checked), Mass (checked), Std.liq.volume (unchecked).
 - Fraction basis:** Mole (checked), Mass (checked), Std.liq.volume (unchecked).
 - Stream format:** Standard (80 characters) (radio button selected), Wide (132 characters) (radio button unselected), Sort streams alphanumerically (checkbox checked).
 - Checklist:** Components with zero flow or fraction (checkbox checked).
 - Buttons:** Include Streams, Exclude Streams, Property Sets, Component Attributes, Stream Names, Batch Operation, Supplementary Stream.

Ροοδιάγραμμα

Simulation

Main Flowsheet x COL-MAIN (RadFrac) x Control Panel x Section - GLOBAL x +

All Items

Setup

Property Sets

Analysis

Flowsheet

Section

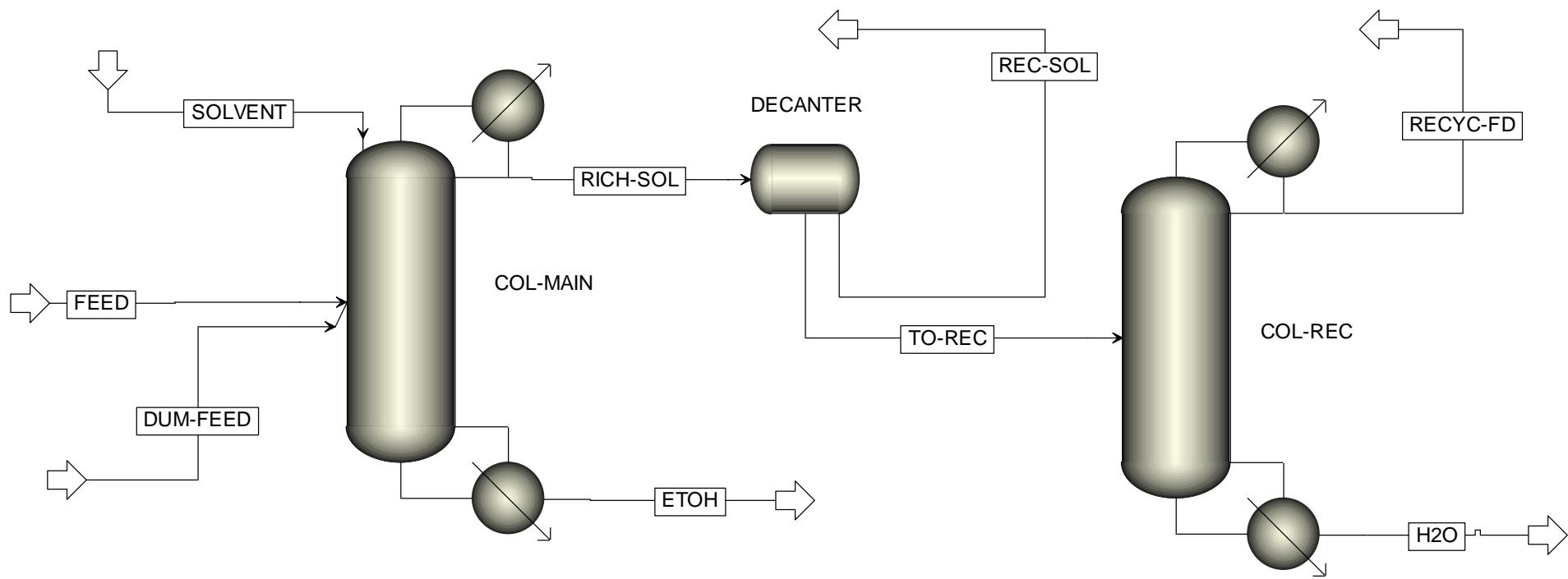
GLOBAL

Custom Tables

Specifications

Comments

Block ID	Model
COL-MAIN	RadFrac
COL-REC	RadFrac
DECANTER	Decanter



Ρεύμα τροφοδοσίας

Run Summary Analysis

Main Flowsheet × COL-MAIN (RadFrac) × Control Panel × Section - GLOBAL × FEED (MATERIAL) × +

Mixed CI Solid NC Solid Flash Options EO Options Costing Comments

Specifications

Flash Type: Pressure Vapor Fraction

State variables

Temperature	C
Pressure	1 bar
Vapor fraction	0.3
Total flow basis	Mole
Total flow rate	kmol/hr
Solvent	

Composition

Mole-Flow kmol/hr

Component	Value
ETHANOL	87
WATER	13
C6H12-1	

Reference Temperature

Volume flow reference temperature

Component concentration reference temperature

Total 100

Ρεύμα διαλύτη (Solvent)

Main Flowsheet × COL-MAIN (RadFrac) × Control Panel × Section - GLOBAL × FEED (MATERIAL) × SOLVENT (MATERIAL) ×

Mixed CI Solid NC Solid Flash Options EO Options Costing Comments

Specifications

Flash Type: Pressure Vapor Fraction: 0

State variables

- Temperature: C
- Pressure: 1 bar
- Vapor fraction: 0
- Total flow basis: Mole
- Total flow rate: 100 kmol/hr
- Solvent:

Reference Temperature

- Volume flow reference temperature: C
- Component concentration reference temperature: C

Composition

Mole-Frac

Component	Value
ETHANOL	0
WATER	0
C6H12-1	1

Total: 1

Αυτό το ρεύμα θα συνδεθεί τελικά με ένα ρεύμα που ανακυκλώνεται από το DECANTER. Οι προδιαγραφές εδώ χρησιμεύουν ως αρχική εικασία.

Εικονικό ρεύμα τροφοδοσίας

The screenshot shows a software interface for a process simulation, specifically a material feed specification dialog. The title bar reads "Main Flowsheet x DUM-FEED (MATERIAL) x". Below the title bar is a toolbar with several tabs: "Mixed" (which is selected), "CI Solid", "NC Solid", "Flash Options", "EO Options", "Costing", and "Comments".

The main area is titled "Specifications". It contains two main sections: "State variables" and "Composition".

State variables:

- Temperature: Set to "C" (degrees Celsius).
- Pressure: Set to "1 bar".
- Vapor fraction: Set to "0".
- Total flow basis: Set to "Mole".
- Total flow rate: Set to "1e-05 kmol/hr".
- Solvent: An empty input field.

Composition:

Composition type: Set to "Mole-Frac".

Component	Value
ETHANOL	0.35
WATER	0.3
C6H12-1	0.35

Αυτός το ρεύμα θα συνδεθεί αργότερα με ένα ρεύμα ανακύκλωσης από την κορυφή του COL-REC. Το εικονικό ρεύμα τροφοδοσίας είναι μια «αναμονή» για το ρεύμα ανακύκλωσης από την κορυφή της στήλης ανακύκλωσης. Προς το παρόν, εισάγουμε έναν μικροσκοπικό ρυθμό ροής με μια πρόχειρη εικασία για τις συνθέσεις όπως φαίνεται παραπάνω.

Στήλη COL-MAIN

Main Flowsheet COL-MAIN (RadFrac) +

Configuration Streams Pressure Condenser Reboiler 3-Phase Comments

Setup options

Calculation type: Equilibrium 62 Stage Wizard

Number of stages: Total Kettle

Condenser: Vapor-Liquid-Liquid

Reboiler: Strongly non-ideal liquid

Valid phases: Vapor-Liquid-Liquid

Convergence: Strongly non-ideal liquid

Operating specifications

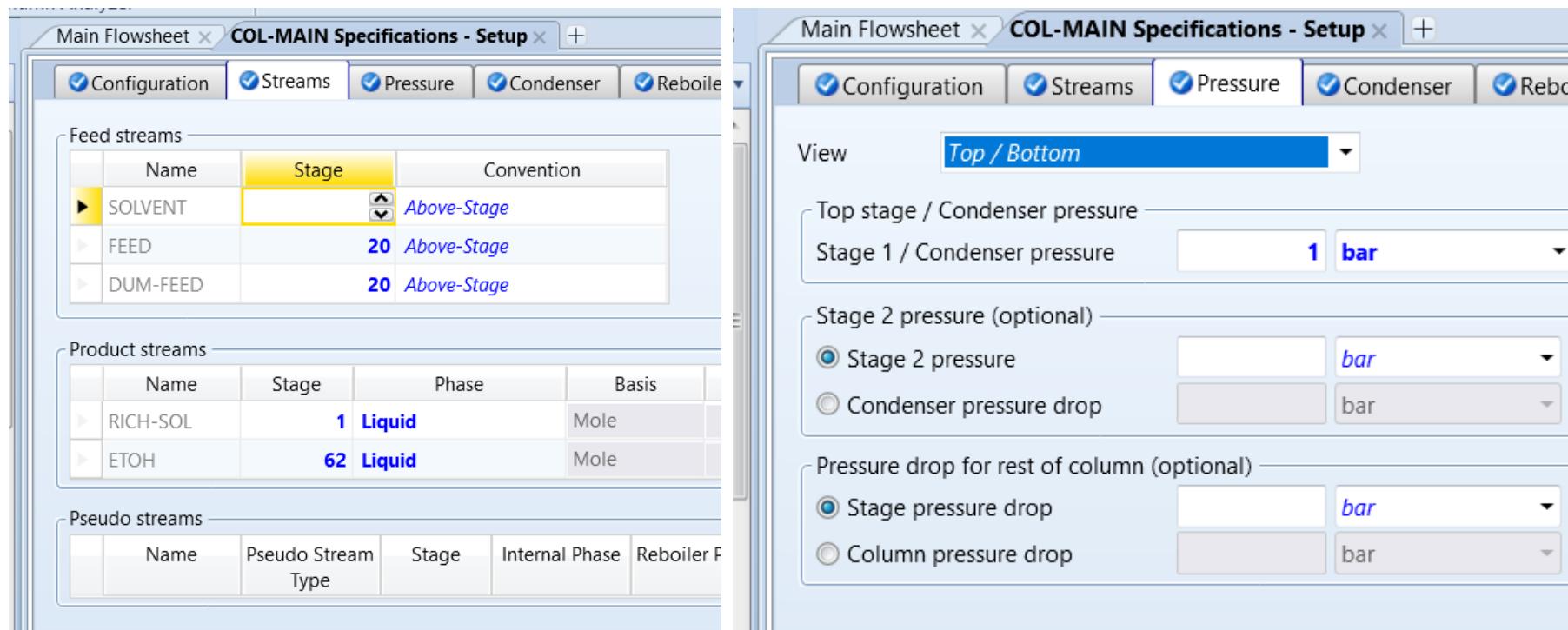
Reflux ratio: Mole 3.5

Bottoms rate: Mole 50 kmol/hr

Free water reflux ratio: 0 Feed Basis

Design and specify column internals

COL-MAIN σύνδεση ρευμάτων, πίεση



Main Flowsheet **COL-MAIN Specifications - Setup**

Configuration Streams Pressure Condenser Reboiler

Feed streams

	Name	Stage	Convention
▶	SOLVENT	20	Above-Stage
▶	FEED	20	Above-Stage
▶	DUM-FEED	20	Above-Stage

Product streams

	Name	Stage	Phase	Basis
▶	RICH-SOL	1	Liquid	Mole
▶	ETOH	62	Liquid	Mole

Pseudo streams

	Name	Pseudo Stream Type	Stage	Internal Phase	Reboiler P
--	------	--------------------	-------	----------------	------------

