



Funded by the Horizon H2020  
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# ZERO BRINE

## Work Package 3

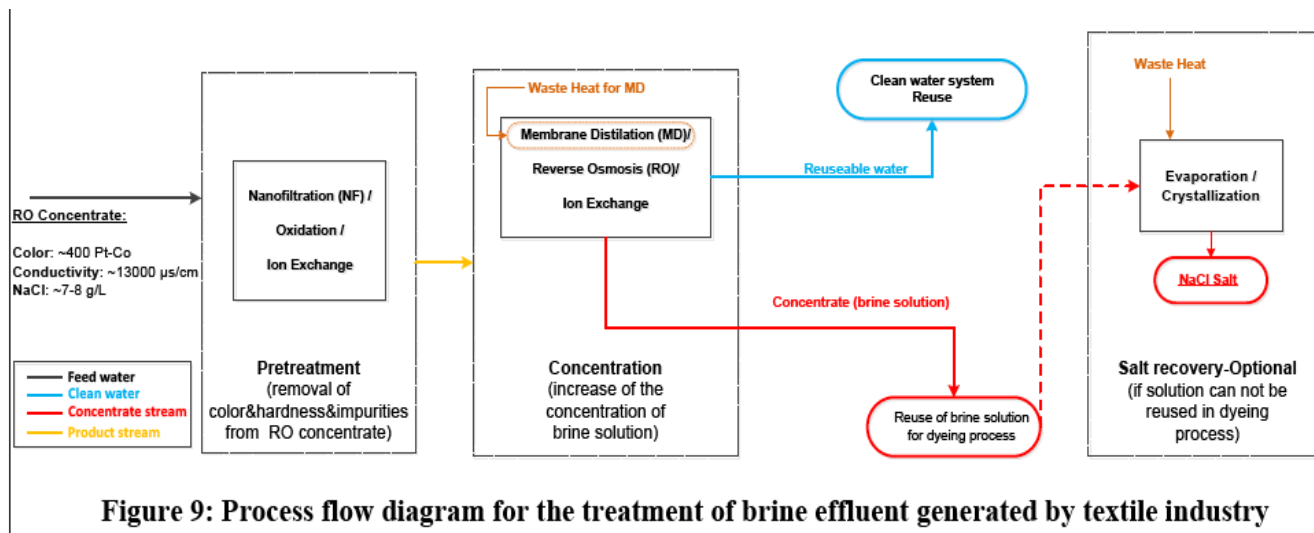
<**Task 3.2.** Demonstration in textile industry, ZORLU Textile>

H2020 project, June 20-21, 2018



# Objective

- a) Utilization of the recovered concentrated salt solution for the dyeing process baths, alternatively,
- (b) Application of evaporation/crystallization processes to obtain recoverable salt for other sectors such as leather salting etc.



# Tasks

- **Task 3.2.** Demonstration in textile industry, ZORLU Textile
- Utilization of the recovered concentrated salt solution for the dyeing process baths (M1-M36)
- **Subtask 3.2.1:** Development of the innovative brine treatment system for textile industry. Characterization and bench scale studies (M1-M30).
- **Subtask 3.2.2:** Construction, operation and optimization

# Tasks

- **Pre-treatment:** removal of impurities color and hardness from the salt stream (NF, oxidation, ion exchange)
- **Concentration:** MD membrane distillation (waste heat for MD), RO, ion exchange...
- Tests on the fabric to check suitability.
- Treated water for reuse...
- **Alternative** technology option for the valorization for leather or other sectors, processes evaporation and crystallization.
- Pilot scale system, with a capacity of 2-4 m<sup>3</sup>/day, will be designed in accordance with the results of the lab-scale experiments. Furthermore, procurement, installation and testing period will be commenced.
  
