



ENERGY EFFICIENT DESALINATION TECHNOLOGY

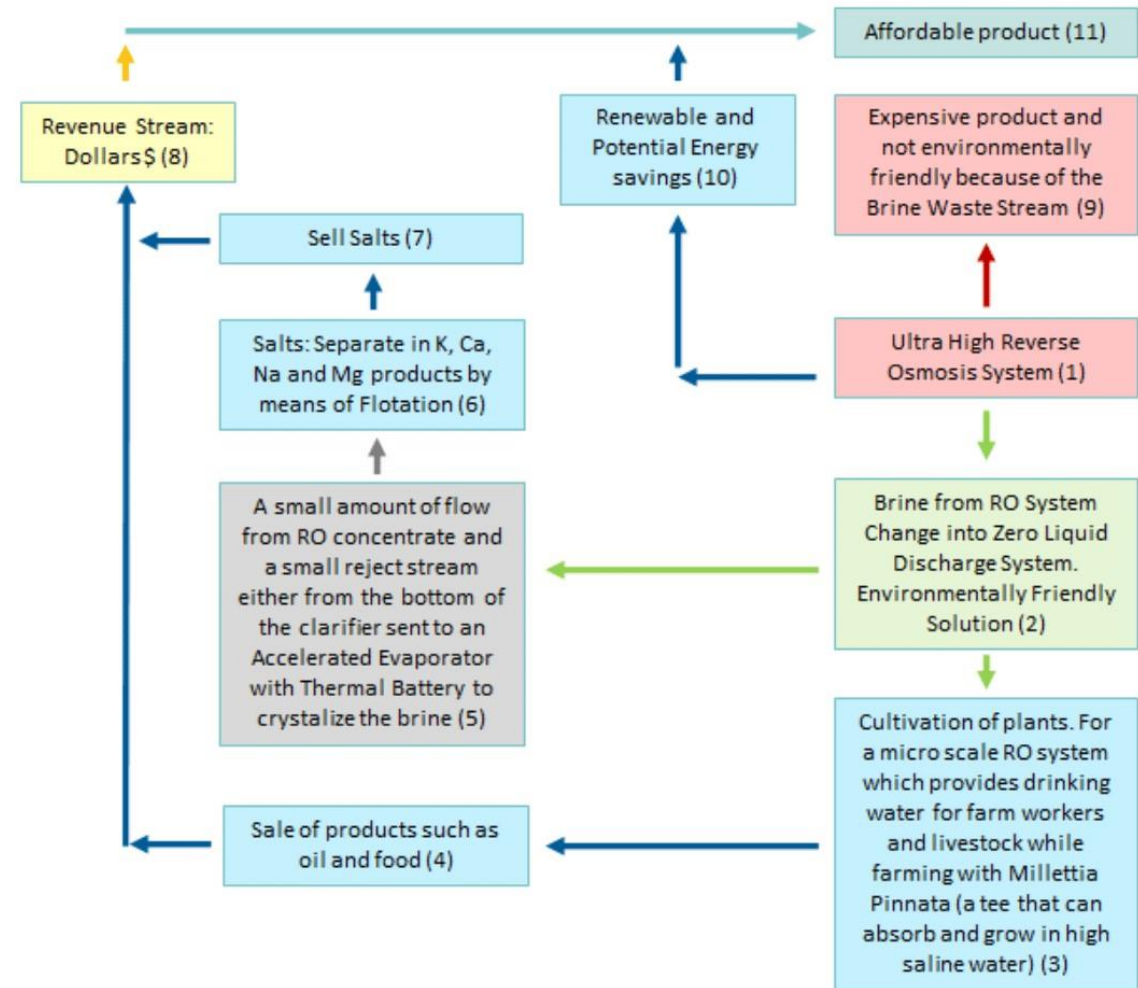
EXECUTIVE SUMMARY

An opportunity to Use more energy-efficient desalination technology in the Agriculture Industry

The business model is built around the RO system producing potable water while at the same time utilizing cost reducing strategies such as:

- harvesting potential energy inherent in the system
- solar energy to harvest industrial salts
- flotation refining these salts in saleable product such as :
 - i. Fertilizer market because of KCl used in the agriculture industry;
 - ii. CaSO_4 , Calcium sulfate is known as gypsum . Used in construction industry ;
 - iii. MgSO_4 , Anhydrous magnesium sulfate. Used in the pharmaceutical and printing and dyeing industries.
 - iv. MgCl_2 , Magnesium Chloride . Used in the industrial, building materials, food industry and medicine industry.