Main Flowsheet **COL-MAIN Specifications - Setup**

Configuration Streams Pressure Condenser Reboiler

View **Top / Bottom**

Top stage / Condenser pressure

Stage 1 / Condenser pressure **1 bar**

Stage 2 pressure (optional)

Stage 2 pressure **bar**

Condenser pressure drop **bar**

Pressure drop for rest of column (optional)

Stage pressure drop **bar**

Column pressure drop **bar**

COL-MAIN φάσεις, σύκλιση

The screenshot shows the Aspen Plus interface with two main windows open:

- COL-MAIN Specifications - Setup**: This window contains:
 - A table titled "Stages to be tested for two liquid phases" with columns "Starting stage" and "Ending stage". The "Starting stage" is highlighted in yellow.
 - A section titled "Key components to identify 2nd liquid phase" with "Available components" (ETHANOL, C6H12-1) and "Key components" (WATER).
- Simulation**: A tree view of simulation items including:
 - COL-MAIN (selected)
 - Specifications
 - Configuration
 - Column Internals
 - Rate-Based Model
 - Analysis
 - Convergence (selected)
 - Dynamics
 - EO Modeling
 - Results
 - Profiles
 - Stream Results
- COL-MAIN Convergence - Convergence**: This window displays convergence settings:
 - Basic tab selected.
 - Algorithm: Newton
 - Maximum iterations: 200
 - Error tolerance: (empty field)
 - Methods tab:
 - Initialization method: Azeotropic
 - Damping level: Medium
 - Liquid-liquid phase splitting method: Gibbs
 - Solids handling: Overall
 - Salt precipitation handling: Include

Text callout (yellow box):

Αυτό λέει στο Aspen Plus ότι αναμένουμε ότι η δεύτερη υγρή φάση θα είναι κυρίως νερό και επειδή δεν γνωρίζουμε ακριβώς ποια στάδια της στήλης θα περιέχουν δύο υγρές φάσεις, θα ζητήσουμε από το Aspen Plus να ελέγξει κάθε στάδιο.

Στήλη COL-REC

Main Flowsheet COL-REC (RadFrac) +

Configuration Streams Pressure Condenser Reboiler 3-Phase Comments

Setup options

Calculation type: Equilibrium

Number of stages: 100 Stage Wizard

Condenser: Total

Reboiler: Kettle

Valid phases: Vapor-Liquid-Liquid

Convergence: Strongly non-ideal liquid

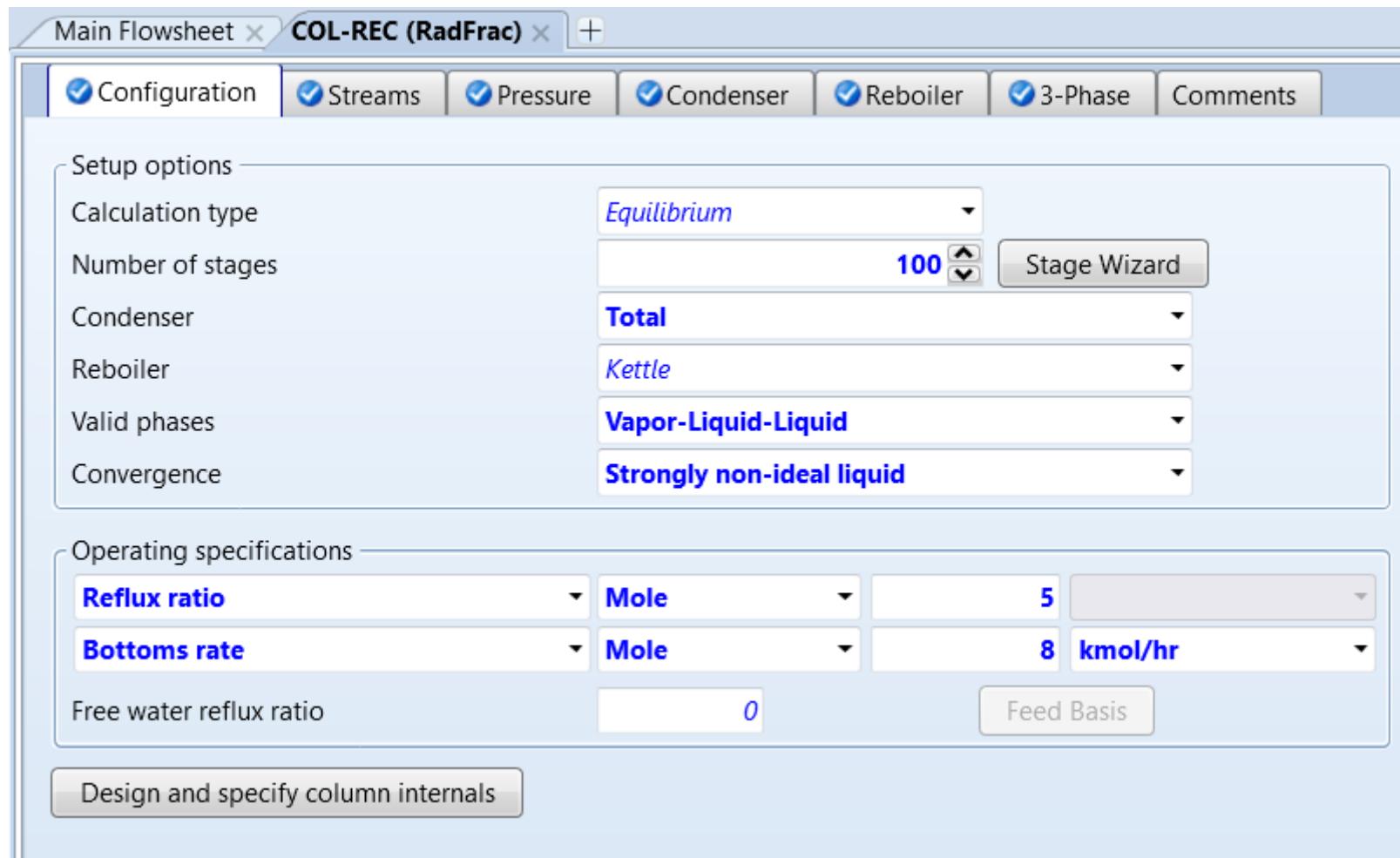
Operating specifications

Reflux ratio: Mole 5

Bottoms rate: Mole 8 kmol/hr

Free water reflux ratio: 0 Feed Basis

Design and specify column internals



COL-REC σύνδεση ρευμάτων, πίεση

Main Flowsheet > COL-MAIN Convergence - Convergence > COL-REC (RadFrac) >

Configuration Streams Pressure Condenser Reboiler 3-Phase

Feed streams

	Name	Stage	Convention
▶	TO-REC	Above-Stage	

Product streams

	Name	Stage	Phase	Basis	Flow
▶	H2O	100	Liquid	Mole	
▶	RECYC-FD	1	Liquid	Mole	

Pseudo streams

	Name	Pseudo Stream Type	Stage	Internal Phase	Reboiler Phase	Reb Cond
--	------	--------------------	-------	----------------	----------------	----------

Main Flowsheet > COL-REC (RadFrac) > +

Configuration Streams Pressure Condenser Reboile

View Top / Bottom

Top stage / Condenser pressure

Stage 1 / Condenser pressure bar

Stage 2 pressure (optional)

Stage 2 pressure bar

Condenser pressure drop bar

Pressure drop for rest of column (optional)

Stage pressure drop bar

Column pressure drop bar

COL-REC φάσεις, σύκλιση

Main Flowsheet COL-REC (RadFrac) +

Configuration Streams Pressure Condenser Reboiler 3-Phase

Stages to be tested for two liquid phases

	Starting stage	Ending stage
▶	1	100
◀		

Αυτό λέει στο Aspen Plus ότι αναμένουμε ότι η δεύτερη υγρή φάση θα είναι κυρίως νερό και επειδή δεν γνωρίζουμε ακριβώς ποια στάδια της στήλης θα περιέχουν δύο υγρές φάσεις, θα ζητήσουμε από το Aspen Plus να ελέγξει κάθε στάδιο.

Key components to identify 2nd liquid phase

Available components Key components

ETHANOL C6H12-1	WATER
--------------------	-------

Simulation Main Flowsheet COL-REC Convergence - Convergence +

All Items

- ▷ COL-MAIN
- ◀ COL-REC
 - ▷ Specifications
 - ▷ Configuration
 - ▷ Column Internals
 - ▷ Rate-Based Modeling
 - ▷ Analysis
- ◀ Convergence
 - Estimates
 - Convergence
- ▷ Dynamics
- ▷ EO Modeling
- ▷ Results

Basic Algorithm Advanced Diagnostics

Basic convergence

Algorithm: **Newton**

Maximum iterations: **200**

Error tolerance

Methods

Initialization method: **Azeotropic**

Damping level: **Medium**

Liquid-liquid phase splitting method: **Gibbs**

Solids handling: **Overall**

Salt precipitation handling: **Include**

Δοχείο διαχωρισμού φάσεων

Simulation

Main Flowsheet x COL-REC Convergence - Convergence x DECANTER (Decanter) - Input x

All Items

- ▷ COL-MAIN
- ▷ COL-REC
- ▲ DECANTER
 - Input
 - Properties
 - HCurves
 - Dynamic
 - Block Options
 - ▷ EO Modeling
 - ▷ Results
 - ▷ Stream Results
 - Summary
- ▷ Utilities
- ▷ Reactions
- ▷ Convergence
- ▷ Flowsheeting Options
- ▷ Model Analysis Tools
- ▷ EO Configuration

Specifications

Decanter specifications

Pressure: 1 bar

Temperature: 25 °C

Duty: cal/sec

Key components to identify 2nd liquid phase

Available components: ETHANOL, C6H12-1

Key components: WATER

Key component threshold for 2nd liquid phase

Component mole fraction: 0.5

F4 – σύκλιση

Block: COL-MAIN Model: RADFRAC

Convergence iterations:

Iter	Err/Tol
1	5680.9
2	215.90
3	1.0345
4	0.21809E-04

Block: DECANTER Model: DECANTER

Block: COL-REC Model: RADFRAC

Convergence iterations:

Iter	Err/Tol
1	4958.0
2	58.079
3	0.31136E-01

->Simulation calculations completed ...

*** No Warnings were issued during Input Translation ***

*** No Errors or Warnings were issued during Simulation ***

ΠΡΟΣΟΜΟΙΩΣΗ 2

ΑΡΧΕΙΟ: SIM_2_NO_RECYCLES_20211207.BKP

Αλλαγή τρόπου επίλυσης - ευρωστία

The image displays two side-by-side screenshots of a process simulation software interface, likely Aspen Plus, illustrating the configuration of distillation columns.

