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General specification**Project description**

Project No.: 6-4-2

Date:

Project title: 6-4-2

Project subtitle:

Remarks:

Customer

Name: NICOL-N

Phone:

Location: BG

Fax:

Contact:

Mail:

Designer

Name:

Phone:

Location:

Fax:

Contact: Pavel Nikolov

Mail:

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Water analysis of feed

Date of sampling: 2020-03-30

Water source:

Water type: Municipal potable supply (SDI less than 5)

Country: Bulgaria

Source flow rate: 8.00 [m³/h]

Cations	Original Unit	[mg/l]	[meq/l]	Anions	Original Unit	[mg/l]	[meq/l]
Na	22.00000 [mg/l]	22.00000	0.95694	Cl	12.00000 [mg/l]	12.00000	0.33850
Ca	90.00000 [mg/l]	90.00000	4.49102	SO ₄	22.00000 [mg/l]	22.00000	0.45805
Mg	15.00000 [mg/l]	15.00000	1.23355	CO ₃	0.78875 [mg/l]	0.78875	0.02629
K	5.00000 [mg/l]	5.00000	0.12788	HCO ₃	360.00000 [mg/l]	360.00000	5.89971
Sr	0.00000 [mg/l]	0.00000	0.00000	NO ₃	5.00000 [mg/l]	5.00000	0.08065
Ba	0.00000 [mg/l]	0.00000	0.00000	F	0.00000 [mg/l]	0.00000	0.00000
NH ₄	1.00000 [mg/l]	1.00000	0.05543	SiO ₂	24.00000 [mg/l]	24.00000	0.39947
Fe(II)	0.00000 [mg/l]	0.00000	0.00000	B	0.00000 [mg/l]	0.00000	0.00000
Mn	0.00000 [mg/l]	0.00000	0.00000	PO ₄	0.00000 [mg/l]	0.00000	0.00000
Al	0.00000 [mg/l]	0.00000	0.00000	Br	0.00000 [mg/l]	0.00000	0.00000
				As(III)	0.00000 [mg/l]	0.00000	0.00000
				As(V)	0.00000 [mg/l]	0.00000	0.00000
H+		0.00003	0.00003	OH-		0.00397	0.00023
Sum C			6.86482	Sum A			6.80319
+ Na		0.00000	0.00000	+ Cl		2.17719	0.06142

Others

Temperature	15.00 [°C]	Turbidity	0.00 [NTU]	Fe (total)	0.00 [ppm]
pH	7.60	SDI	0.00	Free chlorine	0.00 [ppm]
CO ₂	15.47 [mg/l]	TSS	0.00 [ppm]	H ₂ S	0.00 [ppm]
		TOC	0.00 [ppm]		

Summary

TDS	558.97 [ppm]
Conductivity	521.79 [µS/cm]
Osmotic pressure	26.35 [kPa]
Ionic strength	0.010

Comments

Notes and warning messages

- Design: Saturation values exceeded. Adjust feed water pH or use a scaling inhibitor.

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System parameters

Water type	Municipal potable supply (SDI less than 5)
Temperature	15.00 [°C]
Recovery	60.00 [%]
Hydraulic recovery	60.00 [%]
Pump discharge pressure	1050.89 [kPa]
Feed flow	10.00 [m³/h]
Feed flow to stage 1	10.00 [m³/h]
Permeate flow	6.00 [m³/h]
System permeate flow	4.00 [m³/h]

System configuration

Pass	1 / 1
Number of stages / elements	2 / 6
Permeate blending	No
Permeate recirculation	2.00 [m³/h]
Concentrate recirculation	No
Energy recovery device	No

pH adjustment

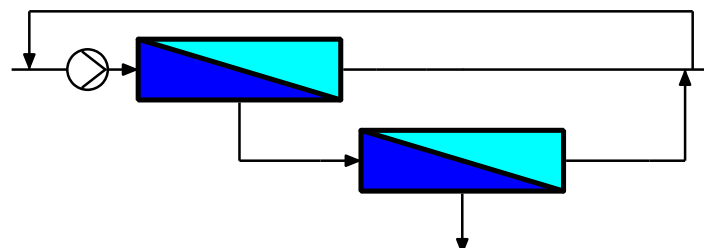
pH	7.60
Chemical	
Dosing (100%)	0.00 [mg/l]

Membrane parameters

Default membrane age	3.00 [a]
Average membrane age	3.00 [a]
Flux decline ratio	13.00 [%]
Salt passage increase	10.00 [%/a]
Average permeate flux	24.45 [l/m²/h]

