RO Membrane System Design Software

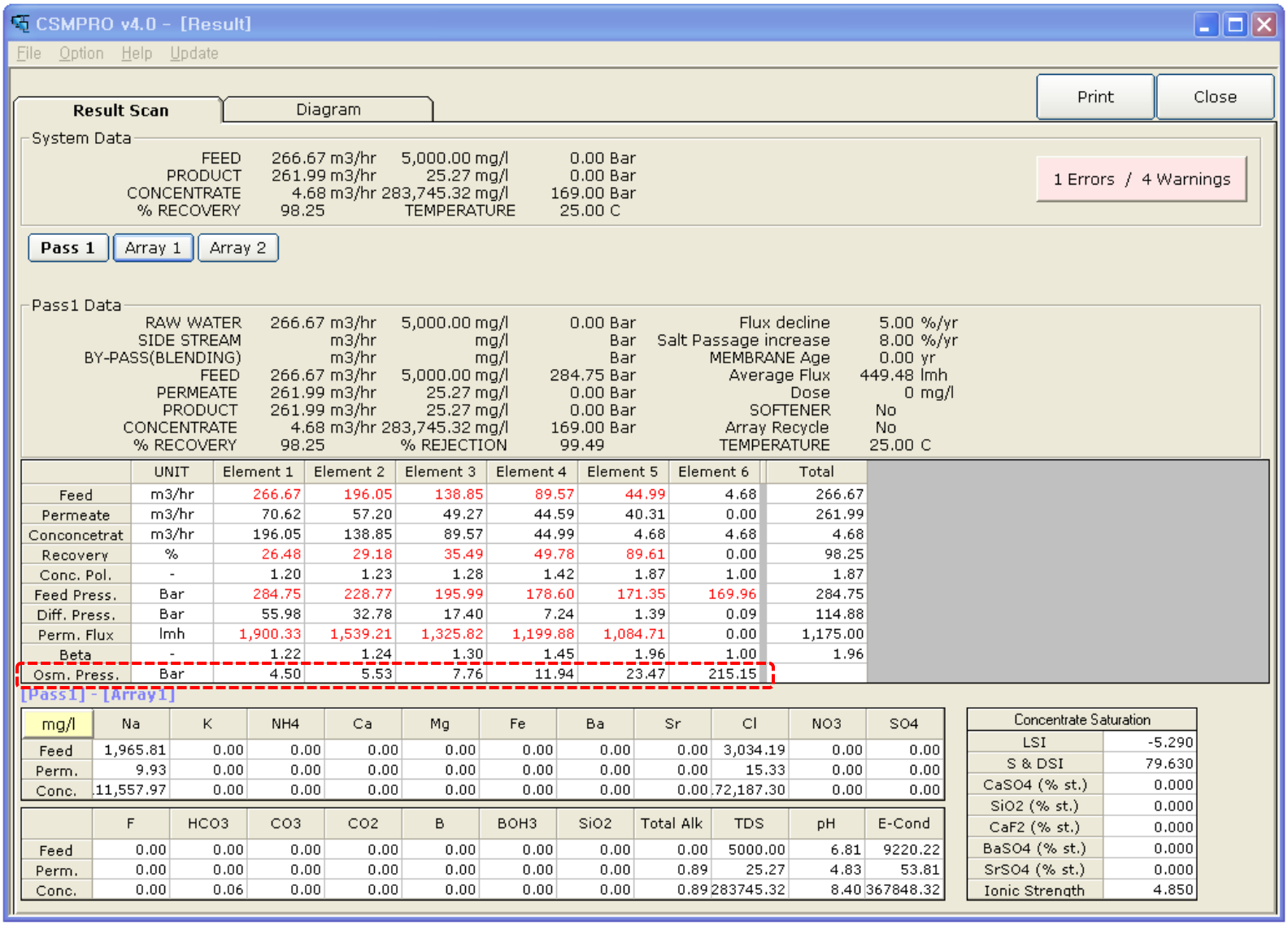
CSMPRO v4.0

A Guide to New Features

This guide outlines the new features of CSMPro v4.0