- **Subtask 3.2.2:** Construction, operation and optimization
- **This task involves detailed engineering design of the proposed system approach which is decided upon within the activities of Task 3.2.1. (M30-M42)**

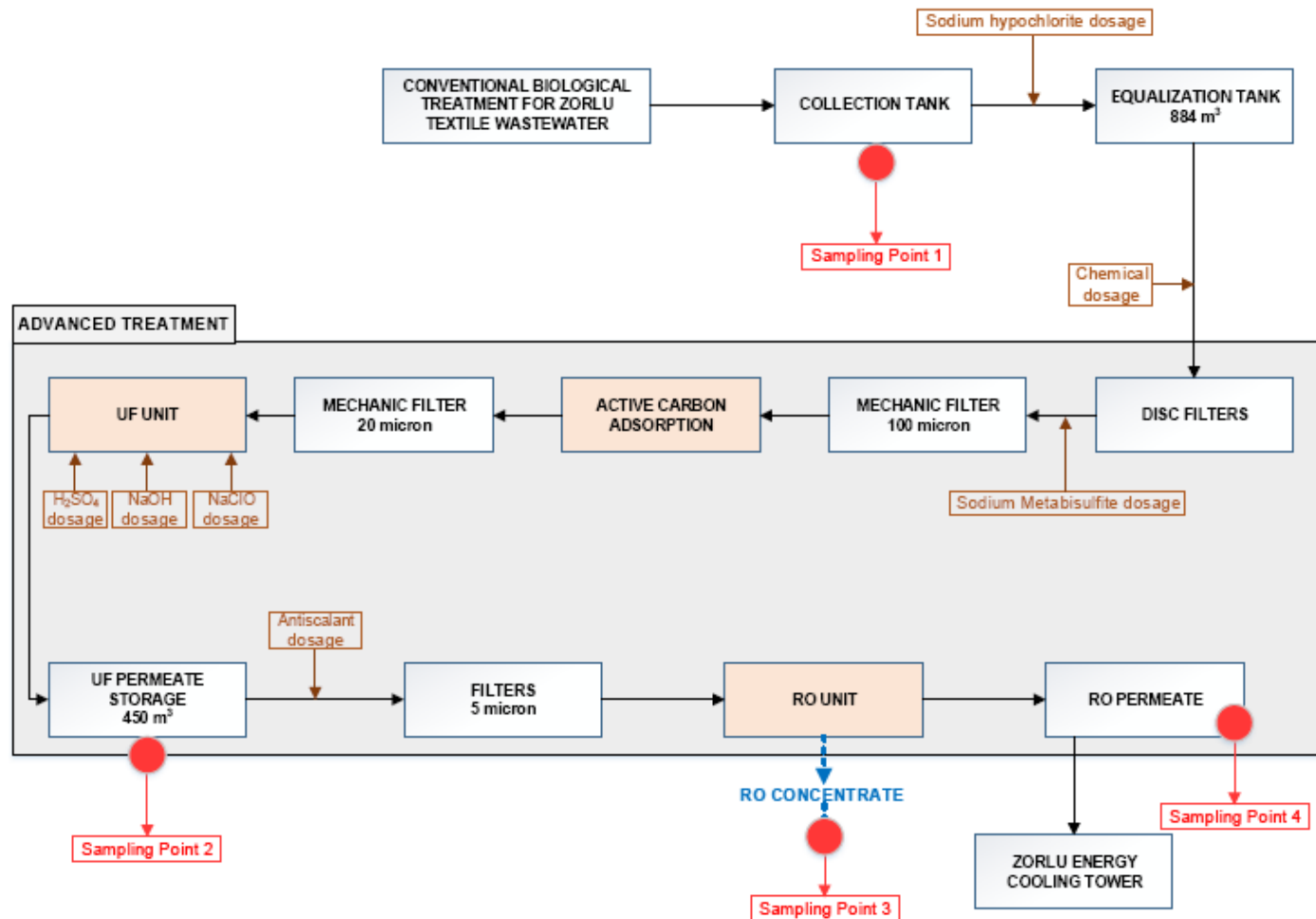
# Gantt Chart of WP 3.2

Work Package (WP) / Task (T) / Deliverable (D)	Year 1												Year 2												Year 3												
	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24	M25	M26	M27	M28	M29	M30	M31	M32	M33	M34	M35	M36	
WP1 - Project management																																					
T1.3 Data management																																					
WP3 - Minimizing energy consumption and increase resource recovery in coal mine and textile																																					
T3.2. Demonstration in textile industry,																																					
Subtask 3.2.1: Development of the innovative brine treatment																																					
Subtask 3.2.2: Construction, operation and optimization																																					
T3.3: Data collection from the demonstration activity																																					
D3.6 Best applicable process lay out for textile industry																																					
D3.7 Detailed design of brine recovery system for textile industry																																					
D3.8 Report on the operation& optimization of the pilot system for the treatment of textile effluents																																					