Permeate salinity

Permeate conductivity	4.19 [µS/cm]
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Design of pass 1


Stage	
Element type	RO B440 LE
Vessels / Elements per vessel	1 / 3
Feed pressure	[kPa]
Concentrate pressure	[kPa]
Permeate pressure	[kPa]
Permeate flux	[l/m²/h]
Feed flow rate per vessel	[m³/h]
Concentrate flow rate per vessel	[m³/h]

1	2
RO B440 LE	RO B440 LE
1 / 3	1 / 3
1000.89	933.72
933.72	895.72
0.00	0.00
25.40	23.50
10.00	6.88
6.88	4.00

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Composition and scaling of pass 1

Composition	Feed Raw water	Feed Treated	Feed Blended	Concentrate	Permeate	Permeate Final	Scaling	Feed water
Ions	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	[mg/l]	CaSO ₄ [% Sat.]	0.98
Na	22.000	22.000	17.635	43.920	0.176	0.176	BaSO ₄ [% Sat.]	0.00
Ca	90.000	90.000	72.050	179.885	0.252	0.252	SrSO ₄ [% Sat.]	0.00
Mg	15.000	15.000	12.008	29.981	0.042	0.042	SiO ₂ [% Sat.]	25.26
K	5.000	5.000	4.012	9.973	0.060	0.060	CaF ₂ [% Sat.]	0.00
Sr	0.000	0.000	0.000	0.000	0.000	0.000	Ca ₃ (PO ₄) ₂	0.00
Ba	0.000	0.000	0.000	0.000	0.000	0.000	LSI	0.29
NH ₄	1.000	1.000	0.804	1.991	0.020	0.020	SDSI	0.52
Fe(II)	0.000	0.000	0.000	0.000	0.000	0.000	Scaling	Concentrate
Mn	0.000	0.000	0.000	0.000	0.000	0.000	CaSO ₄ [% Sat.]	2.32
Al	0.000	0.000	0.000	0.000	0.000	0.000	BaSO ₄ [% Sat.]	0.00
Cl	14.177	14.177	11.352	28.272	0.053	0.053	SrSO ₄ [% Sat.]	0.00
SO ₄	22.000	22.000	17.603	43.975	0.016	0.016	SiO ₂ [% Sat.]	50.39
CO ₃	0.789	0.789	0.492	3.475	0.000	0.000	CaF ₂ [% Sat.]	0.00
HCO ₃	360.000	360.000	288.410	716.726	1.347	1.347	Ca ₃ (PO ₄) ₂	0.00
NO ₃	5.000	5.000	4.030	9.770	0.149	0.149	LSI	1.16
F	0.000	0.000	0.000	0.000	0.000	0.000	SDSI	1.21
SiO ₂	24.000	24.000	19.226	47.872	0.128	0.128	Scaling	Permeate
B	0.000	0.000	0.000	0.000	0.000	0.000	LSI	-6.77
PO ₄	0.000	0.000	0.000	0.000	0.000	0.000	RI	18.75
Br	0.000	0.000	0.000	0.000	0.000	0.000	CCPP	-36.28
As(III)	0.000	0.000	0.000	0.000	0.000	0.000		
As(V)	0.000	0.000	0.000	0.000	0.000	0.000		
CO ₂	15.470	15.470	15.470	15.470	15.470	15.470		
TDS [mg/l]	558.966	558.966	447.624	1115.835	2.244	2.244		
pH	7.600	7.600	7.508	7.884	5.214	5.214		
Conductivity [µS/cm]	521.790	521.790	421.160	1017.036	4.186	4.186		
Osmotic pressure [kPa]	26.354	26.354	21.264	51.159	0.120	0.120		
LSI	0.288	0.288	0.008	1.157	-6.766	-6.766		