Left Screenshot (Main Flowsheet x DUM-FEED (MATERIAL) x COL-MAIN (RadFrac) x):

- Setup options:**
 - Calculation type: Equilibrium (selected)
 - Number of stages: 62
 - Condenser: Kettle
 - Reboiler: Vapor-Liquid-Liquid
 - Valid phases: Custom (highlighted with a red box)
 - Convergence
- Operating specifications:**
 - Reflux ratio: Mole
 - Bottoms rate: Mole
 - Free water reflux ratio: 0
- Design and specify column internals**

Right Screenshot (Main Flowsheet x COL-REC (RadFrac) x):

- Setup options:**
 - Calculation type: Equilibrium (selected)
 - Number of stages: 100
 - Condenser: Total
 - Reboiler: Kettle
 - Valid phases: Vapor-Liquid-Liquid (highlighted with a red box)
 - Convergence: Custom (highlighted with a red box)
- Operating specifications:**
 - Reflux ratio: Mole (value 5)
 - Bottoms rate: Mole (value 8 kmol/hr)
 - Free water reflux ratio: 0
- Design and specify column internals**

Εκτιμήσεις προφίλ Τ, C σε στήλη COL-MAIN

Simulation

Main Flowsheet Control Panel COL-MAIN Convergence - Estimates

Temperature Flows Liquid Composition Vapor Composition

Temperature estimates (optional) Generate Estimates...

Stage	Temperature
1	62.4048
2	63.0874
3	63.5787
4	63.7918
5	63.8661
6	63.8901
7	63.8977
8	63.9001
9	63.9008
10	63.901
11	63.9011
12	63.9011
13	63.9011
14	63.9011

Generate estimates from available results

Generate estimates for –

Temperature

Liquid and vapor mole flows

Liquid and vapor component mole fractions

Generate estimates for stages

Currently specified stages

All stages for temperatures and flows; Feed and product locations for compositions

All stages

Precision of estimates

Keep all available digits

Generate Cancel

All Items

Setup Property Sets Analysis Flowsheet Streams Blocks COL-MAIN Specifications Configuration Column Internals Rate-Based Model Analysis Convergence Estimates Convergence Dynamics EO Modeling Results Profiles Stream Results Summary

Stage	Temperature
1	62.4048
2	63.0874
3	63.5787
4	63.7918
5	63.8661
6	63.8901
7	63.8977
8	63.9001
9	63.9008
10	63.901
11	63.9011
12	63.9011
13	63.9011
14	63.9011

Αλγόριθμος επίλυσης

Simulation Main Flowsheet COL-MAIN Convergence - Convergence

Basic Algorithm Advanced Diagnostics

Basic convergence

Algorithm: **Newton**

Maximum iterations: **200**

Error tolerance:

Methods

Initialization method: **Azeotropic**

Damping level: **Medium**

Liquid-liquid phase splitting method: **Gibbs**

Solids handling: **Overall**

Salt precipitation handling: **Include**

Convergence parameters

	No	
Prop-Deriv	Analytical	
Qmaxbwil	0.5	
Qmaxbwol	0	
Qminbwil	0	
Qminbwol		
Radius-Frac		
Rmsol0	0.1	
Rmsol1		
Stable-Iter		
Stable-Meth		
Tolil0		
Tolilfac		
Tolilmin		

COL-MAIN Convergence - Convergence

Algorithm Advanced Diagnostics

Convergence parameters

	No	
Dsmeth		
Dtmax		
Eff-Flash	No	
Extra-ml	0	
Flash-Maxit		
Flash-Tol	1e-07	
Flash-Tolil		
Flash-Vfrac		
Flexi-Meth	Bulletin 960	
Float-Meth	Aspen90	
Fminfac		
Hmodel1		

COL-MAIN

All Items

- COL-MAIN
 - Specifications
 - Configuration
 - Column Internals
 - Rate-Based Modeli
 - Analysis
- Convergence
 - Estimates
 - Convergence**
- Dynamics
- EO Modeling
- Results
- Profiles
- Stream Results

Column Internals

Rate-Based Modeli

Analysis

Convergence

Estimates

Dynamics

EO Modeling

Results

Profiles

Stream Results

Summary

COL-REC

Specifications

Configuration

Column Internals

Rate-Based Modeli

Analysis

Εκτιμήσεις προφίλ Τ, C σε στήλη COL-REC

Simulation

Main Flowsheet > COL-REC Convergence - Estimates

Temperature Flows Liquid Composition Vapor Composition

Temperature estimates (optional) Generate Estimates...

Stage	Temperature
1	64.8402
2	74.0425
3	76.6902
4	77.07
5	77.1189
6	77.1254
7	77.1266
8	77.1271
9	77.1276
10	77.1281
11	77.1286
12	77.1291
13	77.1297
14	77.1303
15	77.1309

Generate estimates from available results

Generate estimates for Temperature, Liquid and vapor mole flows, Liquid and vapor component mole fractions.

Generate estimates for stages: All stages

Precision of estimates: Keep all available digits

Generate Cancel

All Items

- COL-MAIN
- COL-REC
 - Specifications
 - Configuration
 - Column Internals
 - Rate-Based Model
 - Analysis
 - Convergence
 - Estimates
 - Convergence
 - Dynamics
 - EO Modeling
 - Results
 - Profiles
 - Stream Results
 - Summary
- DECANTER
- Utilities
- Reactions
- Convergence
- Flowsheeting Options
- Model Analysis Tools

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Αλγόριθμος επίλυσης

Main Flowsheet > COL-REC Convergence - Convergence +

Basic Algorithm Advanced Diagnostics

Basic convergence

Algorithm: **Newton**

Maximum iterations: **200**

Error tolerance:

Methods

Initialization method: **Azeotropic**

Damping level: **Medium**

Liquid-liquid phase splitting method: **Gibbs**

Solids handling: **Overall**

Salt precipitation handling: **Include**

Main Flowsheet > COL-REC Convergence - Convergence +

Basic Algorithm Advanced Diagnostics

Advanced convergence parameters

Absorber	No
Dsmeth	
Dtmax	
Eff-Flash	No
Extra-ml	0
Flash-Maxit	
Flash-Tol	
Flash-Tolil	1e-07
Flash-Vfrac	
Flexi-Meth	Bulletin 960
Float-Meth	Aspen90
Fminfac	
Prop-Deriv	Analytical
Qmaxbwil	0.5
Qmaxbwol	0
Qminbwil	
Qminbwol	
Radius-Frac	
Rmsol0	0.1
Rmsol1	
Stable-Iter	
Stable-Meth	Dogleg str
Tolil0	Dogleg strategy
Tolilfac	Line search

DESIGN-SPECS

COL-MAIN Design-Specs για επίτευξη καθαρότητας προϊόντος

The screenshot displays three overlapping windows from the Aspen Plus software interface, specifically for the 'COL-MAIN Specifications Design Specifications - 1' module.

Left Window (Main Flowsheet):

- Specifications:** Checked.
- Components:** Checked.
- Feed/Product Streams:** Checked.
- Options:** Unchecked.
- Results:** Unchecked.

Fields:

- Description:** Mole purity, 0.9995, PRODUCT
- Type:** Mole purity
- Target:** 0.9995
- Stream type:** Product

Middle Window (Main Flowsheet):

- Specifications:** Checked.
- Components:** Checked.
- Feed/Product Streams:** Checked.
- Options:** Unchecked.
- Results:** Unchecked.

Components:

- Available components:** WATER, C6H12-1
- Selected components:** ETHANOL
- Base components:** Available components
- Available components:** ETHANOL, WATER, C6H12-1

Bottom Window (Main Flowsheet):

- Specifications:** Checked.
- Components:** Checked.
- Feed/Product Streams:** Checked.
- Options:** Unchecked.

Product streams:

- RICH-SOL
- ETOH

Vary για επίτευξη καθαρότητας προϊόντος

The screenshot shows the HYSIM software interface with the following details:

- Simulation Tree (Left):** Shows the project structure under "COL-MAIN". The "Vary" folder is expanded, and the "1" item is selected.
- Main Flowsheet Window (Top Right):** Title bar: "Main Flowsheet > COL-MAIN Specifications Vary - 1".
 - Specifications Tab:** Active tab. Description: "Bottoms rate, 1., 120.".
 - Components Tab:** Not active.
 - Results Tab:** Not active.
- Specification Details (Right):**
 - Adjusted variable:** Type: "Bottoms rate".
 - Upper and lower bounds:**
 - Lower bound: 1 kmol/hr
 - Upper bound: 120 kmol/hr
 - Optional:** Maximum step size: [empty input field]

COL-REC Design-Specs για επίτευξη καθαρότητας προϊόντος

The screenshot displays a simulation software interface with three overlapping windows for 'COL-REC Specifications Design Specifications - 1'.

Top Window: Shows the 'Specifications' tab selected. The 'Description' field contains 'Mole purity, 0.9999, PRODUCT'. The 'Design specification' section shows 'Type' set to 'Mole purity' and 'Target' set to '0.9999'. The 'Stream type' is set to 'Product'.

Middle Window: Shows the 'Components' tab selected. The 'Available components' list includes 'ETHANOL' and 'C6H12-1'. The 'Selected components' list includes 'WATER'.

Bottom Window: Shows the 'Feed/Product Streams' tab selected. The 'Product streams' list includes 'RECYC-FD' and 'H2O'.

The left sidebar shows the 'Simulation' tree structure with nodes like 'Setup', 'Property Sets', 'Analysis', 'Flowsheet', 'Streams', 'Blocks', 'COL-MAIN', 'COL-REC', 'Specifications', 'Design Specifications', and a file named '1'.

Vary για επίτευξη καθαρότητας προϊόντος

The screenshot shows the Aspen Plus software interface. On the left, there is a navigation tree under the 'Simulation' tab with categories like All Items, Setup, Property Sets, Analysis, Flowsheet, Streams, Blocks, COL-MAIN, COL-REC, Specifications, Design Specifications, and Vary. The 'Vary' category is currently selected, indicated by a blue border around its icon. The main window title is 'Main Flowsheet > COL-REC Specifications Vary - 1'. The dialog box contains the following fields:

- Specifications** tab is selected.
- Description**: Bottoms rate, 1., 25.
- Adjusted variable**: Type: Bottoms rate
- Upper and lower bounds**: Lower bound: 1 kmol/hr, Upper bound: 25 kmol/hr
- Optional**: Maximum step size: (empty)

F4 - αποτελέσματα

Simulation Main Flowsheet Control Panel RECYC-FD (MATERIAL) - Results (Default)

Material	Vol.% Curves	Wt. % Curves	Petroleum	Polymers	Solids	Status
Mass Liquid Fraction						RECYC-FD
Mass Solid Fraction						1
Molar Enthalpy			cal/mol			0
Mass Enthalpy			cal/gm			-61385.1
Molar Entropy			cal/mol-K			-1281.86
Mass Entropy			cal/gm-K			-81.0037
Molar Density			mol/cc			-1.69154
Mass Density			gm/cc			0.0159191
Enthalpy Flow			cal/sec			0.762326
Average MW						-967032
+ Mole Flows			kmol/hr			47.8876
- Mole Fractions						56.7127
ETHANOL						0.765431
WATER						0.107591
C6H12-1						0.126978

ΠΡΟΣΟΜΟΙΩΣΗ 3

ΑΡΧΕΙΟ: SIM_3_NO_RECYCLES_20211207.BKP

Αλλαγή εικονικού ρεύματος DUM-FEED

Main Flowsheet Control Panel DUM-FEED (MATERIAL) RECYC-FD (MATERIAL) +

Mixed CI Solid NC Solid Flash Options EO Options Costing Comments

Specifications

Flash Type Pressure Vapor Fraction

State variables

Temperature	C
Pressure	1 bar
Vapor fraction	0
Total flow basis	Mole
Total flow rate	5 kmol/hr
Solvent	

Composition

Component	Value
ETHANOL	0.758251
WATER	0.106379
C6H12-1	0.13537

RECYC-FD σύσταση

Total 1

F4 - σύκλιση

COMPUTATION ORDER FOR THE FLOWSHEET:
COL-MAIN DECANTER COL-REC

->Calculations begin ...

