ANJUMAN-I-ISLAM'S KALSEKAR TECHNICAL CAMPUS, NEW PANVEL

WATER DESALINATION BY REVERSE OSMOSIS

Partial Fulfillment of Dissertation work

By

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Overview

- Introduction
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Introduction

Water Scarcity:-

- Shortage of water for Domestic, Industrial, Agriculture.

- Per capita surface water availability decreased from-
  - 1947- 6042 m3
  - 1991-2309 m3
  - 2001- 1980 m3
  - 2025-1401 m3
  - 2050-1191 m3
  - Total country water requirement – 1450m3
  - Current availability – 1086 m3

- Around 3% water is fresh and 97% is saline held in sea.

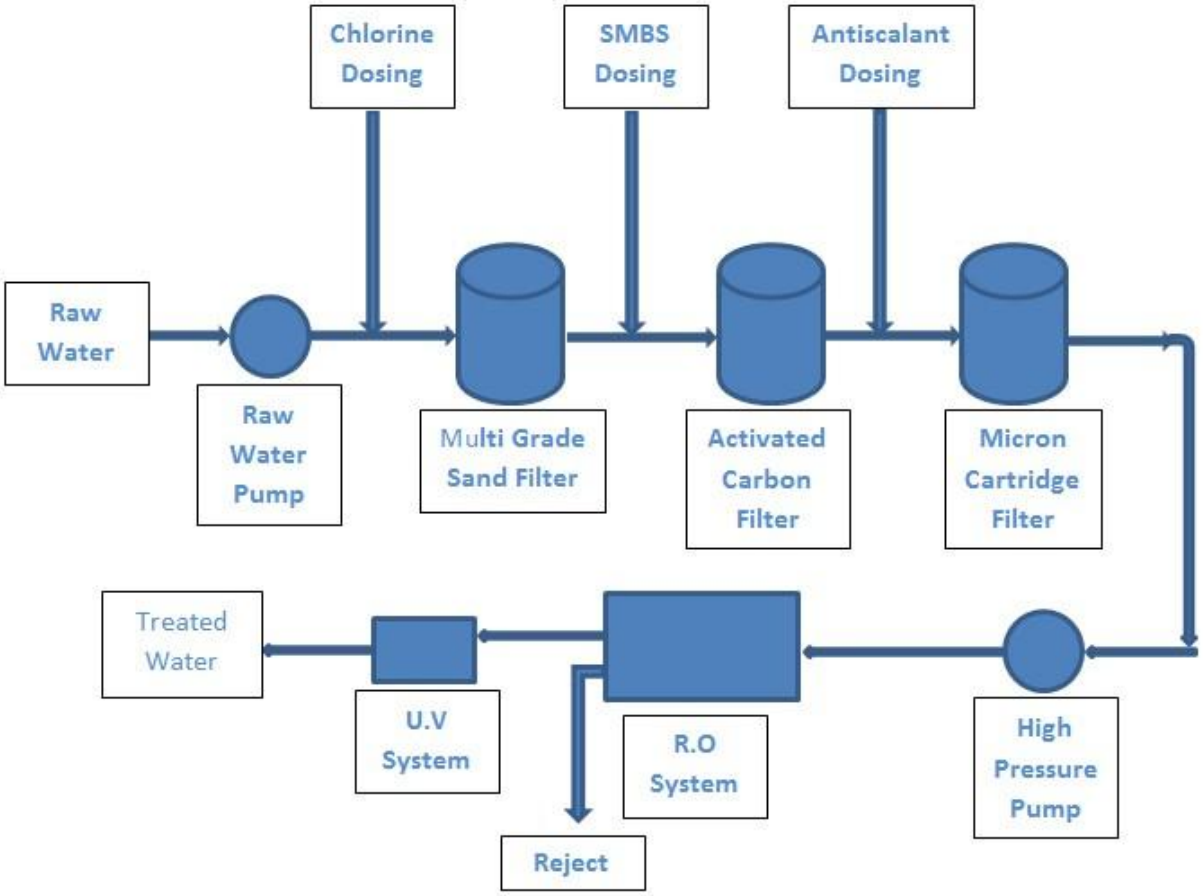
Problem Definition

- Large energy consumption in RO process. & it involves high pressure operation (~50 bar).
- Semi-permeable membrane is sensitive to quality of saline water.
- Corrosive properties of sea water/brackish water.
- Chlorination is required for removal pathogen.
- Brackish water bore wells are in remote places.