woongjin chemical

Element Osmotic Pressure



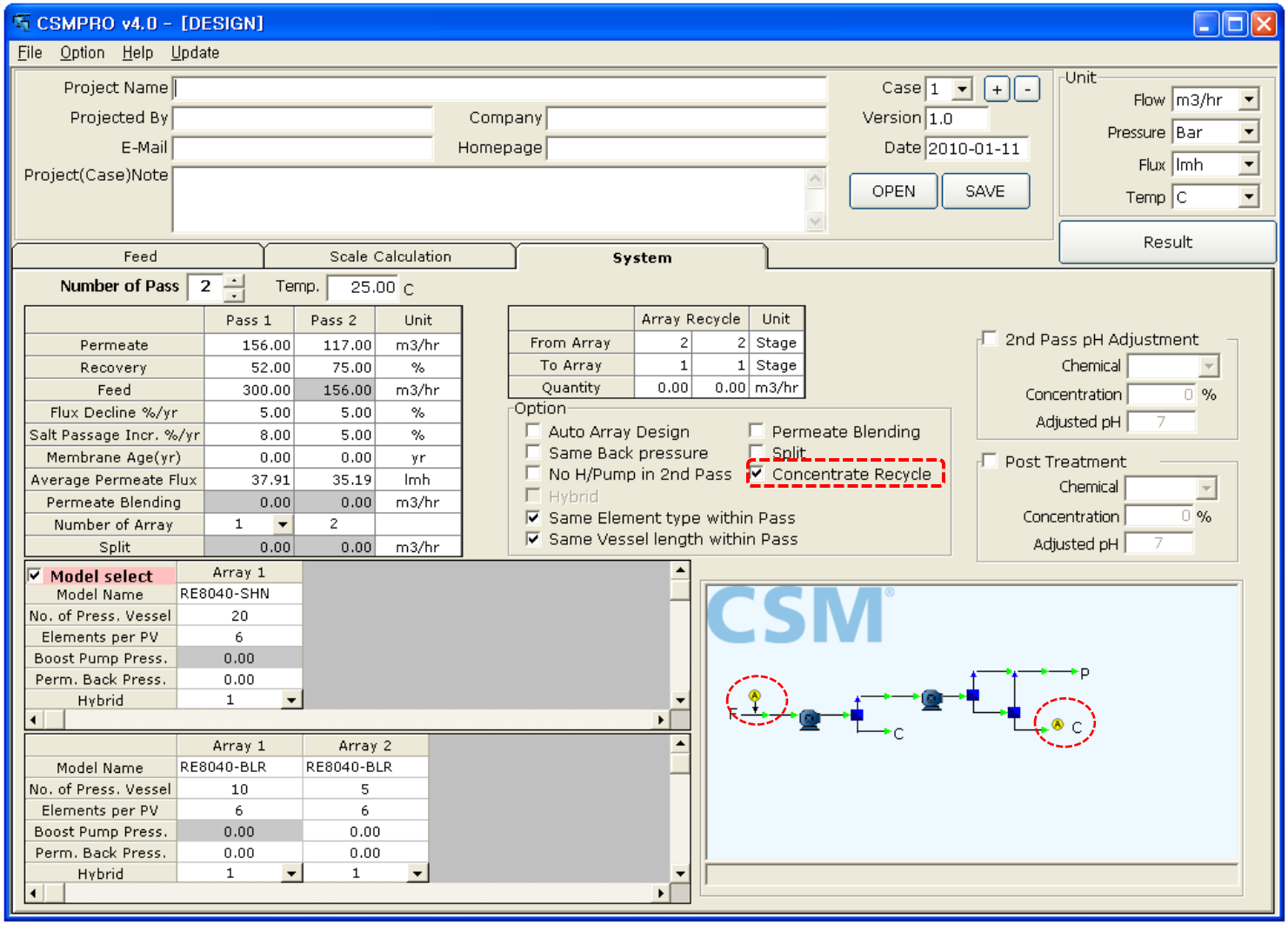
Element osmotic pressure is now included in the result scan tab.