Convergence iterations:

Iter	Err/Tol
1	6946.2
2	336.18
3	2.3928
4	0.11184E-03

Block: DECANTER Model: DECANTER

Block: COL-REC Model: RADFRAC

Convergence iterations:

Iter	Err/Tol
1	6412.0
2	91.450
3	0.73015E-01

->Simulation calculations completed ...

Αρχείο:

[Sim_3_No_recycles_20211207.bkp](#)

*** No Warnings were issued during Input Translation ***

*** No Errors or Warnings were issued during Simulation ***

ΠΡΟΣΟΜΟΙΩΣΗ 4

ΑΡΧΕΙΟ: SIM_4_NO_RECYCLES_20211207.BKP

Σταδιακή αύξηση της ροής του DUM-FEED

Επειδή τα μπλοκ RadFrac χρησιμοποιούν τη μέθοδο του Newton για να συγκλίνουν, μεγάλες αλλαγές στις συνθήκες τροφοδοσίας μπορούν να δημιουργήσουν σφάλματα στην προσομοίωση.

Αλλάξτε τον συνολικό ρυθμό ροής του DUM-FEED σε καθεμία από τις τιμές του παρακάτω πίνακα και εκτελέστε την προσομοίωση μετά από κάθε αλλαγή του ρυθμού ροής **χωρίς** reinitialization.

7	kmol/hr
9	kmol/hr
15	kmol/hr
25	kmol/hr
35	kmol/hr
57	kmol/hr

ΠΡΟΣΟΜΟΙΩΣΗ 5

ΑΡΧΕΙΟ: SIM_5_NO_RECYCLES_20211207.BKP

Αλλαγή ροής διαλύτη

Επειδή ο ρυθμός ροής του DUM-FEED έχει αυξηθεί, ο ρυθμός ροής του SOLVENT πρέπει να αυξηθεί έτσι ώστε η στήλη να λειτουργεί εντός της ίδιας περιοχής απόσταξης. Αλλάξτε τη συνολική ροή σε 150 kmol/hr και εκτελέστε την προσομοίωση.

The screenshot shows the 'SOLVENT (MATERIAL)' properties window in a process simulation software. The top navigation bar includes tabs for 'Main Flowsheet', 'DUM-FEED (MATERIAL)', 'Control Panel', and 'SOLVENT (MATERIAL)'. The 'SOLVENT (MATERIAL)' tab is active. Below the tabs is a toolbar with buttons for 'Mixed' (selected), 'CI Solid', 'NC Solid', 'Flash Options', 'EO Options', 'Costing', and 'Comments'. The main area is divided into sections: 'Specifications' (selected), 'Composition', and 'Reference Temperature'. Under 'Specifications', the 'Flash Type' is set to 'Pressure' and 'Vapor Fraction'. The 'State variables' section contains fields for Temperature (C), Pressure (1 bar), Vapor fraction (0), Total flow basis (Mole), Total flow rate (150 kmol/hr), and Solvent. Under 'Composition', the 'Mole-Frac' selection is shown, along with a table listing components: ETHANOL, WATER, and C6H12-1.

Ανανέωση εικονικού ρεύματος DUM-FEED

Main Flowsheet > RECYC-FD (MATERIAL) > **DUM-FEED (MATERIAL)** +

Mixed Cl Solid NC Solid Flash Options EO Options Costing Comments

Specifications

Flash Type: Pressure Vapor Fraction

State variables

Temperature	C
Pressure	1 bar
Vapor fraction	0
Total flow basis	Mole
Total flow rate	76 kmol/hr
Solvent	

Composition

Mole-Frac	
Component	Value
ETHANOL	0.758251
WATER	0.106379
C6H12-1	0.13537

RECYC-FD σύσταση

Total 1

Αύξηση ροής SOLVENT

Main Flowsheet **SOLVENT (MATERIAL)**

Mixed CI Solid NC Solid Flash Options EO Options Costing Comments

Specifications

Flash Type Pressure Vapor Fraction

State variables

Temperature	C
Pressure	1 bar
Vapor fraction	0
Total flow basis	Mole
Total flow rate	170 kmol/hr
Solvent	

Composition

Mole-Frac

Component	Value
ETHANOL	0
WATER	0
C6H12-1	1

Reference Temperature

Volume flow reference temperature

Component concentration reference temperature

Total 1

135

F4 - αποτελέσματα

```
V ->Calculations begin ...
R

    Block: COL-MAIN Model: RADFRAC

        Convergence iterations:
          Iter      Err/Tol
            1        1494.6
            2        23.622
            3        0.14524E-01

    Block: DECANTER Model: DECANTER

    Block: COL-REC  Model: RADFRAC

        Convergence iterations:
          Iter      Err/Tol
            1        2115.2
            2        12.750
            3        0.15752E-02

->Simulation calculations completed ...

*** No Warnings were issued during Input Translation ***

*** No Errors or Warnings were issued during Simulation ***

->Generating results ...

<< Run Saved >>
```

ΠΡΟΣΟΜΟΙΩΣΗ 6

ΑΡΧΕΙΟ: SIM_6_NO_RECYCLES_20211207.BKP

Αύξηση ροών διαλύτη και εικονικής ανακύκλωσης

Αλλάξτε τη συνολική ροή DUM-FEED και SOLVENT για να ταιριάζει με τις σειρές στον παρακάτω πίνακα. Κάθε φορά μετά την αλλαγή και των δύο ρυθμών ροής, εκτελείτε την προσομοίωση.

DUM-FEED Total flow rate	SOLVENT Total flow rate
96 kmol/hr	190 kmol/hr
116 kmol/hr	210 kmol/hr
136 kmol/hr	230 kmol/hr
156 kmol/hr	250 kmol/hr
176 kmol/hr	270 kmol/hr
196 kmol/hr	290 kmol/hr

F4 - αποτελέσματα

Block: COL-MAIN Model: RADFRAC

Convergence iterations:

Iter	Err/Tol
1	211.79
2	0.25035
3	0.18805E-05

Block: DECANTER Model: DECANTER

Block: COL-REC Model: RADFRAC

Convergence iterations:

Iter	Err/Tol
1	163.80
2	0.79698E-01
3	0.81817E-07

->Simulation calculations completed ...

*** No Warnings were issued during Input Translation ***

*** No Errors or Warnings were issued during Simulation ***

->Generating results ...

<< Run Saved >>

	Units	DUM-FEED	RECYC-FD
▶ Mass Liquid Fraction		1	1
▶ Mass Solid Fraction		0	0
▶ Molar Enthalpy	cal/mol	-61143.4	-60729.4
▶ Mass Enthalpy	cal/gm	-1267.45	-1243.21
▶ Molar Entropy	cal/mol-K	-81.6032	-82.6291
▶ Mass Entropy	cal/gm-K	-1.69156	-1.69152
▶ Molar Density	mol/cc	0.0158149	0.0156364
▶ Mass Density	gm/cc	0.76293	0.763824
▶ Enthalpy Flow	cal/sec	-3.32892e+06	-3.28023e+06
▶ Average MW		48.2413	48.849
▶ + Mole Flows	kmol/hr	196	194.45
▶ - Mole Fractions			
▶ ETHANOL		0.758251	0.746195
▶ WATER		0.106379	0.104134
▶ C6H12-1		0.13537	0.149671

Είναι περίπου ίδια

ΠΡΟΣΟΜΟΙΩΣΗ 7

ΑΡΧΕΙΟ: SIM_7_NO_RECYCLES_20211207.BKP

COL-MAIN Estimates

Main Flowsheet COL-MAIN Convergence - Estimates +

Temperature Flows Liquid Composition Vapor Composition

Temperature estimates (optional) Generate Estimates...

	Stage	Temperature
	1	62.4048
	2	63.0874
	3	63.5787
	4	63.7918
	5	63.8661
	6	63.8901
	7	63.8977
	8	63.9001
	9	63.9008
	10	63.901
	11	63.9011
	12	63.9011
	13	63.9011
	14	63.9011
	15	63.9011

□ Generate estimates from available results X

Generate estimates for Temperature
 Liquid and vapor mole flows
 Liquid and vapor component mole fractions

Generate estimates for stages Currently specified stages
 All stages for temperatures and flows;
Feed and product locations for compositions
 All stages

Precision of estimates Keep all available digits

Generate Cancel

COL-REC Estimates

Main Flowsheet × COL-REC Convergence - Estimates × +

Temperature Flows Liquid Composition Vapor Composition

Temperature estimates (optional) [Generate Estimates...](#)

	Stage	Temperature
	1	65.2078
	2	74.3095
	3	76.7768
	4	77.1241
	5	77.1686
	6	77.1746
	7	77.1758
	8	77.1765
	9	77.1772
	10	77.1778
	11	77.1786
	12	77.1794
	13	77.1802
	14	77.1811
	15	77.182

Generate estimates from available results

Generate estimates for

Temperature
 Liquid and vapor mole flows
 Liquid and vapor component mole fractions

Generate estimates for stages

Currently specified stages
 All stages for temperatures and flows;
Feed and product locations for compositions
 All stages

Precision of estimates

Keep all available digits

[Generate](#) [Cancel](#)

Re-initialize + F4 - αποτελέσματα

COMPUTATION ORDER FOR THE FLOWSHEET:

COL-MAIN DECANTER COL-REC

->Calculations begin ...

Block: COL-MAIN Model: RADFRAC

Convergence iterations:

Iter	Err/Tol
1	0.25521E-02

Block: DECANTER Model: DECANTER

Block: COL-REC Model: RADFRAC

Convergence iterations:

Iter	Err/Tol
1	0.48894E-01

->Simulation calculations completed ...

*** No Warnings were issued during Input Translation ***

*** No Errors or Warnings were issued during Simulation ***

->Generating results ...

