



## Absorber Simulation





Example: In order to eliminate CO<sub>2</sub> from a gas stream with flowrate of 300 kmole/hr. and composition of 20 mole% CO<sub>2</sub> and 80% methane, a packing column functioning as absorber is used. In this regard, 2000 kmole/hr. pure propylene carbonate is used as solvent. The operating temperature and pressure are 60C and 6090 kPa respectively. Determine the mole fraction of CO<sub>2</sub> in outlet gas stream. Use Sour PR as the fluid package.

How to simulate:

## 1. Add the components to the component list

Source Databank: HYSYS

Select: **Pure Components** Filter: **All Families**

Search for: Search by: **Full Name/Synonym**

Component	Type	Group
CO2	Pure Component	
Methane	Pure Component	
C3=Carbonate	Pure Component	

< Add Replace Remove

Simulation Name	Full Name / Synonym	Formula
Ethane	C2	C2H6
Propane	C3	C3H8
i-Butane	i-C4	C4H10
n-Butane	n-C4	C4H10
i-Pentane	i-C5	C5H12
n-Pentane	n-C5	C5H12
n-Hexane	C6	C6H14
n-Heptane	C7	C7H16
n-Octane	C8	C8H18
n-Nonane	C9	C9H20
n-Decane	C10	C10H22
n-Undecane	C11	C11H24

Status: OK

## 2. Select Sour PR as the Fluid Package.

Set Up | Binary Coeffs | StabTest | Phase Order | Tabular | Notes

Package Type: HYSYS Component List Selection: **Component List - 1 [HYSYS Databanks]** View

Property Package Selection:

- Kabadi-Danner
- Lee-Kesler-Plöcker
- MBWR
- NBS Steam
- NRTL
- Peng-Robinson
- PR-Twu
- PRSV
- Sour PR**
- Sour SRK
- Sour Water
- SRK
- SRK-Twu
- Sulsim (Sulfur Recovery)
- Twu-Sim-Tassone
- UNIQUAC
- Wilson
- Zudkevitch-Joffe

Options:

Enthalpy	<b>Property Package EOS</b>
Density	Costald
Modify Tc, Pc for H2, He	<b>Modify Tc, Pc for H2, He</b>
Viscosity Method	<b>HYSYS Viscosity</b>
Peng-Robinson Options	<b>HYSYS</b>
EOS Solution Methods	<b>Cubic EOS Analytical Method</b>
Phase Identification	<b>Default</b>
Surface Tension Method	<b>HYSYS Method</b>
Thermal Conductivity	<b>API 12A3.2-1 Method</b>

Parameters:

Property Pkg: OK Edit Properties



3. Enter Simulation Environment and select an Absorber from Model Palette/Separator. Define streams Pure Solvent, Inlet Gas, Purified Gas, Impure Gas. Then click Next.

Absorber Column Input Expert

Column Name: T-100

Top Stage Inlet: Pure Solvent

Optional Inlet Streams

Stream	Inlet Stage
<< Stream >>	

Bottom Stage Inlet: Inlet Gas

Stage Numbering: ☒ Top Down ☐ Bottom Up

Ovhd Vapour Outlet: Purified Gas

Top Stg. Reflux: ☒ Liquid inlet ☐ Pump-around

Optional Side Draws

Stream	Type	Draw Stage
<< Stream >>		

Bottoms Liquid Outlet: Impure Gas

< Prev Next >

Connections (page 1 of 3) Cancel

4. Specify the top and bottom stage.

Absorber Column Input Expert

Top Stage Pressure: 6090 kPa

Bottom Stage Pressure: 6090 kPa

< Prev Next >

Pressure Profile (page 2 of 3) Cancel



5. Let Aspen decide for the page and click Done.

Absorber Column Input Expert

Optional Top Stage Temperature Estimate

Optional Bottom Stage Temperature Estimate

< Prev Done... Side Ops > Optional Estimates (page 3 of 3) Cancel

6. Now go to Worksheet and provide the operating condition and composition.

Column: T-100 / COL1 Fluid Pkg: Basis-1 / Sour PR

Design Parameters Side Ops Internals Rating Worksheet Performance Flowsheet Reactions Dynamics

Worksheet

Name	Pure Solvent @COL1	Inlet Gas @COL1	Purified Gas @COL1	Impure Gas @COL1
Vapour	<empty>	<empty>	<empty>	<empty>
Temperature [C]	60.00	60.00	<empty>	<empty>
Pressure [kPa]	6090	6090	6090	6090
Molar Flow [kgmole/h]	2000	304.5	<empty>	<empty>
Mass Flow [kg/h]	<empty>	<empty>	kg/h <empty>	<empty>
Std Ideal Liq Vol Flow [m3/h]	<empty>	<empty>	<empty>	<empty>
Molar Enthalpy [kJ/kgmole]	<empty>	<empty>	<empty>	<empty>
Molar Entropy [kJ/kgmole-C]	<empty>	<empty>	<empty>	<empty>
Heat Flow [kJ/h]	<empty>	<empty>	<empty>	<empty>

Delete Column Environment... Run Reset Unconverged [x] Update Outlets [ ] Ignored



Column: T-100 / COL1 Fluid Pkg: Basis-1 / Sour PR

Design	Parameters	Side Ops	Internals	Rating	Worksheet	Performance	Flowsheet	Reactions	Dynamics
<b>Worksheet</b>									
Conditions	CO2	Pure Solvent	0.0000	Inlet Gas	0.2000	Purified Gas	<empty>	Impure Gas	<empty>
Properties	Methane	0.0000	0.8000	<empty>	<empty>	<empty>	<empty>	<empty>	<empty>
Compositions	C3=Carbonate	1.0000	0.0000	<empty>	<empty>	<empty>	<empty>	<empty>	<empty>
PF Specs									

Delete Column Environment... Run Reset Unconverged ☒ Update Outlets ☐ Ignored

## 7. Results

Column: T-100 / COL1 Fluid Pkg: Basis-1 / Sour PR

Design	Parameters	Side Ops	Internals	Rating	Worksheet	Performance	Flowsheet	Reactions	Dynamics
<b>Worksheet</b>									
Conditions	CO2	Pure Solvent	0.0000	Inlet Gas	0.2000	Purified Gas	0.0000	Impure Gas	0.0275
Properties	Methane	0.0000	0.8000	0.9999	0.0684				
Compositions	C3=Carbonate	1.0000	0.0000	0.0001	0.9041				
PF Specs									

Delete Column Environment... Run Reset Converged ☒ Update Outlets ☐ Ignored

Based on the results, 99% of purified gas is methane which is our desired objective in the example.