All the savings are re-invested in the process in an effort to reduce the cost of the potable portion.



This market entry approach yields significant benefits to both DDFS and its prospective customers

Alternative approaches to initial market entry

- Partner with Water Treatment Systems Suppliers
- Sell DDFS - Enhanced off-shelf Systems direct to market
- ✓ Operate DDFS – Enhanced Systems through a Water Purchase Agreement (BOT Contract)
- Distribute through Manufacturing Representatives
- Supplier to Water Treatment Solutions providers

Benefits to water buying customer

- ✓ Very low upfront costs
- ✓ DDFS assumes full operational/ performance risk
- ✓ Energy savings = reduced cost of H₂O

Benefits to DDFS

- ✓ Ongoing stable revenue stream
- ✓ Ongoing R&D development
- ✓ Protect proprietary technology

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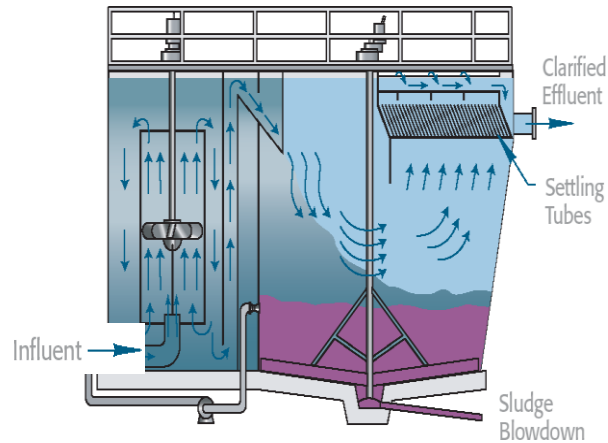
On June 1, 2018, DD Filter Solutions, Inc. and Applied Membranes, Inc. (AMI) launched a joint marketing and sales programme in South Africa. AMI, based in San Diego, CA, is a global leader in the design and manufacture of high quality and reliable reverse osmosis components and systems. An overview of each company and a description of the range of products on offer is featured in the video.



EXECUTIVE SUMMARY

Zero Liquid Discharge Reverse Osmosis System: Advanced Reject Recovery of Water with Concentrate Disposal

Water Softening Process



Ultra-High Recovery Reverse Osmosis System



Feed 1,374 m³/d @ 1,804 mg/l to 5,000 mg/l
Energy Use : 0.43 kWh / m³ to 0.68 kWh/m³

- Environmentally Engineered Solutions
- Continuous Product Water Production
- Near Zero Liquid Discharge (ZLD)
- Complete solution for new or retrofitting applications

Energy Use : 0.9 kWh / m³
Energy Cost Rate : R0.18 kW

Total Permeate or Irrigation Water
1,000 m³/d @ 24 mg/l

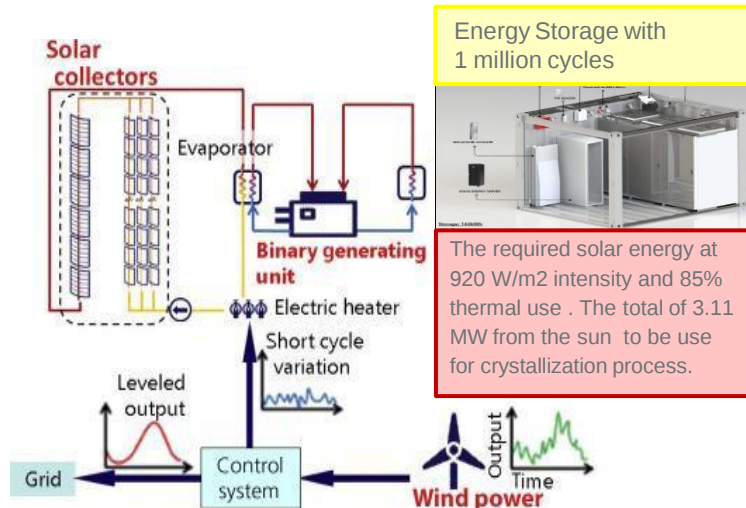
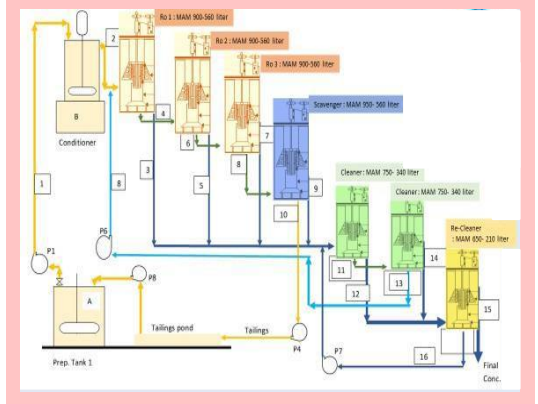
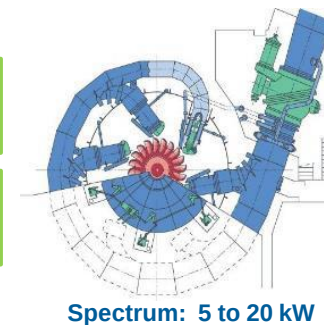
Brine Disposal via Floatation process