# Deliverables

D3.6	Best applicable process lay out for textile industry	17 - TUBITAK	Report	Confidential	30
D3.7	Detailed design of brine recovery system for textile industry	17 - TUBITAK	Demonstrator	Confidential	36
D3.8	Report on the operation & optimization of the pilot system for the treatment of textile effluents	17 - TUBITAK	Demonstrator	public	36

# Existing advanced treatment system – sampling points

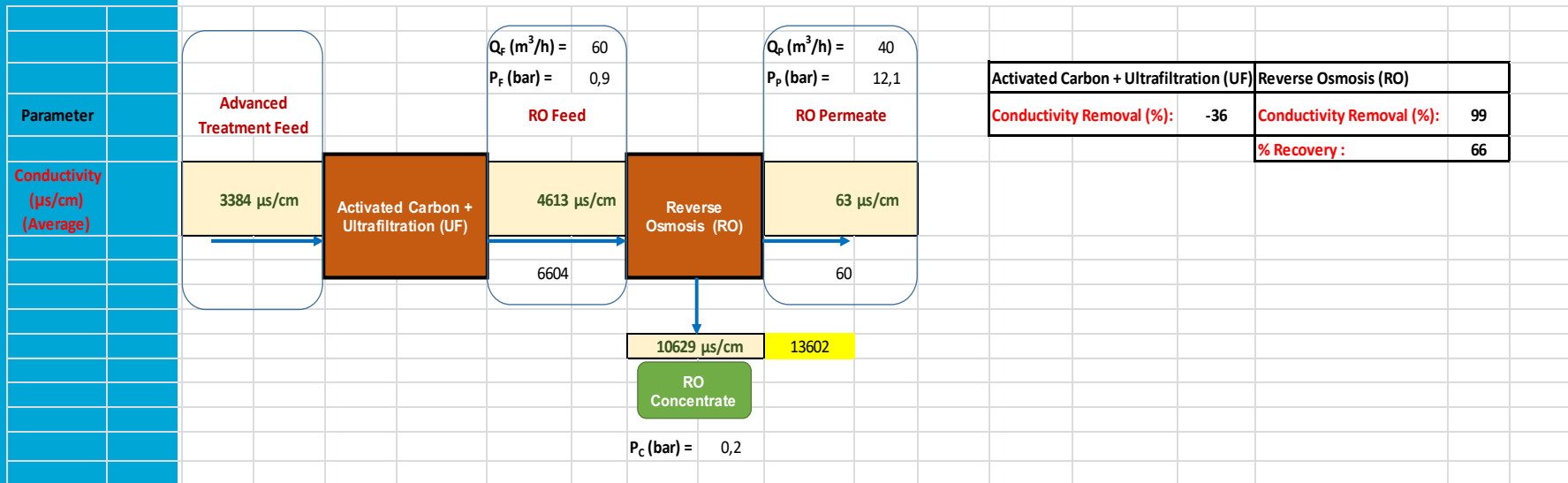


# Characteristics

Capacity= 110 m<sup>3</sup>/h

Q=300 m<sup>3</sup>/day actual → RO eff **Q=150 m<sup>3</sup>/d (cooling tower)**