Changes in Values According Feed Water Source

Feed Water Source	Flux decline (%/yr)	SP increase (%/yr)	Membrane Type
Well water SDI<3	7	10	RE8040-BE
Surface water SDI <3	7	10	RE8040-BE
Surface water SDI <5	12	10	RE8040-BE
Tertiary Effluent SDI <3	12	10	RE8040-FEn
Tertiary Effluent SDI <5	15	10	RE8040-FEn
Sea water SDI <3	7	10	RE8040-SHN
Sea water SDI <5	7	10	RE8040-SHN
RO/UF permeate SDI <1	5	5	RE8040-HUE

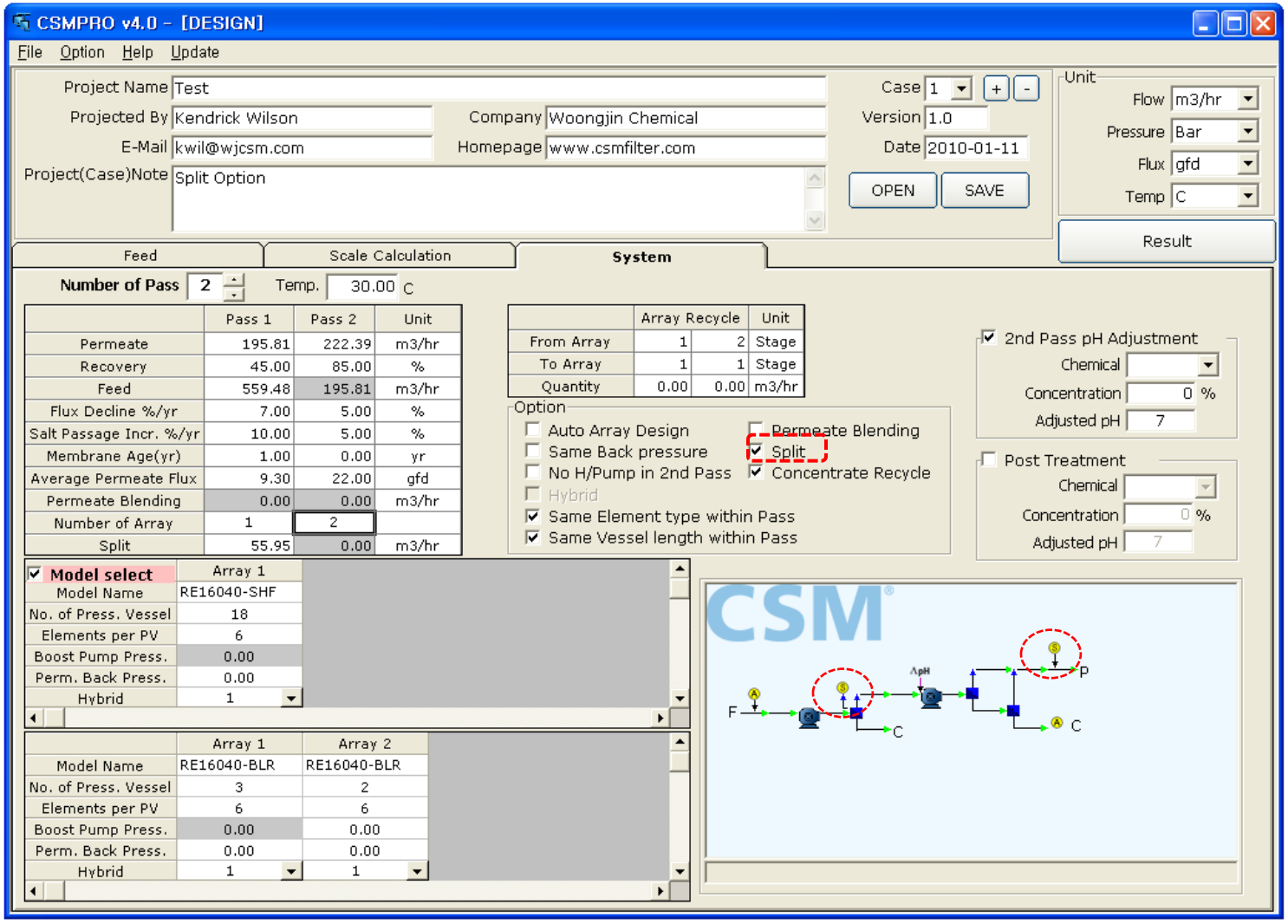
CSMPro v4.0 calculates various flux decline and salt passage increase values for each membrane model and feed water source.