The total mass of salt that will be produced by the RO plant of 374 m³/day brine is 3,230 ton per year; The total mass of salt for 374 m³/day @ 23,399 mg / l is 269 ton per month.
NaCl: (46%):
MgSO₄: (12.3%): KCl: (1,2%):
CaSO₄: (31,6%):
Which has the potential gross income of USD \$484,502 pj.

Energy Harvest : Energy Recovery Hydro-Generator Device

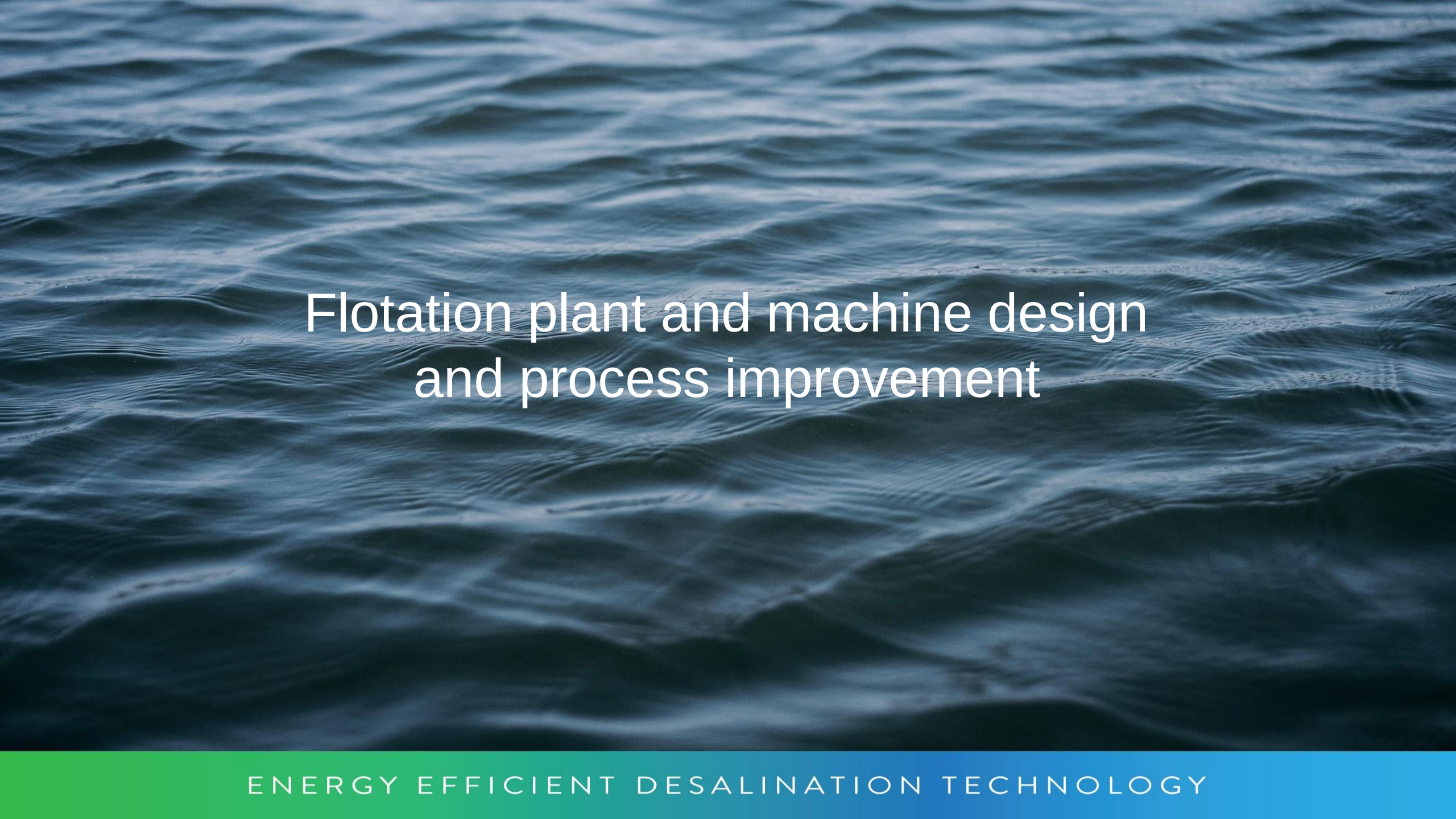
Total Concentrate.
374 m³/d @ 23,399 mg/l