All backwash → WWTP 200 m<sup>3</sup>/day





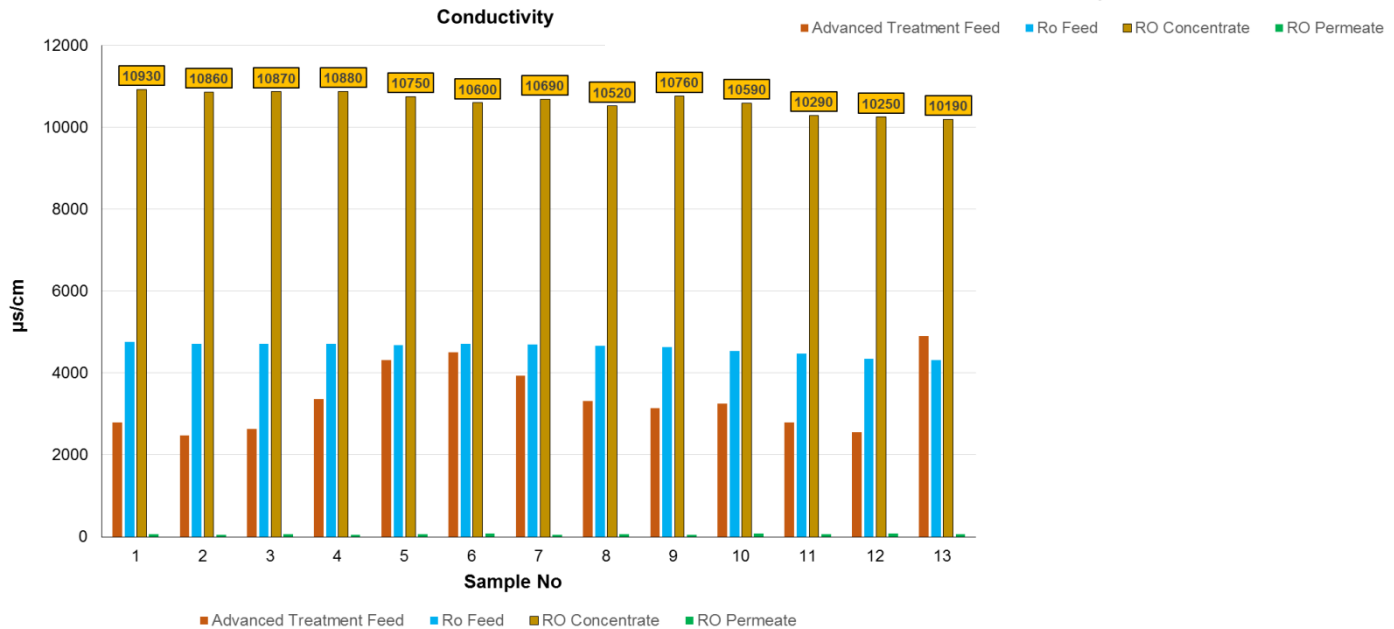
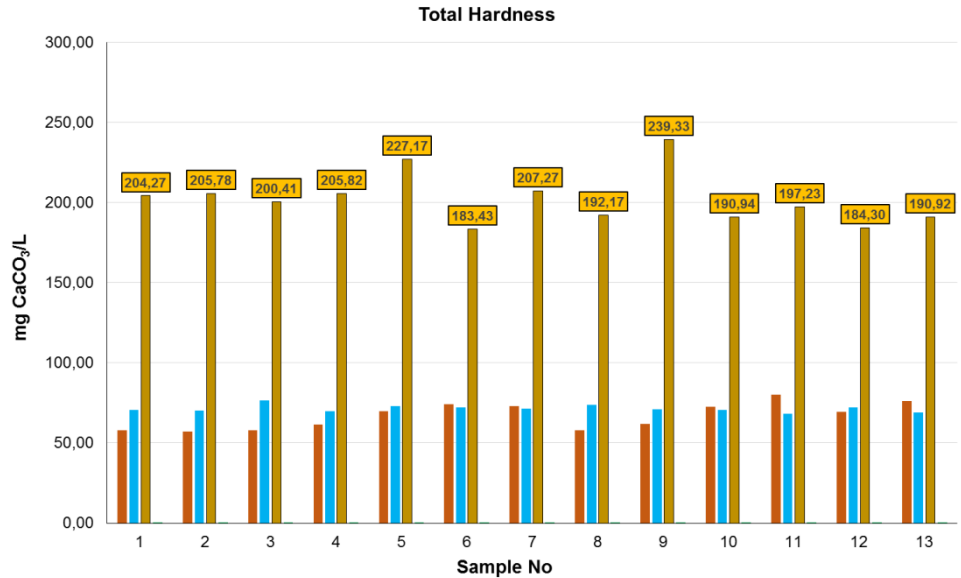
# Parameters monitored