Concentrate Recycle from 2nd Pass



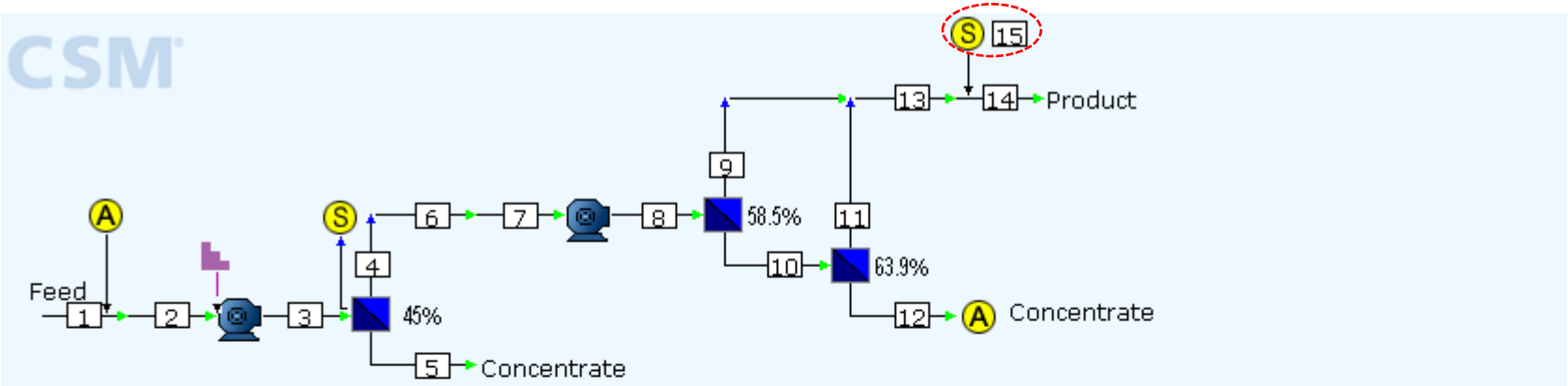
CSMPro v4.0 can control the concentrate recycle from the 2nd pass.

Split Option



A Split option is available in CSMPro v4.0 where a portion of the lead-end permeate of the 1st pass can be blended with the permeate from the 2nd pass.

Split Option



		1	2	3	4	5	6	7	8	9	10
Flow	m3/hr	510.42	538.37	538.37	186.32	296.10	186.32	186.32	186.32	108.92	77.40
TDS	mg/l	33,060.53	31,403.92	31,467.78	433.98	56,804.73	446.50	446.50	446.50	4.22	1,032.30
Press	Bar	0.00	0.00	45.91	0.00	45.13	0.00	0.00	9.29	0.00	7.41

		11	12	13	14	15
Flow	m3/hr	49.45	27.95	158.37	214.32	55.95
TDS	mg/l	14.09	2,833.90	16.60	57.55	168.04
Press	Bar	0.00	6.25	0.00	0.00	0.00

The above diagram indicates how split information about flow-rate and concentrate are displayed.