Concentrate Salts to Floatation
Flotation Feed Rate, 10 tph feed for eight hours every two to six weeks



Energy Storage with
1 million cycles

The required solar energy at 920 W/m² intensity and 85% thermal use . The total of 3.11 MW from the sun to be use for crystallization process.



Flotation plant and machine design and process improvement

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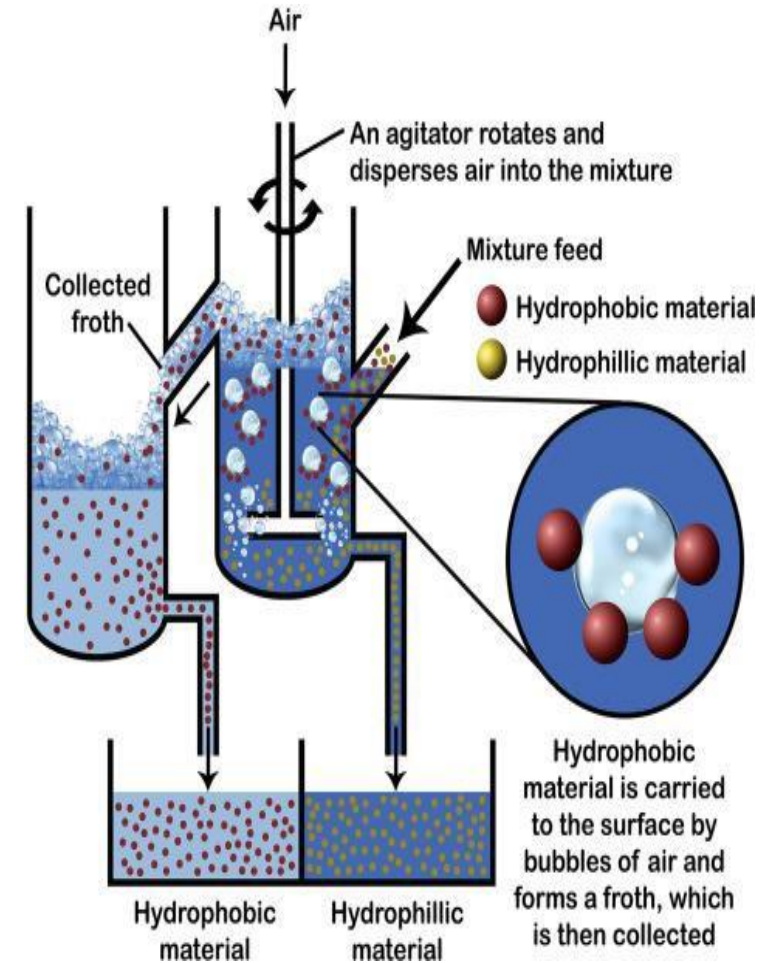
Brine Disposal : Froth Flotation : Principle

During the process, four things happen:

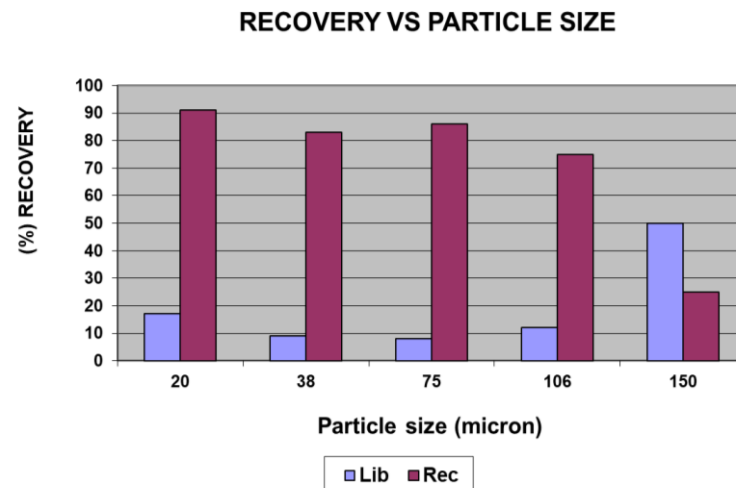
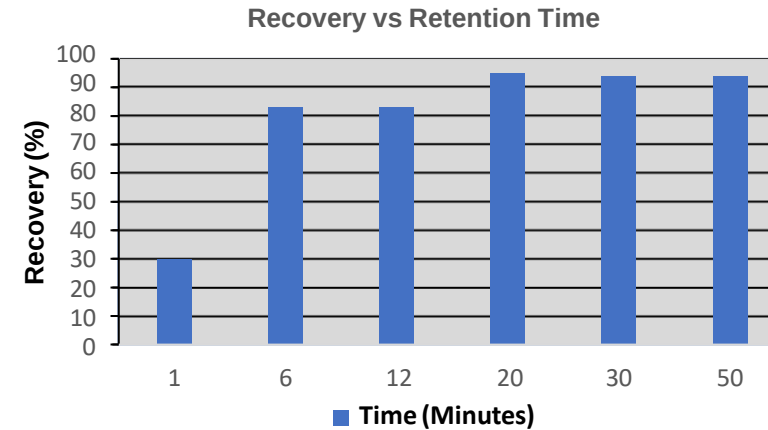
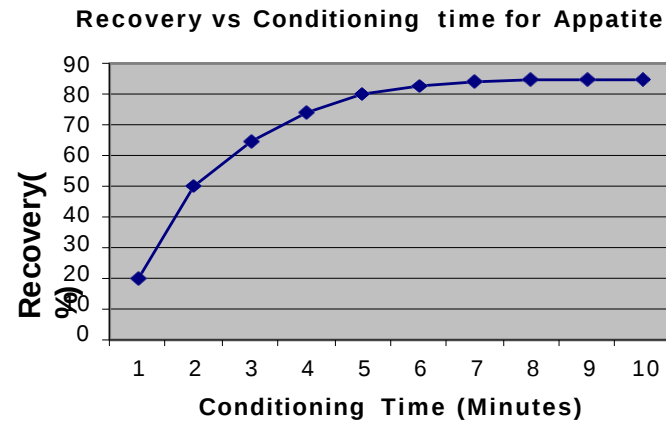
1. Reagent conditioning happens in order to achieve hydrophobic surface charges on the desired particles
2. Collection and upward transport by bubbles in contact with air or nitrogen
3. A stable froth formats on the surface of the flotation cell
4. There's a separation of the mineral laden froth from the bath

The flotation process has three stages:

1. Roughing
2. Cleaning
3. Scavenging



Brine Disposal : Froth Flotation : Principle



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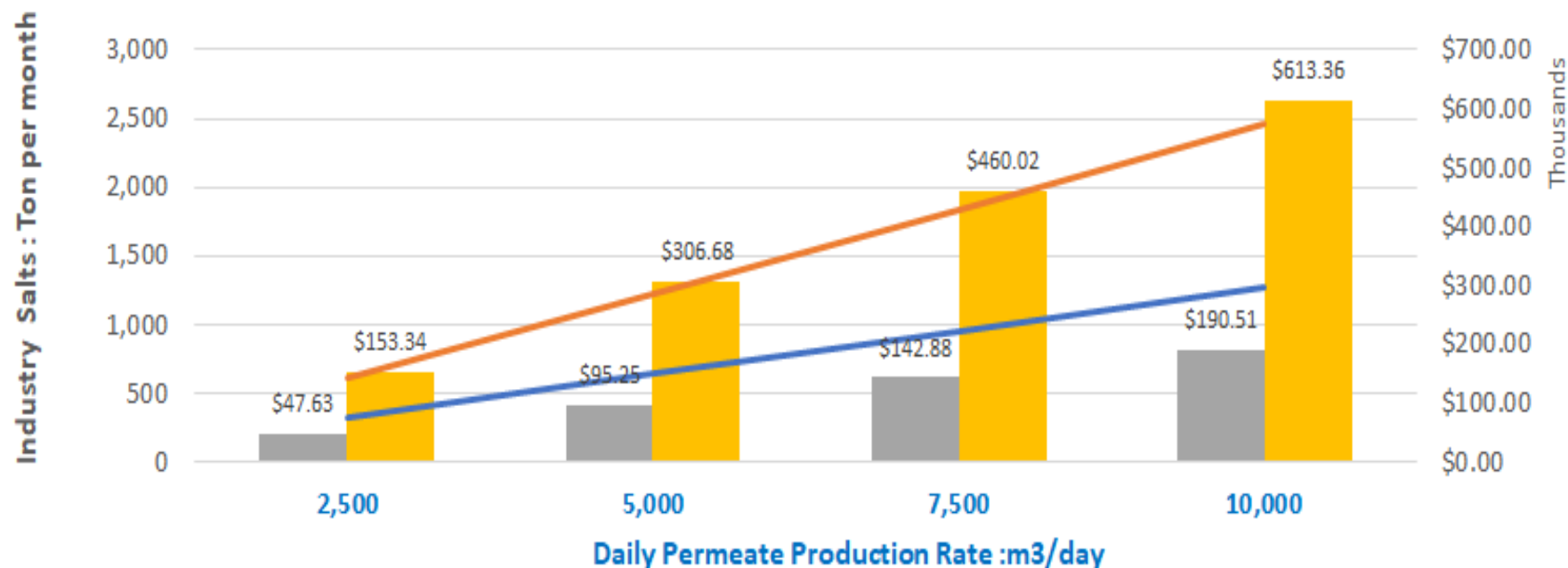
Extraction of potassium chloride salt from the brine of desalinated borehole water

Brine disposal from RO. 3rd Party (Clariant) has verified our team's success. An ion balance conducted of the concentrate showed that the K⁺ present would be associated with Cl⁻. Subsequently, K was analysed for using ICP-OES, and, based on the ion balance, it could thus be calculated that the concentrate collected from flotation had a grade of 65.9 % KCl. This surpasses the specification of 50 % KCl required for the salt to be sold commercially.