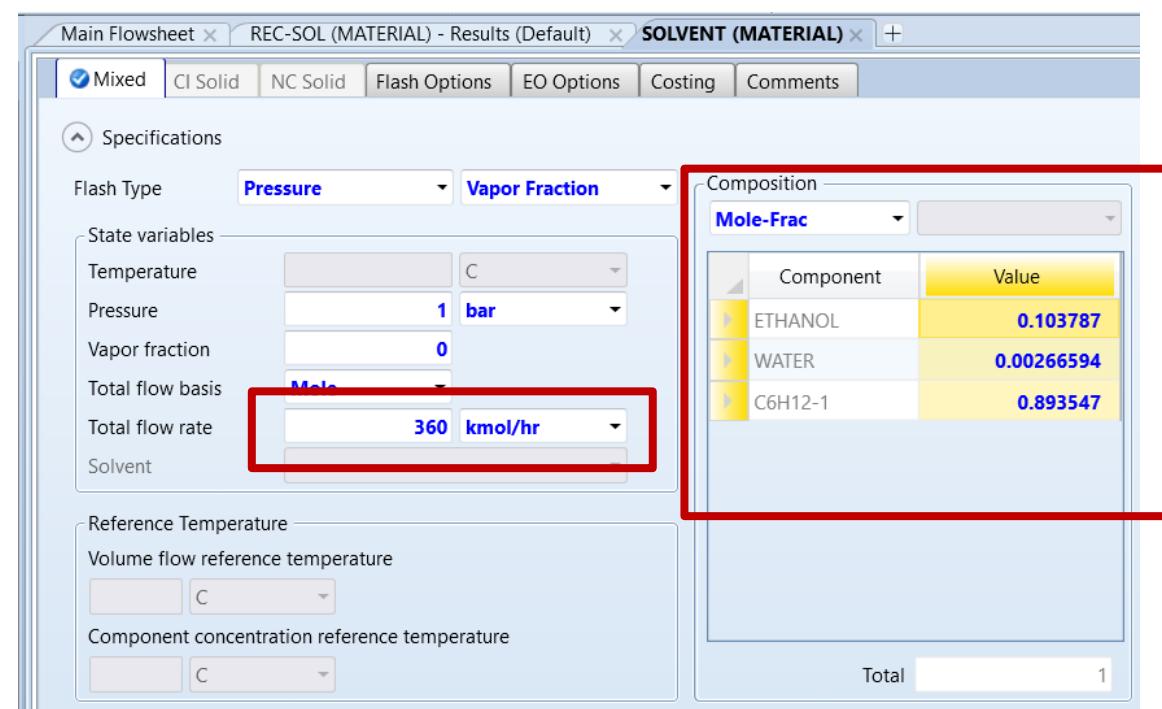
<< Run Saved >>

ΠΡΟΣΟΜΟΙΩΣΗ 8

ΑΡΧΕΙΟ: SIM_8_NO_RECYCLES_20211207.BKP

Ανανέωση ρεύματος SOLVENT με νέα ροή και σύσταση του REC-SOL

	Units	REC-SOL
Molar Liquid Fraction		1
Molar Solid Fraction		0
Mass Vapor Fraction		0
Mass Liquid Fraction		1
Mass Solid Fraction		0
Molar Enthalpy	cal/mol	-40427.9
Mass Enthalpy	cal/gm	-505.15
Molar Entropy	cal/mol-K	-139.607
Mass Entropy	cal/gm-K	-1.7444
Molar Density	mol/cc	0.00972499
Mass Density	gm/cc	0.778305
Enthalpy Flow	cal/sec	-3.61201e+06
Average MW		80.0314
+ Mole Flows	kmol/hr	321.64
- Mole Fractions		
ETHANOL		0.103787
WATER		0.00266594
C6H12-1		0.893547



F4 - αποτελέσματα

->Calculations begin ...

Block: COL-MAIN Model: RADFRAC

Convergence iterations:

Iter	Err/Tol
1	305.49
2	1.0690
3	0.37207E-04

Block: DECANTER Model: DECANTER

Block: COL-REC Model: RADFRAC

Convergence iterations:

Iter	Err/Tol
1	519.34
2	0.91350
3	0.94102E-05

->Simulation calculations completed ...

*** No Warnings were issued during Input Translation ***

*** No Errors or Warnings were issued during Simulation ***

ΠΡΟΣΟΜΟΙΩΣΗ 9

ΑΡΧΕΙΟ: SIM_9_NO_RECYCLES_20211207.BKP

COL-MAIN Estimates

Main Flowsheet COL-MAIN Convergence - Estimates +

Temperature Flows Liquid Composition Vapor Composition

Temperature estimates (optional) Generate Estimates...

	Stage	Temperature
	1	62.4048
	2	63.0874
	3	63.5787
	4	63.7918
	5	63.8661
	6	63.8901
	7	63.8977
	8	63.9001
	9	63.9008
	10	63.901
	11	63.9011
	12	63.9011
	13	63.9011
	14	63.9011
	15	63.9011

□ Generate estimates from available results X

Generate estimates for

Temperature
 Liquid and vapor mole flows
 Liquid and vapor component mole fractions

Generate estimates for stages

Currently specified stages
 All stages for temperatures and flows;
Feed and product locations for compositions
 All stages

Precision of estimates

Keep all available digits

Generate Cancel

COL-REC Estimates

Main Flowsheet × COL-REC Convergence - Estimates × +

Temperature Flows Liquid Composition Vapor Composition

Temperature estimates (optional) [Generate Estimates...](#)

	Stage	Temperature
	1	65.2078
	2	74.3095
	3	76.7768
	4	77.1241
	5	77.1686
	6	77.1746
	7	77.1758
	8	77.1765
	9	77.1772
	10	77.1778
	11	77.1786
	12	77.1794
	13	77.1802
	14	77.1811
	15	77.182

Generate estimates from available results

Generate estimates for

Temperature
 Liquid and vapor mole flows
 Liquid and vapor component mole fractions

Generate estimates for stages

Currently specified stages
 All stages for temperatures and flows;
Feed and product locations for compositions
 All stages

Precision of estimates

Keep all available digits

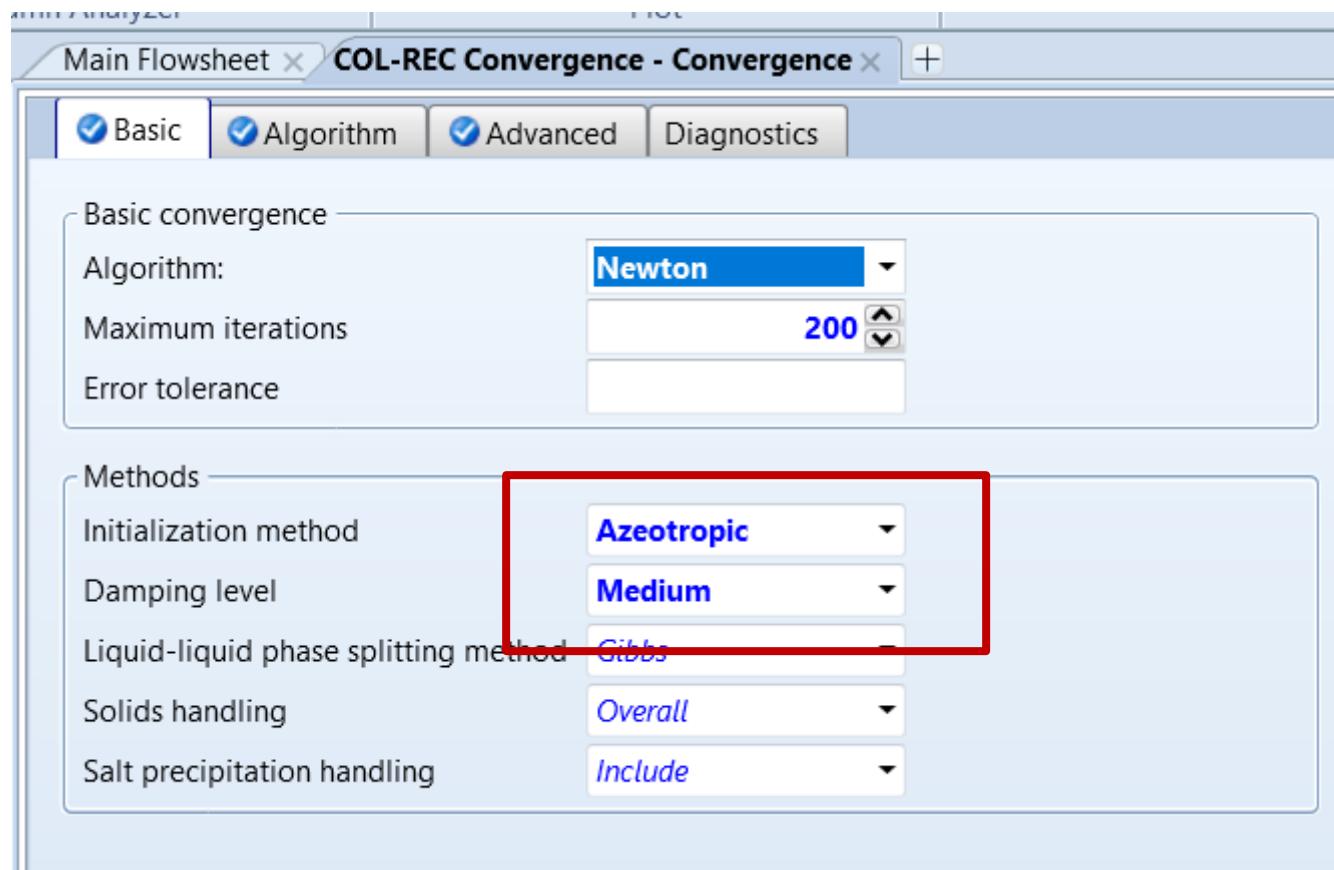
Generate Cancel

Ρυθμίσεις σύγκλισης COL-MAIN

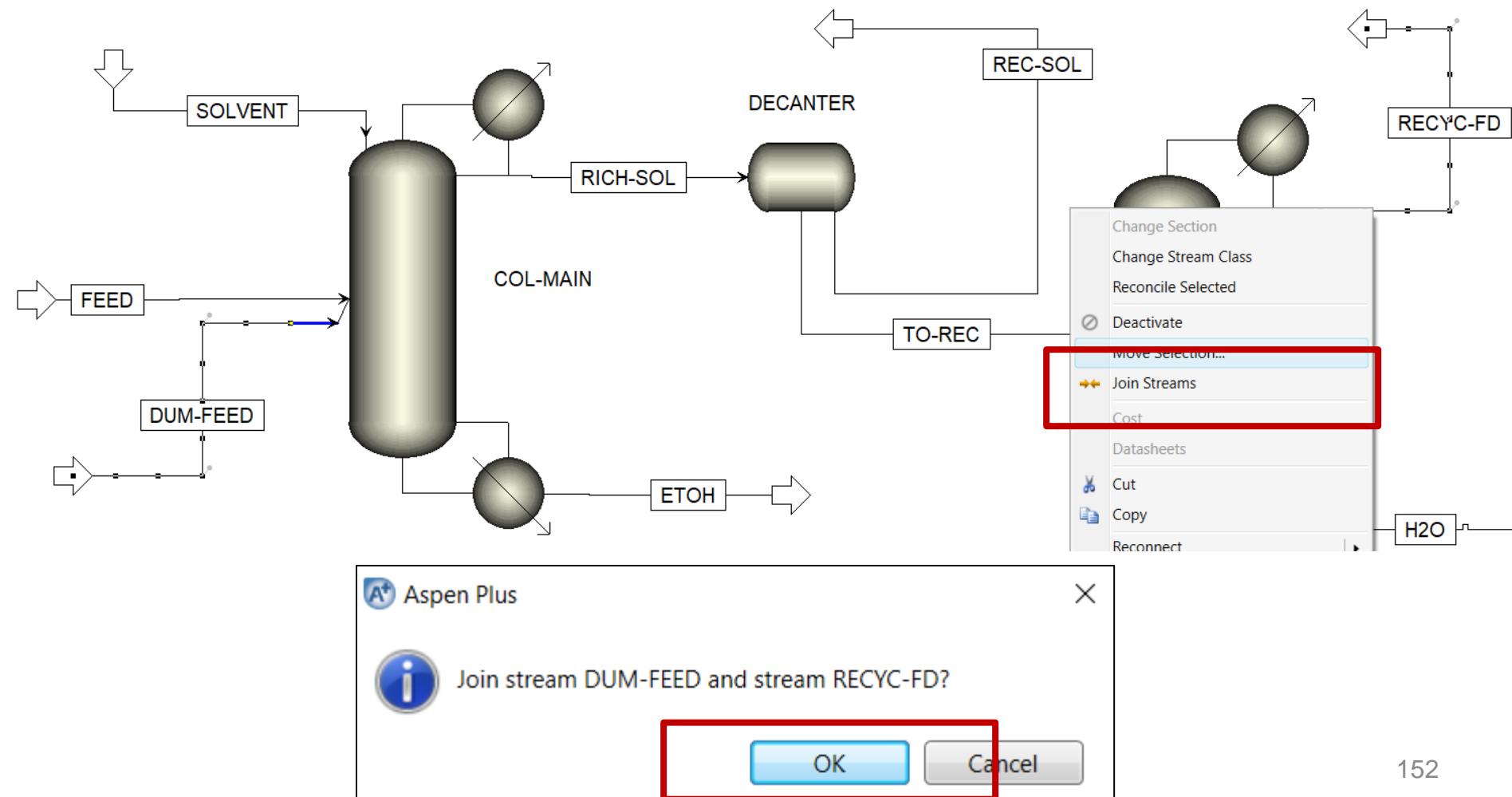
The screenshot shows the Aspen Plus software interface with the following details:

- Simulation** tab is active.
- Main Flowsheet** and **COL-MAIN Convergence - Convergence** windows are open.
- COL-MAIN** folder is expanded in the left sidebar, showing:
 - Specifications
 - Configuration
 - Column Internals
 - Rate-Based Modeli
 - Analysis
 - Convergence
 - Estimates
 - Convergence** (selected)
 - Dynamics
 - EO Modeling
 - Results
 - Profiles
 - Stream Results
- Convergence** tab is selected in the right panel.
- Basic**, **Algorithm**, and **Advanced** tabs are checked.
- Basic convergence** section:
 - Algorithm: **Newton**
 - Maximum iterations: **200**
 - Error tolerance: (empty input field)
- Methods** section:
 - Initialization method: **Azeotropic** (highlighted with a red box)
 - Damping level: **Medium** (highlighted with a red box)
 - Liquid-liquid phase splitting method: **GIBBS**
 - Solids handling: **Overall**
 - Salt precipitation handling: **Include**

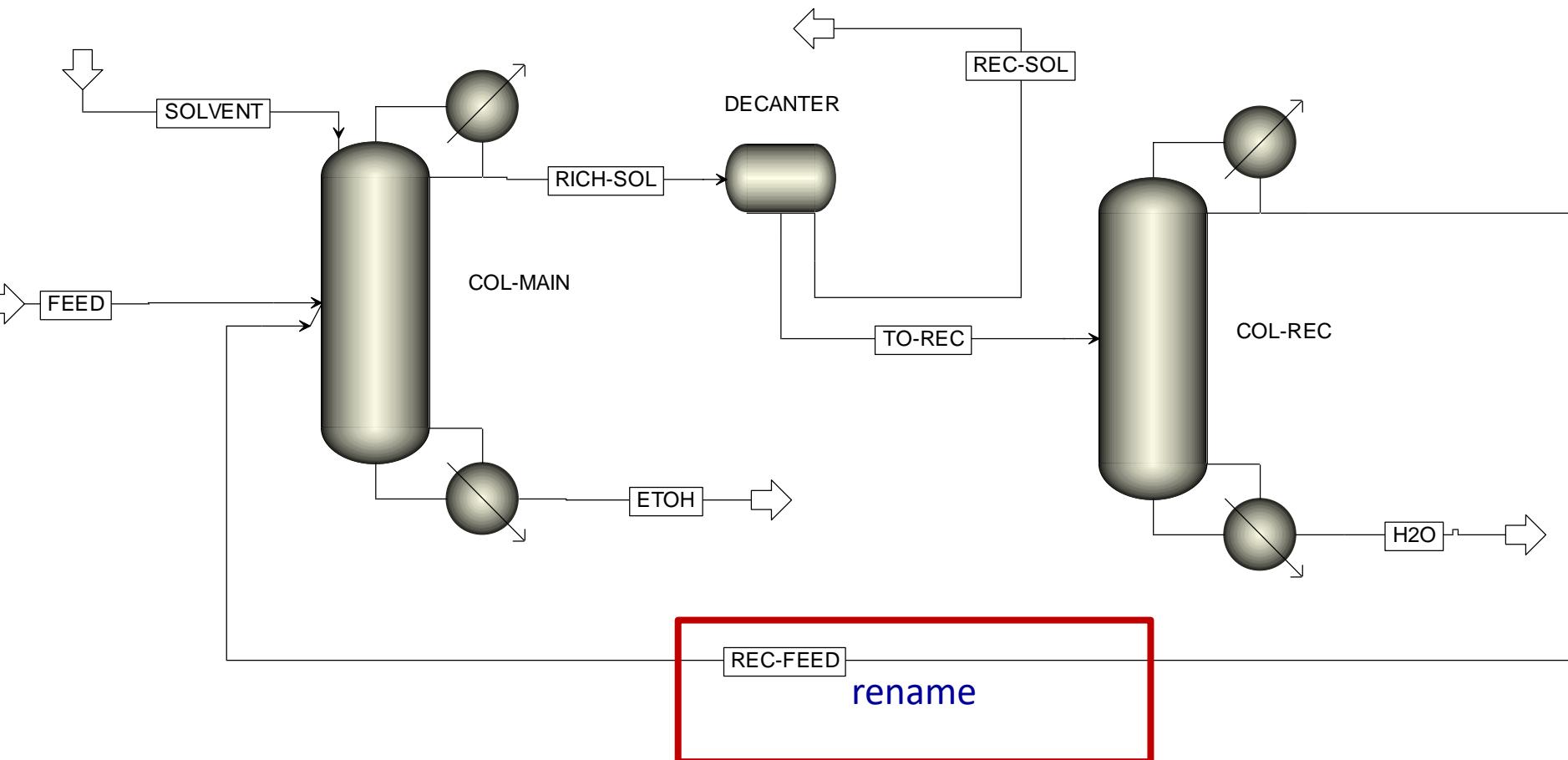
Ρυθμίσεις σύγκλισης COL-REC



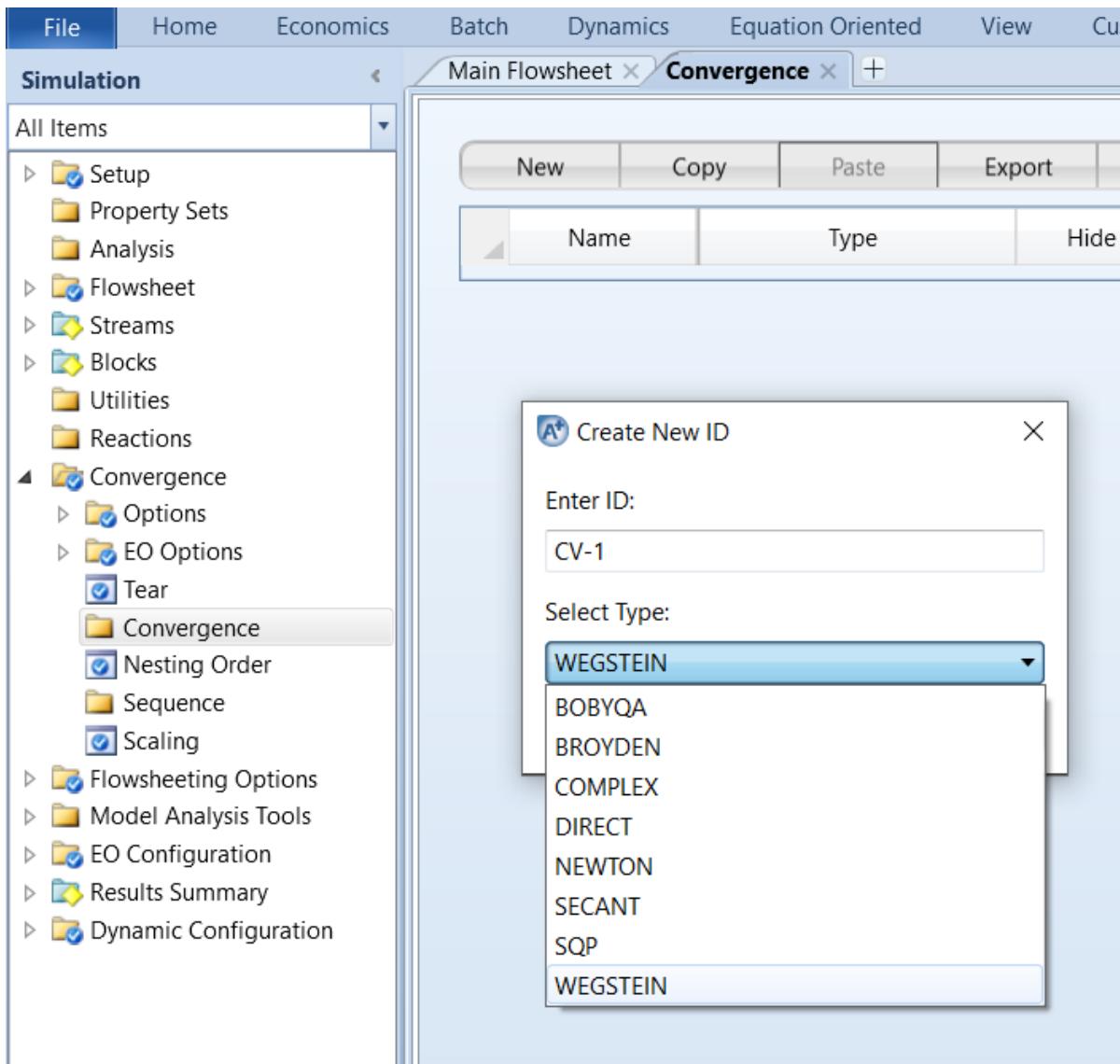
Επιλογή DUM-FEED και RECYC-FD, δεξί κλικ και Join Streams



Ροοδιάγραμμα



Ρυθμίσεις σύγκλισης



Ρυθμίσεις σύγκλισης

The screenshot shows the Aspen Plus software interface. On the left, the 'Simulation' tree view is open, showing various categories like Setup, Flowsheet, Streams, and Convergence. Under Convergence, there are sub-folders for Options, EO Options, and Tear, with 'Tear' currently selected. In the center, a window titled 'CV-1 (WEGSTEIN) - Input' is displayed. It has tabs for 'Tear Streams', 'Calculator Tears', 'Parameters', and 'Comments'. The 'Tear Streams' tab is active, showing a table with one row for 'REC-FEED'. The columns are Stream, Tolerance, Trace, and State variables. The Stream column contains 'REC-FEED', the Tolerance column contains '0.0001', and the State variables column contains 'Pressure & enthalpy'. There is also a checkbox labeled 'Tear Streams' at the top of the table.