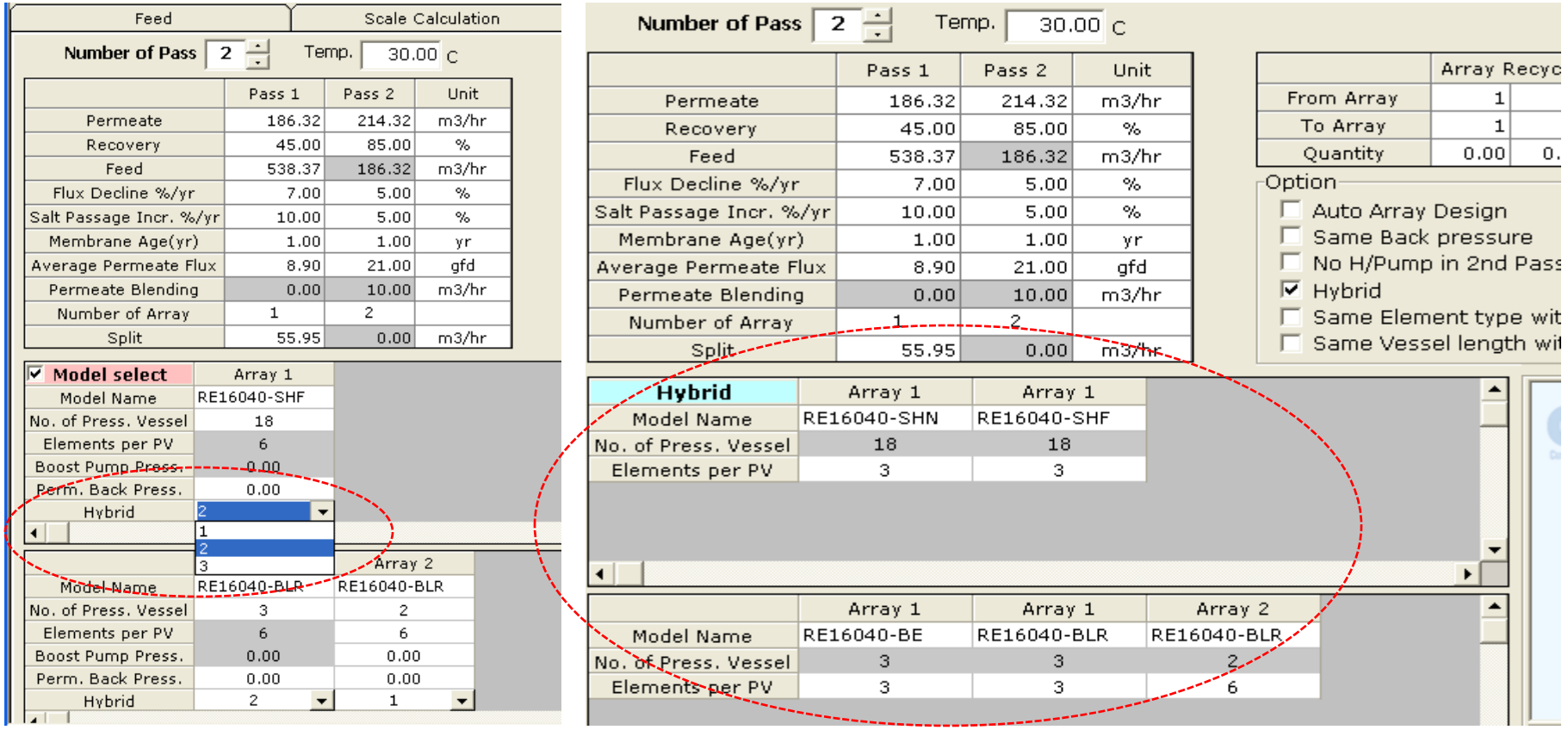
Designing a Hybrid System

1. Go to the system tab
2. Input system information (e.g. permeate flow rate, recovery)
3. Input the number of array and pressure vessels
4. Input the number of membrane type in each stage