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Stage details for pass 1

Composition	Stage 1		Stage 2	
	Concentrate	Permeate	Concentrate	Permeate
Ions	[mg/l]	[mg/l]	[mg/l]	[mg/l]
Na	25.584	0.126	43.920	0.230
Ca	104.622	0.180	179.885	0.329
Mg	17.437	0.030	29.981	0.055
K	5.816	0.043	9.973	0.078
Sr	0.000	0.000	0.000	0.000
Ba	0.000	0.000	0.000	0.000
NH ₄	1.164	0.014	1.991	0.026
Fe(II)	0.000	0.000	0.000	0.000
Mn	0.000	0.000	0.000	0.000
Al	0.000	0.000	0.000	0.000
Cl	16.469	0.038	28.272	0.069
SO ₄	25.567	0.012	43.975	0.022
CO ₃	1.087	0.000	3.475	0.000
HCO ₃	418.186	0.964	716.726	1.762
NO ₃	5.788	0.107	9.770	0.194
F	0.000	0.000	0.000	0.000
SiO ₂	27.889	0.091	47.872	0.168
B	0.000	0.000	0.000	0.000
PO ₄	0.000	0.000	0.000	0.000
Br	0.000	0.000	0.000	0.000
As(III)	0.000	0.000	0.000	0.000
As(V)	0.000	0.000	0.000	0.000
CO ₂	15.470	15.470	15.470	15.470
TDS [mg/l]	649.610	1.607	1115.835	2.933
pH	7.662	5.069	7.884	5.330
Conductivity [µS/cm]	603.240	4.226	1017.036	4.481
Osmotic pressure [kPa]	30.458	0.086	51.159	0.157
LSI	0.477	-7.400	1.157	-6.352

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Element details for pass 1 (12)

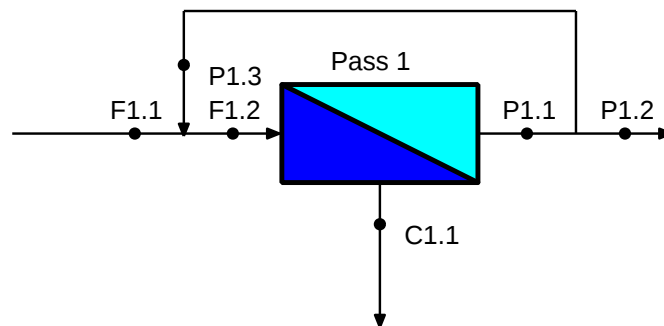
Stage 1		Age	Recovery	Beta	Permeate Flux	Permeate Flow	Permeate TDS	Concentrate Flow	Concentrate TDS	Feed Flow	Feed TDS
#	Element	[a]	[%]		[l/m ² /h]	[m ³ /h]	[mg/l]	[m ³ /h]	[mg/l]	[m ³ /h]	[mg/l]
1	RO B440 LE	3.0	10.68	1.09	26.12	1.07	1.36	8.93	501.01	10.00	447.62
2	RO B440 LE	3.0	11.62	1.10	25.38	1.04	1.59	7.89	566.69	8.93	501.01
3	RO B440 LE	3.0	12.80	1.11	24.70	1.01	1.89	6.88	649.61	7.89	566.69
Stage 2		Age	Recovery	Beta	Permeate Flux	Permeate Flow	Permeate TDS	Concentrate Flow	Concentrate TDS	Feed Flow	Feed TDS
#	Element	[a]	[%]		[l/m ² /h]	[m ³ /h]	[mg/l]	[m ³ /h]	[mg/l]	[m ³ /h]	[mg/l]
1	RO B440 LE	3.0	14.31	1.12	24.09	0.99	2.29	5.90	757.75	6.88	649.61
2	RO B440 LE	3.0	16.30	1.14	23.50	0.96	2.85	4.94	904.76	5.90	757.75
3	RO B440 LE	3.0	18.98	1.17	22.91	0.94	3.70	4.00	1115.83	4.94	904.76

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Overview of system design
Recovery rates [%]

Pass 1	Recovery	60.00
	Hydraulic recovery	60.00
System	Recovery	50.00


List of element types

Type	Count
RO B440 LE	6

Pass 1

Feed pressure	1000.89 [kPa]
Concentrate pressure	895.72 [kPa]

		Flow	TDS	Conductivity	pH
	Position	[m³/h]	[mg/l]	[µS/cm]	[-]
Feed	F1.1	8.00	558.97	521.79	7.60
	F1.2	10.00	447.62	421.16	7.51
Permeate	P1.1	4.00	2.24	4.19	5.21
	P1.2	4.00	2.24	4.19	5.21
	P1.3	2.00	2.24	4.19	5.21
Concentrate	C1.1	4.00	1115.83	1017.04	7.88

Scaling Pass 1 [% Sat.]

Concentrate		CaSO ₄	2.32
Ca ₃ (PO ₄) ₂	0.00	BaSO ₄	0.00
LSI	1.16	SrSO ₄	0.00
SDSI	1.21	SiO ₂	50.39
		CaF ₂	0.00

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