Potential Income on Small Scale Reverse Osmosis Systems

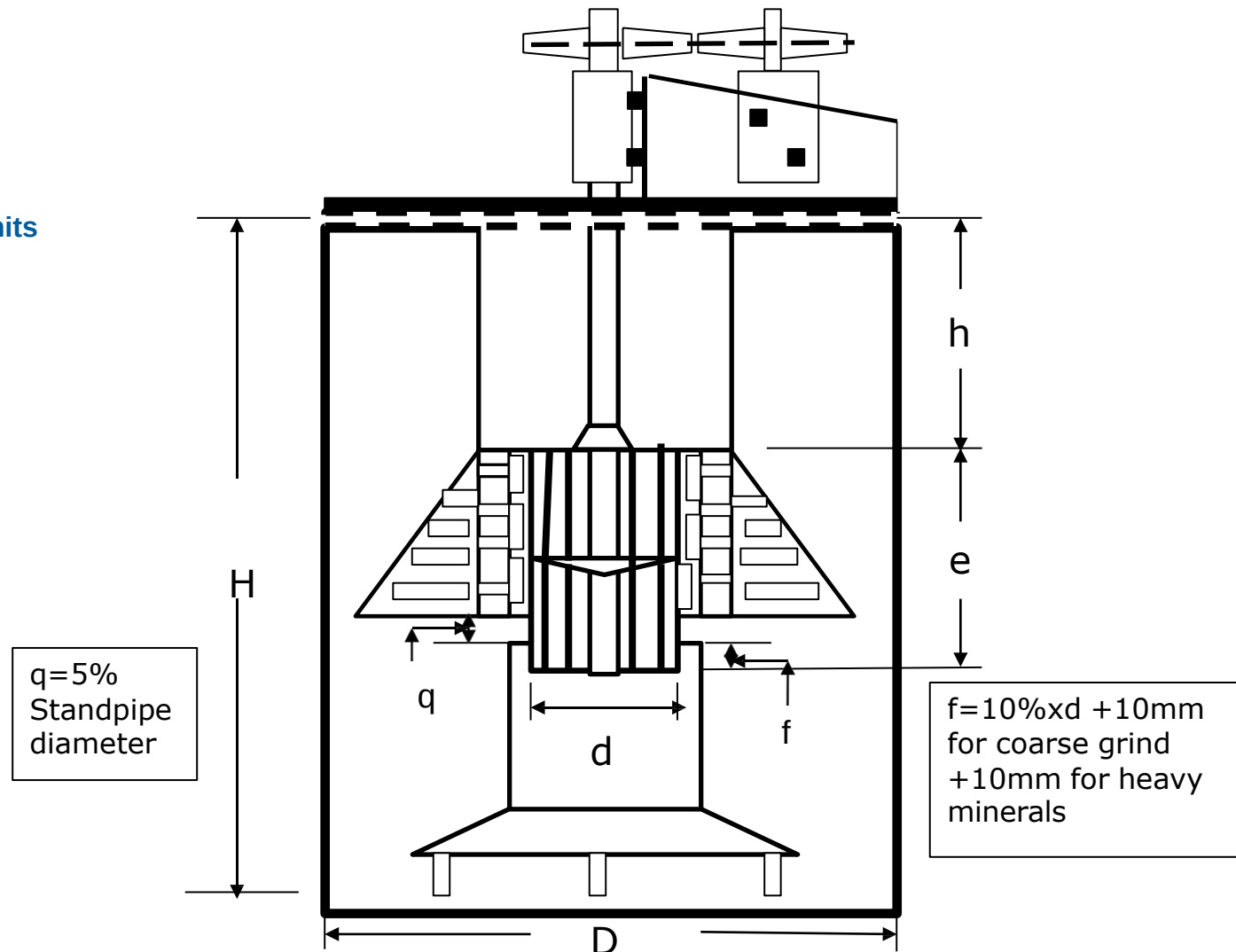
The Brine Disposal is by processing industry salts like NaCl , MgCl₂ + MgSO₄ , CaSO₄, KCl at 92% Recovery Rate



- Brine @ TDS 23,399 ppm discharge residuals: Income of salts production per month(Thousands).
- Brine @ TDS 46,343 ppm discharge residuals: Income of salts production per month(Thousands).
- Feed from high saline borehole water. RO is brine/concentrate at TDS 23,399 ppm discharge residuals .
- Feed from high saline mining water. RO is brine/concentrate at TDS 46,343 ppm discharge residuals .