   (2 or 3 types of membranes can be selected in each stage)
5. Choose the “Hybrid” in option
6. Choose the membrane type and number of membranes

   (“Same Element type within Pass” should be unchecked)

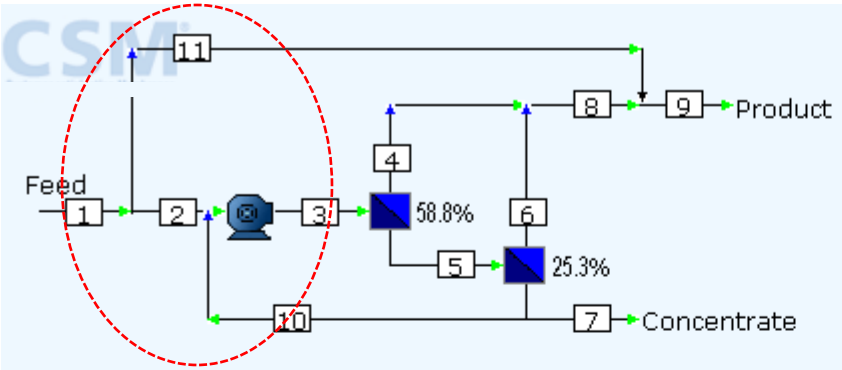
How to Use the Hybrid Function



System information

- 2nd pass (1st pass / 1 array, 2nd pass / 3-2 array, 6 elements per pressure vessel)
- 1st pass has 3 number of 16040-SHN & 3 number of 16040-SHF in each vessel
- 1st array of 2nd pass has 3 number of 16040-BE & 3 number of 16040-BLR in each vessel

Permeate Blending Before the Array Recycle



		1	2	3	4	5	6	7	8	9	10
Flow	m3/hr	130.00	120.00	130.00	76.47	53.53	13.53	30.00	90.00	100.00	10.00
TDS	mg/l	2,000.00	2,000.00	2,456.02	29.41	5,922.81	137.71	7,879.38	45.69	241.12	7,879.38
Press	Bar	0.00	0.00	9.01	0.00	8.42	0.00	7.48	0.00	0.00	7.48

		11
Flow	m3/hr	10.00
TDS	mg/l	2,000.00
Press	Bar	0.00

In CSMPro v4.0, the feed water is blended with the permeate water before the concentrate is recycled with the feed water.

Permeate TDS Bug

Pass 1 | Array 1

Pass 2 | Array 1 | Array 2

Pass1 Data

RAW WATER	538.37 m3/hr	33,060.53 mg/l	0.00 Bar	Flux decline	7.00 %/yr	
SIDE STREAM	41.34 m3/hr	2,372.35 mg/l	7.36 Bar	Salt Passage increase	10.00 %/yr	
BY-PASS(BLENDING)	m3/hr	mg/l	Bar	MEMBRANE Age	1.00 yr	
FEED	579.71 m3/hr	31,398.94 mg/l	45.29 Bar	Average Flux	8.90 gfd	
PERMEATE	242.27 m3/hr	366.76 mg/l	0.00 Bar	NaOH(100) Dose	31.93 mg/l	
PRODUCT	242.27 m3/hr	366.76 mg/l	0.00 Bar	SOFTENER	No	
CONCENTRATE	337.44 m3/hr	53,678.62 mg/l	44.36 Bar	Array Recycle	1 >> 1,	5.00 m3/hr
% RECOVERY	45.00	% REJECTION	98.89	TEMPERATURE	30.00 C	

	Element/Vessel Data			Flow Rate (m3/hr)				Last Beta	Press. (Bar)			Avg Flux	TDS			
	Vessel#	Element#	Element Type	Feed	Concentrat	Permeate	% Rec.		Feed	Conc.	DP	(gfd)	Feed	Perm.	Conc.	% Rej.
1	18	108/6	RE16040-SHF	579.71	337.44	242.27	41.79	1.040	45.29	44.36	0.93	8.89	31,376.94	353.78	53,641.86	98.87
Tot	18	108/6	RE16040-SHF	579.71	337.44	242.27	41.79	1.040	45.29	44.36	0.93	8.90	31,376.94	366.76	53,641.86	98.83