Ρυθμίσεις σύγκλισης

The screenshot shows the Aspen Plus software interface with the following details:

- Simulation** tab is selected.
- Main Flowsheet** and **CV-1 (WEGSTEIN)** tabs are open.
- Convergence - Nesting Order** dialog is active.
- Specifications** tab is selected.
- All Items** tree view on the left includes:
 - Setup
 - Property Sets
 - Analysis
 - Flowsheet
 - Streams
 - Blocks
 - Utilities
 - Reactions
 - Convergence
 - Options
 - EO Options
 - Tear
 - Convergence
 - CV-1
 - Input
 - Results
 - Nesting Order
 - Sequence
 - Scaling
 - Flowsheeting Options
 - Model Analysis Tools
- CV-1** is listed under the **CV-1** section.
- Buttons** on the right side of the dialog:
 - > (Move up)
 - >> (Move up)
 - < (Move down)
 - << (Move down)
 - New
- Legend** on the bottom right:
 - Most deeply nested** (Up arrow)
 - Least deeply nested** (Down arrow)

F4 - αποτελέσματα

```
) Messages
      Iter      Err/Tol
      1        0.31599E-04

  Block: DECANTER Model: DECANTER

  Block: COL-REC  Model: RADFRAC

    Convergence iterations:
      Iter      Err/Tol
      1        0.33820E-04

> Loop CV-1      Method: WEGSTEIN      Iteration  12
Converging tear streams: REC-FEED
  1 vars not converged, Max Err/Tol  0.12539E+01

  Block: COL-MAIN Model: RADFRAC

    Convergence iterations:
      Iter      Err/Tol
      1        0.71578E-04

  Block: DECANTER Model: DECANTER

  Block: COL-REC  Model: RADFRAC

    Convergence iterations:
      Iter      Err/Tol
      1        0.93564E-04

> Loop CV-1      Method: WEGSTEIN      Iteration  13
Converging tear streams: REC-FEED
# Converged          Max Err/Tol  0.48232E+00

->Simulation calculations completed ...

***  No Warnings were issued during Input Translation ***

***  No Errors or Warnings were issued during Simulation ***
```

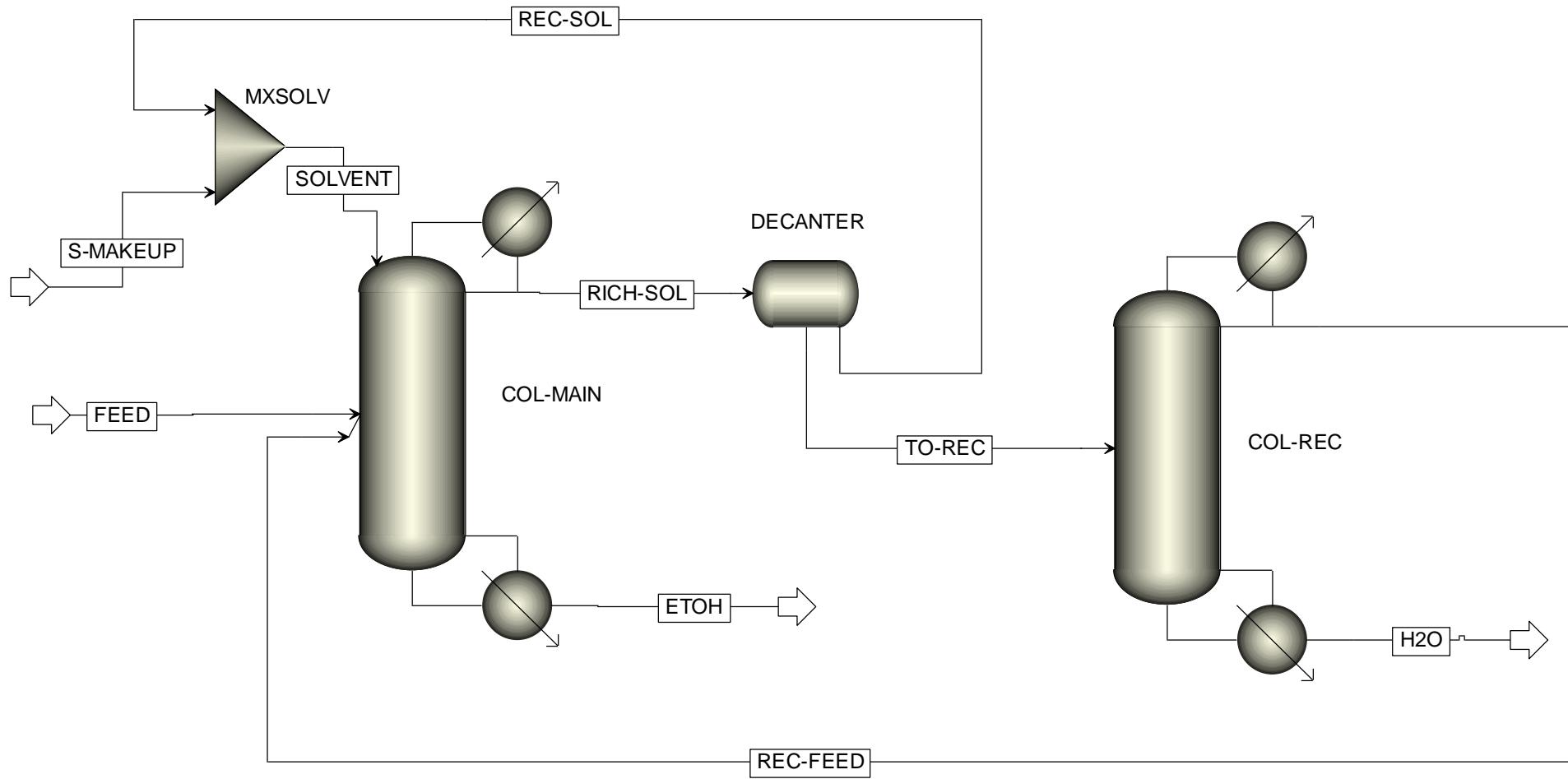
ΠΡΟΣΟΜΟΙΩΣΗ 10

ΑΡΧΕΙΟ: **SIM_10_NO_RECYCLES_20211207.BKP**

Απώλειες διαλύτη

	Units	ETOH	H2O
Temperature	C	77.9215	99.617
Pressure	bar	1	1
Molar Vapor Fraction		0	0
Molar Liquid Fraction		1	1
Molar Solid Fraction		0	0
Mass Vapor Fraction		0	0
Mass Liquid Fraction		1	1
Mass Solid Fraction		0	0
Molar Enthalpy	cal/mol	-64560.2	-66919.9
Mass Enthalpy	cal/gm	-1400.8	-3714.04
Molar Entropy	cal/mol-K	-77.6023	-34.9505
Mass Entropy	cal/gm-K	-1.68378	-1.93975
Molar Density	mol/cc	0.0159255	0.0509838
Mass Density	gm/cc	0.733976	0.918631
Enthalpy Flow	cal/sec	-1.54956e+06	-241775
Average MW		46.0881	18.0181
- Mole Flows	kmol/hr	86.4064	13.0065
ETHANOL	kmol/hr	86.3632	0.00130065
WATER	kmol/hr	7.05335e-17	13.0052
C6H12-1	kmol/hr	0.0432032	9.52075e-20

Προσθήκη αναπλήρωσης και σύνδεση ανακύκλωσης



Ρεύμα S-MAKEUP

Main Flowsheet × Control Panel × **S-MAKEUP (MATERIAL)** × +

Mixed CI Solid NC Solid Flash Options EO Options Costing Comments

Specifications

Flash Type: Temperature Pressure

State variables:

Temperature	25	C
Pressure	1	bar
Vapor fraction		
Total flow basis	Mole	
Total flow rate	1e-05	kmol/hr
Solvent		

Composition:

Component	Value
ETHANOL	
WATER	
C6H12-1	1

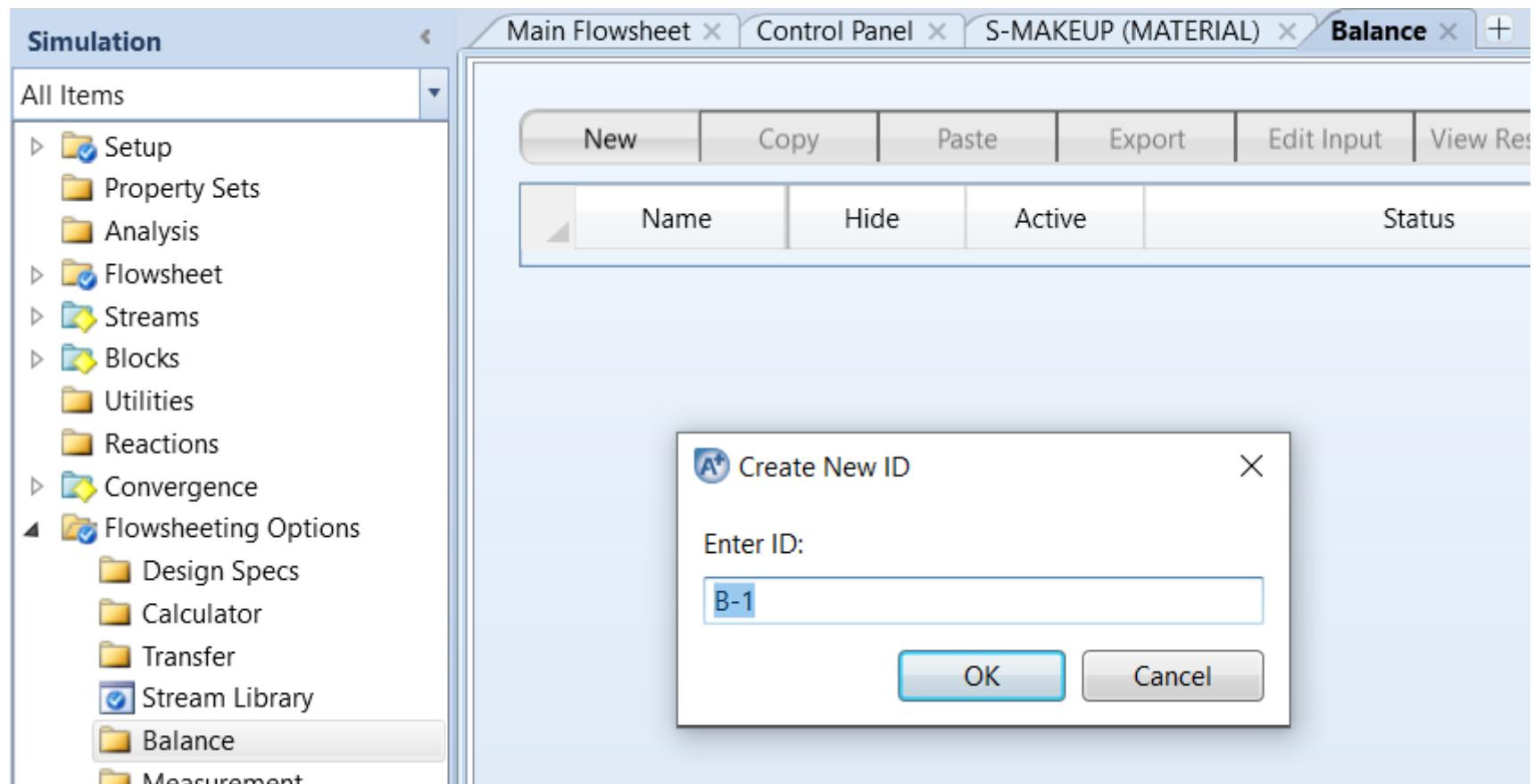
Reference Temperature:

Volume flow reference temperature: C

Component concentration reference temperature: C

Total: 1

Ορισμός Balance



Ορισμός Balance

Main Flowsheet × Control Panel × S-MAKEUP (MATERIAL) × B-1 × +

Mass Balance Energy Balance Equations Calculate Scale Com

Mass balance number 1

Enter blocks or streams to define mass balance envelope

Blocks Streams MXSOLV

Inlet stream name

Outlet stream name

Stream qualifiers

Component ID

Component group ID

Substream name

Main Flowsheet × Control Panel × S-MAKEUP (MATERIAL) × B-1 × +

Mass Balance Energy Balance Equations Calculate Scale Com

Stream name S-MAKEUP

Calculate enthalpy Update calculated variables

Flow variables to be calculated

Total flow
 Substream flows Substream name
 Component flows Component ID
Component group ID
Substream name
 None

Ορισμός Convergence

The screenshot shows a software interface for simulation setup. On the left, a sidebar titled "Simulation" lists various items under "All Items". The "Convergence" section is expanded, showing options like Options, EO Options, Tear, Convergence (which is selected), Nesting Order, Sequence, and Scaling. Below these are Flowsheeting Options and other collapsed sections. The main workspace has tabs at the top: Main Flowsheet, Control Panel, S-MAKEUP (MATERIAL), and Convergence. The Convergence tab is active, showing a table with columns for Name, Type, and Hide. A row for "CV-1" is selected, showing "WEGSTEIN" in the Type column. Below this, a modal dialog box titled "Create New ID" is open. It has fields for "Enter ID:" containing "CV-2" and "Select Type:" containing "WEGSTEIN". At the bottom are "OK" and "Cancel" buttons.