13 samples  
from each of the 4 sample  
collection ports

Operational parameters  
RO Feeding rate  
RO Permeate rate  
First stage RO input pressure  
Second stage RO input pressure  
Permeate line pressure  
Reject line pressure

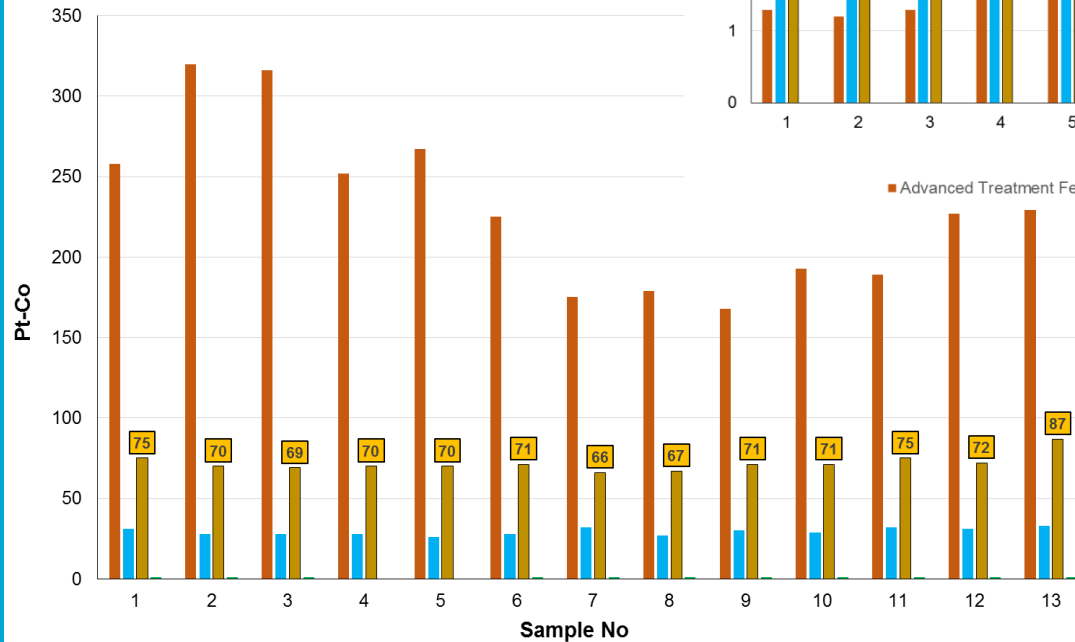
No	Parameter
1	COD
2	Color
3	Color SAC 436 nm
4	Color SAC 525 nm
5	Color SAC 620 nm
6	Conductivity
7	TDS
8	NaCl
9	Total Hardness
10	TOC
11	CO <sub>3</sub>
12	HCO <sub>3</sub>
13	Cl
14	SO <sub>4</sub>
15	SiO <sub>2</sub>
16	Al
17	B
18	Ca
19	Mg
20	Fe
21	K
22	Na
23	Zn
24	Turbidity
25	NH <sub>4</sub> -N
26	pH
27	T-P
28	T-N