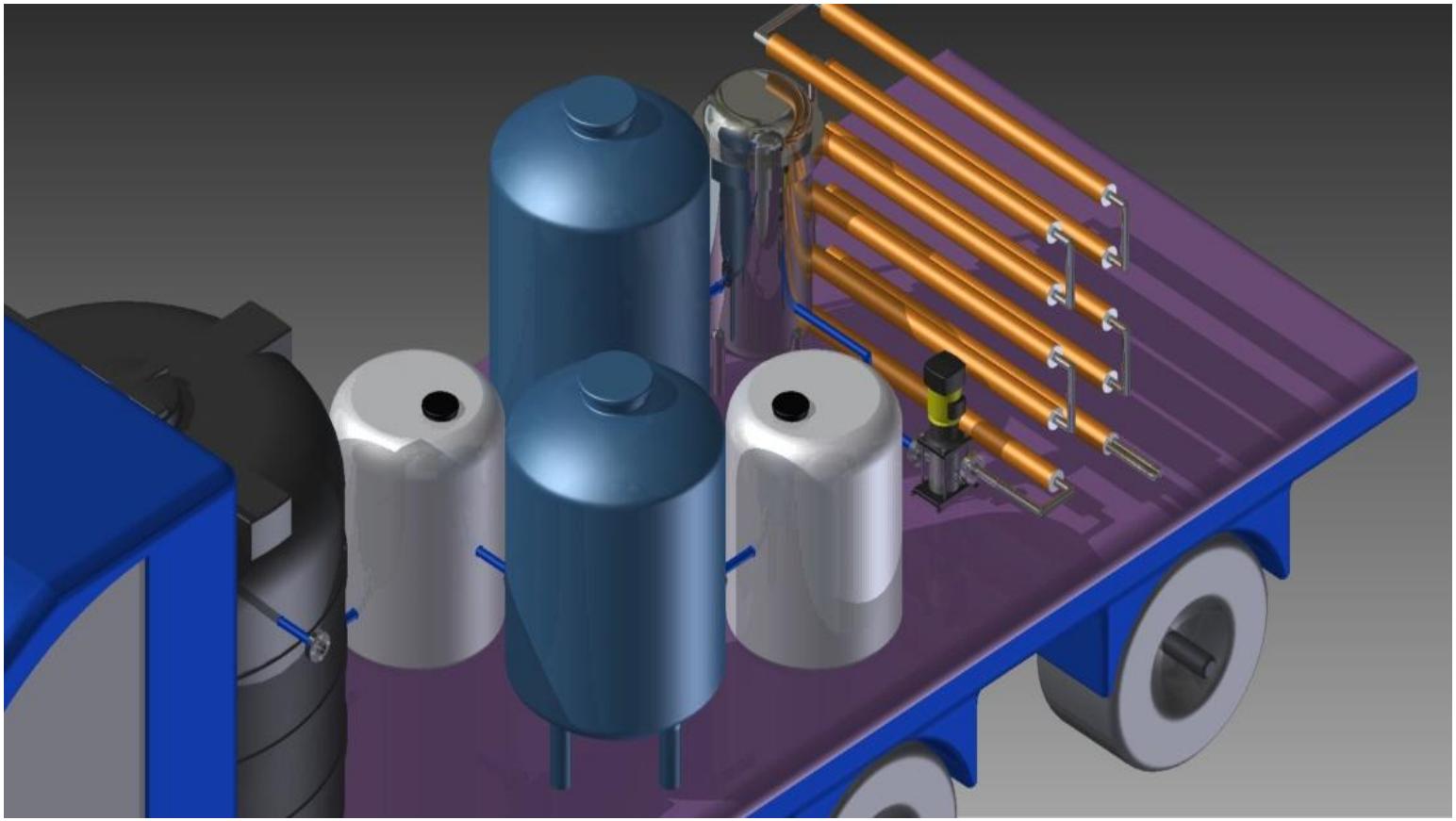
Aim

- 4 Tons of pure(treated) water in an hour.
- To design a desalination setup (RO) of adequate capacity, of mobile type.
- Design and Selection of material of constructions for the components of the Desalination setup.
- Selection of semi permeable membrane.
  Modeling in Autodesk Inventor Professional.

