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THE DESALINATION UNITS

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Abstract - *Water is the foundation of our economy; safe and sufficient water supplies are essential for agricultural production, industry, recreation, and human consumption. We face increasing water supply challenges as a nation as a result of extended droughts, population growth, polluted water bodies, and competing demands from a variety of users. To meet these challenges in the coming decades, water treatment technologies, which include desalination, will make a significant contribution to ensuring India's safe, sustainable, cost effective, and appropriate water supply. If brackish or salt water is available, desalination is commonly used to overcome freshwater scarcity in some parts of the world. Various technologies have been proposed over the last century. The state of the mainstream solution, such as reverse osmosis, is reported in this report (RO). In this case, In this case, seawater treatment plants are the same as traditional ones, with the exception that they are designed to be portable. The overview describes the purification techniques and the development of the unit to be compact, usable without complex installation procedures, and capable of treating seawater anywhere. Thus, classifications are first introduced, taking into account the operating principle, the primary energy input treatment, the components required, the process involved, and the unit's testing.*

***Key Words*: Desalination, reverse osmosis, treatment, compact, polluted water bodies, brackish water, sea water**

1. INTRODUCTION

Water resources are groundwater sources resources that have the potential to be used as a source of water. Only 3% of the water on Earth is freshwater, with slightly more than two-thirds frozen in glaciers and polar ice caps. The remaining unfrozen rainwater is mostly found as groundwater, with only a trace above ground or in the air. Surface water, under river flow, ground water, and frozen water are all natural sources of freshwater.

1.1 Motivation of need

Following the expected population growth by 2050, India's demand for safe and dependable water quantities will continue to rise. Furthermore, in the absence of other sustainable water sources, desalination is the only viable option for meeting domestic, public, and industrial water demand. It not only addresses immediate water needs, but also plays an important role in addressing India's long-term water security issue. While our country is implementing desalination plants to reduce fresh water scarcity, these plants require a significant amount of land, building, time, money, and water production capacity. They will not be able to provide water to every location, so installing handheld desalination units will solve the problem.

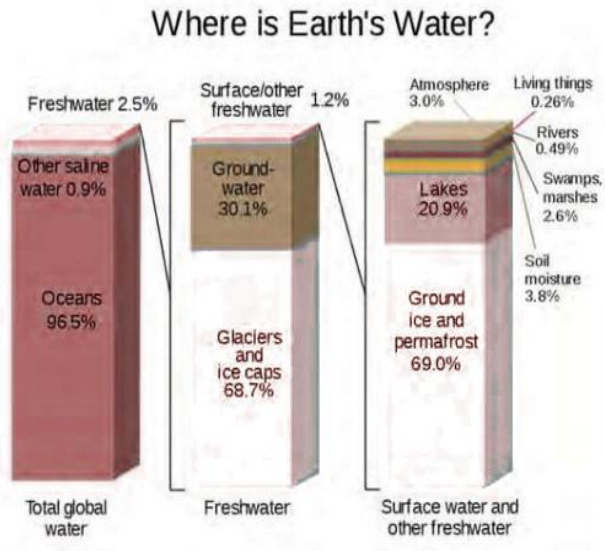

Fig 1. Where is Earth's water?

1.2 Water Resources in India

Precipitation, surface and ground water storage, and hydropower potential are all part of India's water resources. The average annual precipitation in India is 1,170 millimetres. The majority of the rain falls during the monsoon season (July - September), with the northern and north receiving far more rain than the west and south of India. Aside from rain, the melting of snow over the Himalayas at the end of the winter season continues to feed the northern rivers to varying degrees. The southern rivers, on the other hand, have greater flow variability throughout the year. This causes inundation in some months and water scarcity in others in the Himalayan basin. Despite its extensive river system, safe clean drinking water and irrigation water supplies for sustainable agriculture are in short supply across India, in part because the country has only harnessed a small portion of its obtainable and recoverable surface water resource. Desalination technologies have attracted a lot of attention as sources of water to combat water scarcity. Desalination is typically deemed to be more expensive than other existing sources, but it is more dependable in meeting the country's water

needs because India has 7516.6 km of coastline with unlimited access sea water.

2. DESALINATION

Natural desalination has occurred on Earth since the seas were formed. Water evaporates from the sea and condenses to form pure rain. For over 2000 years, humans have used distillation to desalinate water. The process can be traced back to the 4th century B.C., when Greek sailors used an evaporative process to desalinate seawater. The recent discovery of oil in the arid region of Arabian Gulf countries has made a significant contribution to the development of the region. Plants for thermal desalination by mid-2007, desalination processes in Middle Eastern countries accounted for approximately 75% of total global desalinated water capacity. Although there are several methods for converting seawater to fresh water, all schemes follow a similar overall process. The exact nature of each step would be determined by the desalination method used. Figure 1 depicts the steps in the process. The type of pretreatment is determined by the type of intake system and the level of pollution in the around it sea. Water may be directly obtained from superficial bays near the shore. provide seawater containing a high concentration of bacteria, algae, and suspended solids Seawater drawn from the open ocean is typically cleaner and requires fewer pre-treatment steps. Raw feed water must be pre-treated to extend the life and reliability of the membrane separation machinery. As previously stated, there are several methods for converting saltwater to fresh water. Regardless of conversion method, the product water must have a total dissolved solid (TDS) material of the less than 500 ppm .