[Pass1]

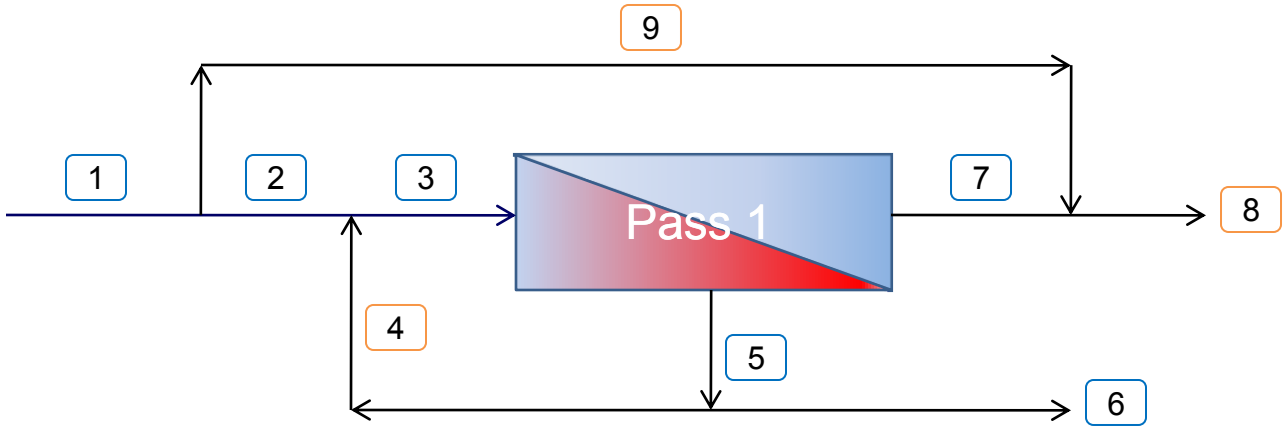
mg/l	Na	K	NH4	Ca	Mg	Fe	Ba	Sr	Cl	NO3	SO4
Feed	9,231.46	401.46	0.10	421.27	1,329.44	0.00	0.02	8.41	17,089.84	0.76	2,702.08
Perm.	130.18	6.13	0.00	3.97	4.70	0.00	0.00	0.05	190.98	0.02	11.15
Conc.	15,765.77	685.30	0.16	720.88	2,280.54	0.00	0.03	14.42	29,222.44	1.30	4,634.04

	F	HCO3	CO3	CO2	B	BOH3	SiO2	Total Alk	TDS	pH	E-Cond
Feed	0.60	178.88	1.00	9.21	4.89	4.83	1.90	164.31	31398.94	7.28	50695.61
Perm.	0.09	4.19	0.00	9.21	2.28	2.28	0.03	3.71	366.76	5.80	752.48
Conc.	0.97	304.30	1.71	9.21	6.77	6.66	3.24	353.98	53678.62	7.49	82636.88

Concentrate Saturation	
LSI	1.040
S & DSI	0.288
CaSO4 (% st.)	46.898
SiO2 (% st.)	2.400
CaF2 (% st.)	0.388
BaSO4 (% st.)	136.621
SrSO4 (% st.)	34.805
Ionic Strength	1.087