Name	Type	Hide
CV-1	WEGSTEIN	<input type="checkbox"/> Input Changed

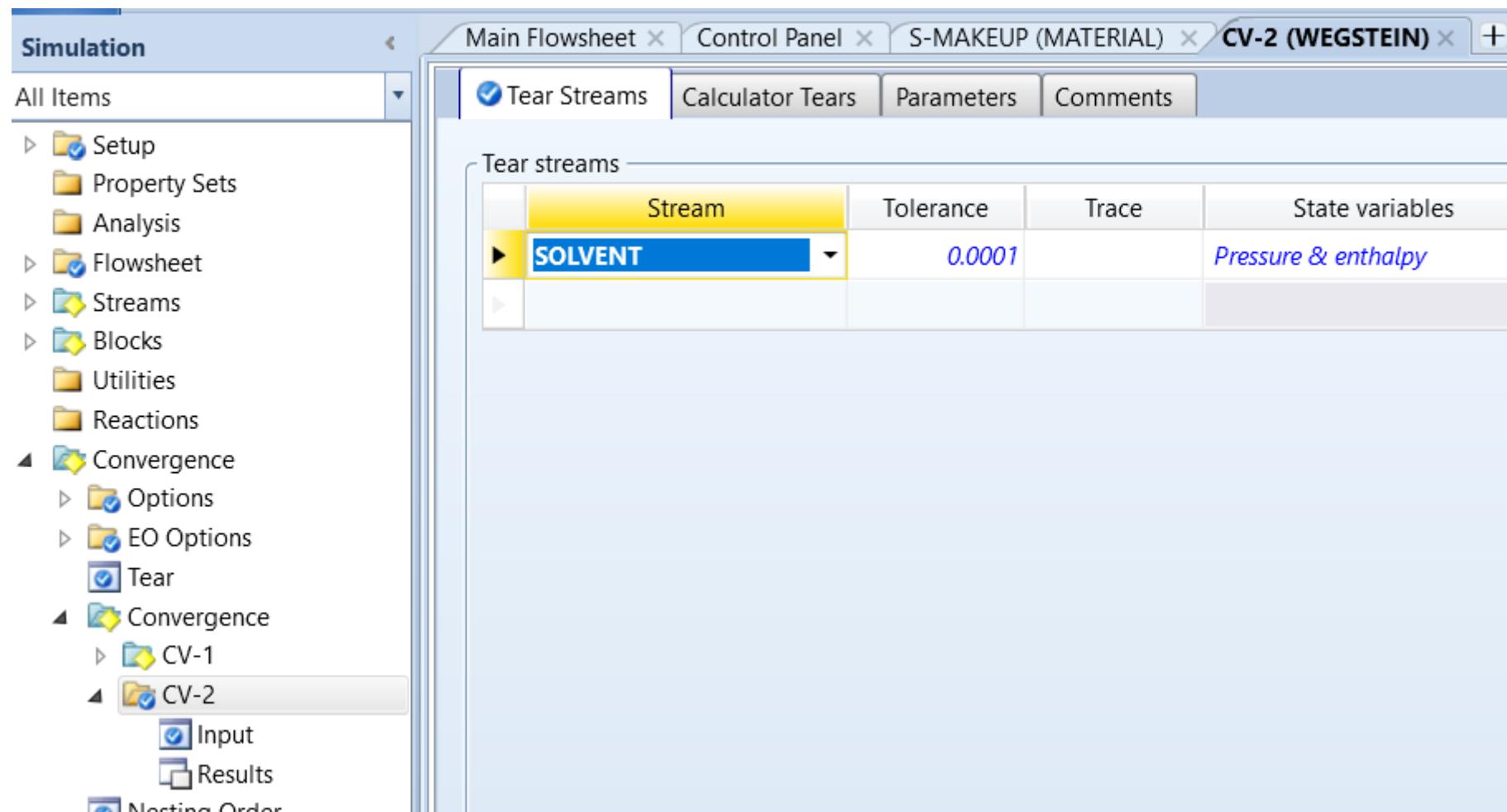
Create New ID

Enter ID:
CV-2

Select Type:
WEGSTEIN

OK Cancel

Ορισμός Convergence



The screenshot shows the Aspen Plus software interface with the following details:

- Simulation** tab is selected.
- Main Flowsheet**, **Control Panel**, **S-MAKEUP (MATERIAL)**, and **CV-2 (WEGSTEIN)** tabs are visible at the top.
- All Items** dropdown menu is open, showing categories like Setup, Property Sets, Analysis, Flowsheet, Streams, Blocks, Utilities, Reactions, and Convergence.
- Convergence** category under All Items is expanded, showing Options, EO Options, Tear, and two sub-folders: CV-1 and CV-2. CV-2 is currently selected.
- Tear Streams** tab is active in the central panel.
- Tear streams** table:
 - Stream: SOLVENT
 - Tolerance: 0.0001
 - Trace: (empty)
 - State variables: Pressure & enthalpy

Ορισμός Convergence

The screenshot shows the Aspen Plus software interface with the following details:

- Top Menu Bar:** File, Home, Economics, Batch, Dynamics, Equation Oriented, View, Customize, Resources.
- Simulation Tab:** Active tab.
- Toolbar:** Main Flowsheet, Control Panel, S-MAKEUP (MATERIAL).
- Convergence - Nesting Order Dialog:**
 - Specifications Tab:** Active tab.
 - Comments Tab:** Unselected tab.
 - Text:** List convergence blocks in order of convergence.
 - Blocks List:** CV-1, CV-2.
 - Buttons:** > button.
- Left Sidebar:** All Items tree view.
 - Setup
 - Property Sets
 - Analysis
 - Flowsheet (selected)
 - Streams
 - Blocks
 - Utilities
 - Reactions
 - Convergence
 - Options
 - EO Options
 - Tear
 - Convergence (selected)
 - Nesting Order (selected)
 - Sequence
 - Scaling

Reinitialize, F4 - αποτελέσματα

```
1      0.12390E-05

Block: DECANTER Model: DECANTER

Block: COL-REC Model: RADFRAC

Convergence iterations:
Iter      Err/Tol
1      0.12625E-05

>> Loop CV-1      Method: WEGSTEIN      Iteration      1
    Converging tear streams: REC-FEED
# Converged          Max Err/Tol  0.54931E+00

Balance B-1

Block: MXSOLV  Model: MIXER

> Loop CV-2      Method: WEGSTEIN      Iteration      3
    Converging tear streams: SOLVENT
# Converged          Max Err/Tol  0.65084E-01

->Simulation calculations completed ...

*** No Warnings were issued during Input Translation ***

*** Summary of Simulation Errors ***

      Physical
      Property      System      Simulation
Terminal Errors      0          0          0
  Severe Errors      0          0          0
    Errors          0          0          1
  Warnings          0          0          0
```

Solvent makeup

Simulation

Main Flowsheet | Control Panel | S-MAKEUP (MATERIAL)

All Items

- Setup
- Property Sets
- Analysis
- Flowsheet
- Streams
 - ETOH
 - FEED
 - H2O
 - REC-FEED
 - REC-SOL
 - RICH-SOL
 - S-MAKEUP
 - Input
 - Results
 - EO Variables
 - SOLVENT
 - TO-REC
- Blocks
- Utilities
- Reactions
- Convergence
 - Options
 - EO Options
 - Tear
 - Convergence
 - Nesting Order
 - Sequence

Properties

Simulation

Material Vol.% Curves Wt. % Curves Petroleum Po

	Units	S-MAKEUP
Phase		Liquid Phase
Temperature	C	25
Pressure	bar	1
Molar Vapor Fraction		0
Molar Liquid Fraction		1
Molar Solid Fraction		0
Mass Vapor Fraction		0
Mass Liquid Fraction		1
Mass Solid Fraction		0
Molar Enthalpy	cal/mol	-37337
Mass Enthalpy	cal/gm	-443.636
Molar Entropy	cal/mol-K	-146.717
Mass Entropy	cal/gm-K	-1.74328
Molar Density	mol/cc	0.00916377
Mass Density	gm/cc	0.771235
Enthalpy Flow	cal/sec	-476.178
Average MW		0.41612
+ Mole Flows	kmol/hr	0.0459126
+ Mole Fractions		
+ Mass Flows	kg/hr	3.86406
+ Mass Fractions		
Volume Flow	l/min	0.0835038

Έλεγχος διαχωρισμού

Main Flowsheet × Control Panel × FEED (MATERIAL) - Results (Default) × +					
Material	Vol.% Curves	Wt. % Curves	Petroleum	Polymers	Solids
		Units	FEED	ETOH	H2O
▶ Pressure	bar		1	1	1
▶ Molar Vapor Fraction			0.3	0	0
▶ Molar Liquid Fraction			0.7	1	1
▶ Molar Solid Fraction			0	0	0
▶ Mass Vapor Fraction			0.3005	0	0
▶ Mass Liquid Fraction			0.6995	1	1
▶ Mass Solid Fraction			0	0	0
▶ Molar Enthalpy	cal/mol		-62085.7	-64560.2	-66919.9
▶ Mass Enthalpy	cal/gm		-1463.52	-1400.8	-3714.04
▶ Molar Entropy	cal/mol-K		-63.5279	-77.6023	-34.9505
▶ Mass Entropy	cal/gm-K		-1.49752	-1.68378	-1.93975
▶ Molar Density	mol/cc		0.000115439	0.0159255	0.0509838
▶ Mass Density	gm/cc		0.00489718	0.733976	0.918631
▶ Enthalpy Flow	cal/sec		-1.7246e+06	-1.56095e+06	-241678
▶ Average MW			42.4221	46.0881	18.0181
+ Mole Flows	kmol/hr		100	87.0417	13.0012
- Mole Fractions					
▶ ETHANOL			0.87	0.9995	0.0001
▶ WATER			0.13	8.59253e-19	0.9999
▶ C6H12-1			0	0.0005	1.34124e-22
+ Mass Flows	kg/hr		4242.21	4011.58	234.257
+ Mass Fractions					
▶ Volume Flow	l/min		14437.6	91.0926	4.25011