OBJECTIVE

1. Investigate the use of desalination in having met the world's water needs.

2. To treat highly saline moisture so that the water is suitable for drinking.

3. To create a small, portable device that is easy to use.

4. Natural disasters, such as drought, are resolvable.

METHODOLOGY

The study was conducted to address the fresh water problem using various research papers, articles, and backlink to the goal we wanted to achieve. The flow chart below depicts the steps taken to conduct research. osmosis process passes water through with a series of filters, with the clean water eventually going to the holding tank and the contaminants being flushed down the drain.

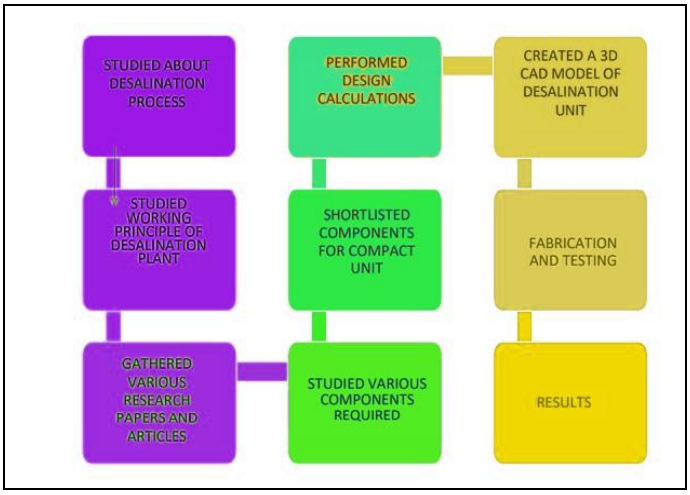

Fig 2.1

Reverse Osmosis (RO)

The reverse osmosis water purification process process is straightforward. Water pressure is used to force tap seawater membrane, removing contaminants from the water. This is a method of removing dissolved inorganic solids from a solution. This method differs from traditional filtration in that particulates are gathered within the filter material. The reverse osmosis process passes water through with a series of filters, with the clean water eventually going to the holding tank and the contaminants being flushed down the drain.

Membranes

RO membranes lack distinct pores that circumnavigate the membrane and are at one end of the spectrum of available commercially membranes. The plastic material of Porous materials forms a layered, internet structure, as well as water must travel through the membrane in a tortuous way to reaching the permeate side.

Desalination feed water

For feed water, seawater RO plants have different options: seawater wells (beach wells) or groundwater (open seawater intake).

Around the world, typical seawater concentrations range from less than 35,000 mg/L to more than 45,000 mg/L. TDS is commonly used to represent concentration (Total Dissolved Solids). The TDS level indicates whether the drinking water is safe to drink, needs filtration, or is heavily polluted. per million (PPM) is the unit of measurement for measuring TDS levels in water.

Pre-treatment for seawater

The main objective of any RO pre-treatment system (for salt water or brackish water) is to reduce water fouling in the RO

membrane system. Surface waters (seawater and salt water) have a higher priority .membrane fouling and necessitate more identifying activities systems than groundwater resources Acid addition, coagulant/ flocculant addition, wastewater treatment, mainstream press filtration, and cartridge filtration are all common components of conventional pre-treatment. The feed water is prepared for granular media filtration with the first chemical additions, which include an acid, coagulant, and flocculant. The pH of the feed water is reduced by acid treatment (typical pH range 5-7), which tends to increase the solubility of calcium carbonate, the main solution will turn in many feed waters. Sulfuric acid is the most commonly used acid to reduce the pH of feed water (H2SO4).

Desalination Process in Desalination Plant

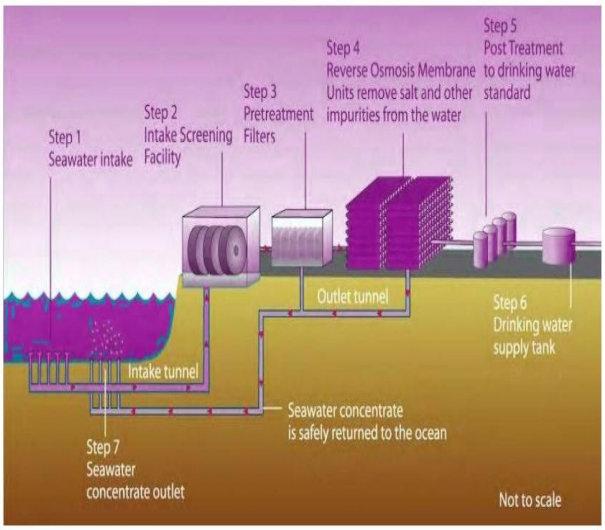

Fig 2.2

Step one: Obtaining seawater

First, a source of seawater or brackish water (a mixture of sea and freshwater) is required. Ordinarily, seawater is piped in slowly from a depth of at least 5 metres in the ocean. It's very slow - only 0.1 metre per second - so the fish can swim against by the current without being sucked in. The desalination plant is fed with seawater. It's currently devoid of fish, but it contains a plethora of small organisms, particles, and salt: mostly sodium chloride, or NaCl, but some other substances as well. Seawater contains approximately 37,000 milligrammes [of sodium] per litre.