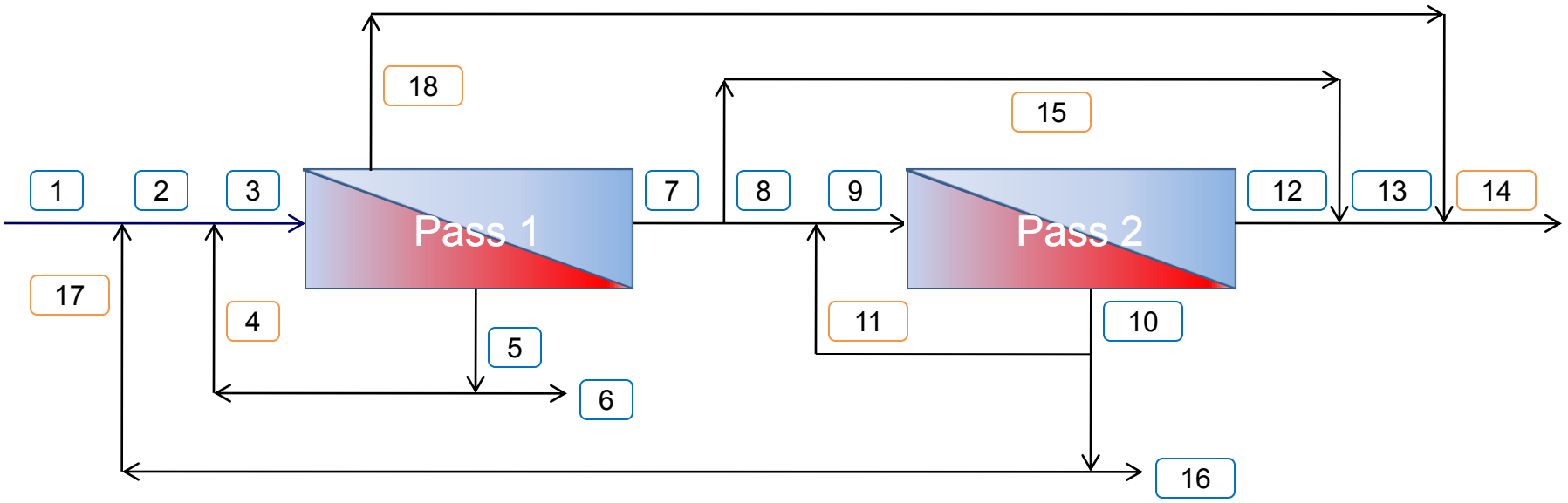
CSMPro v3.15 had a bug where the RO permeate yielded different TDS values, and this has been fixed in CSMPro v4.0

Definition of Recovery in a Single Pass System



Case		Pass Recovery	System Recovery
case 1	No blending, No array recycle (no 4, no 9)	=7/2=8/1	=8/1
case 2	Blending (9, no 4)	=7/2=(8-9)/(1-9)	=8/1
case 3	Array recycle (4, no 9)	=7/2=8/1	=8/1
case 4	Blending, array recycle (4, 9)	=7/2=(8-9)/(1-9)	=8/1

Definition of Recovery in a Double Pass System



Case		1st Pass Recovery	2nd Pass Recovery	System Recovery
case 5	No recycle, No blending, No split (No 4, 11, 15, 17, 18)	=7/2 =7/1	=12/8 =14/8	=14/1
case 6	blending (15, no 4, 11, 17, 18)	=7/2 =7/1	=12/8=(14-15)/(7-15)	=14/1
case 7	concentrate recycle (17, no 4, 11, 15, 18)	=7/2=7/(1+17)	=12/8	=14/1
case 8	blending, concentrate recycle (15, 17, no 4, 11, 18)	=7/2=7/(1+17)	=12/8=(14-15)/(7-15)	=14/1
case 9	blending, concentrate & array recycle (4, 11, 15, 17, 18)	=7/2=7/(1+17)	=12/8=(14-15)/(7-15)	=14/1
case 10	Blending, concentrate & array recycle, Split (4, 11, 15, 17, 18)	=(7+18)/2=(7+18)/(1+17)	=12/8=(14-15-18)/(7-15)	=14/1

Thank you!

For further assistance or inquiries, please contact us at csm@wjchemical.co.kr or visit our website at www.csmfilter.com