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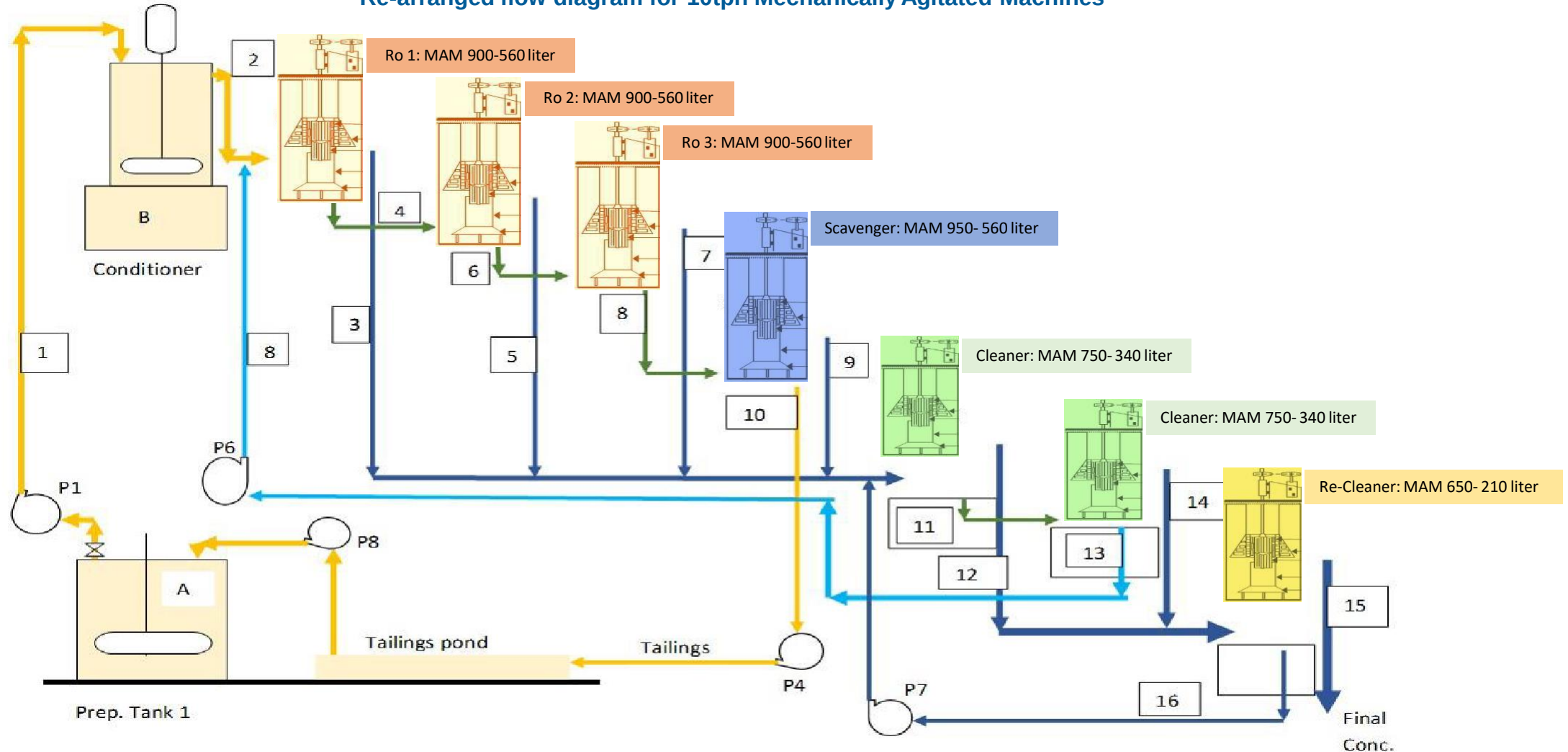
TORNADO Flotation Units



TORNADO Flotation Units General Information

Machine size	M ³	100	50	20	10	0.58	0.34	0.225	0.14	0.08
Diameter(D)	m	5	4	3	2.4	0.9	0.75	0.65	0.55	0.45
Height (H)	m	6	5	3.5	2.7	1.05	0.9	0.8	0.7	0.6
Rotor dia (d)	m	1.3	1.15	0.9	0.75	0.290	0.263	0.224	0.193	0.158
Rotor height(e)	m	1.3	1.15	0.9	0.75	0.290	0.263	0.226	0.193	0.158
Engagement (f)	mm	130	115	90	75	29	25	21	16	15
Gap (q)	mm	85	75	55	45	15	12	12	10	9
Rotor subm (h)	m	1	0.74	0.57	0.55	0.284	0.243	0.216	0.189	0.165
Rotor AR	-	1	1	1	1	1.00	1.00	1.00	1.00	1.00
Volumetric ratio	-	15	15	15	15	8	7	7	6.5	5.8
Ret	>>1E6	6E6	5.4E6	4.2E6	3.2E6	1.4E6	1.24E6	1.01E6	0.9E6	0.75E6
Rotor RPM	rad/s	10	11	15	17	48	55	63	73	88
Critical RPM	rad/s-cR	11	12	16	20	57	71	84	102	130
Aeration No	>>5.6E-4	7E-4	7E-4	7E-4	7E-4	8E-3	7.3E-3	6.6E-4	5.7E-4	5.3E-4
Circulation No	>=1.25E-3	2E-4	2E-4	2E-4	2E-4	3.3E-3	3E-3	3.7E-3	3.6E-3	1.7E-3
Sb	>60 s ⁻¹	67	50	50	50	70	70	70	70	70
Power No	>=2E-2	2E-3	2E-2	2E-2	2E-2	2E ²	2E-2	4E-3	4E-3	4E-3
T.P.No	=>1.5E-5	2.4E-5	3.9E-5	4.9E-5	5.9E-5	4.5E-5	2.4E-5	2.4E-5	2.4E-5	2.7E-5
Power	Kw	250	110	60	36	1.5	1.0	0.75	0.5	0.3

— Re-arranged flow diagram for 10tph Mechanically-Agitated Machines





‘Water is the driving force of all nature.’

– Leonardo da Vinci

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