# Conductivity / hardness



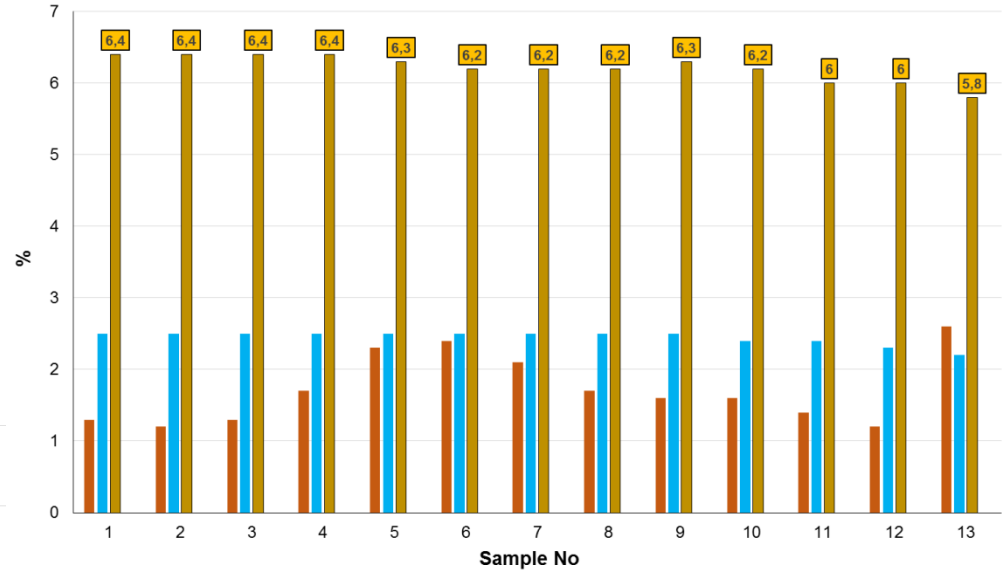
# Salinity and colour

Color - Pt-Co



Advanced Treatment Feed   Ro Feed   RO Concentrate   RO Permeate

% Salinity (NaCl)



Advanced Treatment Feed   Ro Feed   RO Concentrate   RO Permeate

# Dead end filtration

9 no WW							
PARAMETERS	Raw	NF90 perm	NF270 perm	Np030 perm	NFW perm	NDX perm	NFG perm
Colour Pt-Co	71	9	8,0	22,0	6	18	25
Colour RES 436 nm	2,5	0,3	0,2	0,8	0,3	0,9	1
Colour RES 525 nm	0,72	0,1	0,3	0,4	0,3	0,2	0,4
Colour RES 620 nm	0,30	0,1	0,2	0,3	0,2	0,1	0,2
COD(mg/L)	339	36	55	90	90	147	140
pH	8,2	8,07	8,95	8,68	8,67	8,57	8,81
Cond. (µs/cm)	10.760	387	5.280	5.860	6.620	7.870	9.000
NaCl, Salinity	6,30	0,0	2,9	3,2	3,6	4,4	5,1
T hardness (mgCaCO3/L)	239	4	9	27	25	55	72
Ca (µg/L)	60.869	136,6	1.755	6.256	6.636	14.480	22.810
Mg(µg/L)	21.211	15,13	291	1.531	1.215	2.829	5.059

	MWCO (Da)	TMP	Jwo (LMH)	Jww (LMH)	Jww/Jwo	Conductivity Rem %	COD Rem %	Colour Rem %				Salinity Rem %	Hardness Rem %
								Pt-Co	436	525	620		
NF90	~200-400	20	80	12	15	96	89	87	88	86	67	100	98
NF270	~200-400	15	189	33	17	51	84	89	92	58	33	54	96
NP030	~500	30	23	13	57	46	73	69	67	45	0	49	89
NFW	~300-500	20	44	20	45	38	73	92	88	58	33	43	90
NDX	~800-1,000	25	29	18	62	27	57	75	63	72	67	30	77
NFG	~600-800	15-25	108	45	42	16	59	65	59	45	33	19	70

# Resin – softening studies

T, min.	Colour Pt-Co	Cond, $\mu\text{s}/\text{cm}$	NaCl, %	T. hardness, mg $\text{CaCO}_3/\text{L}$	Ca, ppb	Mg, ppb	Na, ppb	pH	%rem color	%rem hardness	g hardness rem, $\text{CaCO}_3$ -g cumulative	cumulative mg $\text{CaCO}_3$ hardness rem/g resin
0	71	10760	6,3	239,33	60869	21211	2338000	8,16				
90	115	10600	6	4,76	794	674	1075000	8,27	-61,971831	98,011887	0,0106	0,4569581
180	61	10950	6,3	4,01	473	687	1136000	8,38	14,084507	98,324428	0,0212	0,9168306
270	61	10990	6,3	4,36	519	745	1108000	8,37	14,084507	98,176638	0,0317	1,3731788
360	61	11000	6,3	4,34	522	738	1092000	8,36	14,084507	98,185552	0,0423	1,8310713

seplite SC130  
cationic resin

## Next steps

- Ozone oxidation for colour removal,
- Test amberlite anionic resin for chloride removal,
- Electro-coagulation

## Concentration step

- MD
- RO
- ion exchange