RO Process


Chlorine Dosing
SMBS Dosing
Antiscalant Dosing
Raw Water
Raw Water Pump
Multi Grade Sand Filter
Activated Carbon Filter
Micron Cartridge Filter
Treated Water
U.V System
R.O System
High Pressure Pump
Reject

Modeling



Survey

- Visit to Sparkle Clean Tech

- Market Survey

Design Parameters

- Pressure = 50 bar
- Raw Water Discharge (Flow Rate) = 6 m^3/hr (6000 lit/hr)
- Velocity of Flow = 1.5 m/s

Design of Componenets

- Motor:-

  Power = 11 KW , Speed = 1000 rpm

- Pipe:-

  Nominal Diameter = 40mm , Schedule – 80

- High Pressure Reciprocating Pump

  Cylinder, Piston, Connecting Rod, Crankshaft etc.

- Bearing

  SKF6024

- Flange

  BS 4504 PN64 DN40 Flange

- Coupling

Other Components

- Raw Water Storage Tank – Sintex CCWS-500.01
- Submersible Pump – Tsurumi 80SFQ 21.5 Series
- Truck - Ashok Leyland 3118L 5200/COWL

Total Capital Investment

Component	Cost(₹)	Quantity	Total Cost(₹)
Submersible Pump	1,23,740	1	1,23,740
Storage Tank	46,339	1	46,339
Multi Grade Sand Filter	35,500	1	35,500
Chlorine Dosing Pump	10,000	1	10,000
SMBS Dosing Pump	10,000	1	10,000
Activated Carbon Filter	45,000	1	45,000
Antiscalent Dosing Pump	10,000	1	10,000
Dosing Tank	1400	3	4200
Micron Cartridge Filter	400	1	400
High Pressure Pump	50,000	1	50,000
Pressure Gauge	900	2	1800
Flow Meter	5255	5	5255
Total			3,63,000
RO Membrane	31,160	5	1,60,000
Total			5,23,000

Production Cost

Sr. no	Elements	Annual cost
1	Membrane depreciation	54,000
2	Other depreciation cost	33,000
3	Labor cost	2,40,000
4	Chemical cost	1,12,000
5	Electrical cost	7,62,000
6	Consumable cost	16,000
7	Maintenance cost	36,500
	Total	12,53,500/-

Cost Calculation

- Total annual production cost = **12,53,500 Rs /-**

- **Total annual production**
- Flow rate per m3= 4 m^3 / hr
- Flow rate per year = 4 x 6000
  = 24,000 m^3/year
- Total annual production = **32, 000 Rs/-**

- Water cost per m3 = Annual production cost / Annual production
  = 12,53,500 / 24000
  = **52.22 Rs /-**
  Water cost per lit = **0.052 Rs /-**
  = 5.2 paise/lit

Water cost for this project is approximate 6 paisa/lit.

Result

- Treated water will have a less than 500 ppm.
- The designed system is portable.
- Water cost for this project is approximate 6 paisa/lit.
- Over 98 to 99 % salt are removed from feed water in this process.

Future Scope

- Energy recovery from disposed water.
- Membrane development for Indian condition & sturdy membrane development.
- Development of membrane element that operate at lower pressures, and require less pre-filtration.

Refrences

- Desalination Engineering Planning and Design by “Nikolay Voutchkov”
- M. Sarai Atab, A.J Smallbone "An operational and economic study of reverse osmosis system for portable water and land irrigation".
- PSG College of technology "Design Data Book“
- Kale and Khandare "Reciprocating Pump Design“
- Sparkle Clean Tech PVT. LTD. "Validation“
- AvestaPolarit "Stainless Steel for SWRO plants high-pressure piping“
- Standard Pipe Chart "For pipe size and schedule"

Thank you!