Step two is to screen the intake water.

Water must be pre-treated before it can be desalinated; this care procedure is identical to that used for fresh water.

Because you want to desalinate pure seawater, water is first filtered through intake filters to remove any particles, biological matter, or anything else that makes it impure. The desalination process is very effective at removing salt and nothing else. These which was before filters can be made of sand or ultrafiltration membranes.

Step three: Pre-treatment

Following that, the water is pumped through additional filters known as cartridge filters and

Carbon filters are used to ensure that the water is pure. In this case, the cartridge removes micro particles.

A carbon filter, on the other hand, removes bacteria or viruses.

Step four: Reverse osmosis

The salt must then be removed from the water. This is accomplished through a process known as reverse osmosis (RO). At high pressure, water is forced through a sequence of very thin membranes with roughly particle holes in them. Water molecules (H2O) pass through these membranes, but salt remains on the other side. Water is pumped through rising pumps, which consume the majority of the energy and pressurise the water. A pressure gradient of 500 metres was required for the RO process (50 bar). To overcome osmotic pressure, water is pressurised, which also aids in pushing it through this extremely fine membrane.

Step five: Post Treatment.

Reverse osmosis does not produce dry salt and water –. It's both pure and also very salty water. Here, half of the seawater is purified, and the other half is returned to the sea at twice the salinity.

But the other 50% still has all of this energy, so it is passed through an energy recovery device, in which half of the energy is recovered - a saving grace for modern desalination.

At a rate of 4 meters per second, this doubly salted water is being pumped into the ocean. Within 50 metres of discharge, this naturally mixes with seawater. Essentially, carbon dioxide has been injected, followed by liquid lime, which adds toughness to the water as a result of calcium, making it drinkable. These additions all occur at levels ranging from 1 to 500 ppm. After that, drinking water is collected, and chlorine is decided to add to disinfect. Then it either tends to leave the plant or is kept in large storage facilities.

ADVANTAGES, DISADVANTAGES AND APPLICATIONS

1. It is the most effective method of water softening.
2. It provides people with safe drinking water.

3. All ion atoms and other contaminants will be blocked by the semi-permeable membrane.
4. This framework does not use any chemical compounds to purify water.
5. Feed water can be taken directly from the sea.
6. The built asset is simple and strong in design, and it is small in size.
1. The water rate of production is around 900 LPD.
2. When compared to other purifying devices, installation is relatively simple.
3. Transportable from one place to another.
4. The system is very simple to maintain.
5. Because the majority of the components are non-metallic, the material's chances of
6. corrosion are extremely low.

Disadvantages

1. Sometimes reverse osmosis causes clogging of the entire system, causing a low water rate of production.
2. It necessitates routine maintenance.
3. The applied pressure must be greater than that of the osmotic pressure for the system to function.
4. To avoid fouling, the membrane must be cleaned.

Applications

1. Can be widespread used in homes and businesses near coastal areas; can be used in areas prone to flooding, tsunamis, or other natural disasters;
2. affected area, where access to clean water is difficult
3. Can be utilized in rural areas where fresh water is scarce.
4. Used on commercial cruise ships to solve the problem of storing drinking water.
5. Can be used for trekking, picnics, and other similar activities.

3. RESULT

The goal of developing a COMPACT DESALINATION UNIT was to convert seawater and brackish water into pure water. The design was based on an actual desalination plant.

Different materials were studied for the expected outcome, and components were chosen based on their specifications such as compactness, water purification, and production capacity.

Based on the components chosen, a desalination process was developed and CAD models were created, after which pressure drop calculations for each filtration media were performed. TDS was also determined in accordance with the manufacturer's guidelines for their specific product.

4. CONCLUSION

As water pollution and scarcity become a major concern, and consumption of water continues to rise, we must lower emissions and reuse waste in the some form or another, or seek a different water source. To address this issue, a desalination process study was conducted, and a portable SEA WATER RO DESALINATION UNIT was designed. This device can be used to treat any type of sea water, brackish water, ground water, and so on. Its use can be for both residential and commercial purposes in coastal areas. And it can be used in areas affected by floods, tsunamis, or any other natural disaster where getting fresh water is difficult. There are multiple kinds of desalination processes for the same application, but each has its own limitations; to overcome these, a compact, user-friendly, innovative, and simple design is created. Future research could be useful in discovering new techniques for increasing output in terms of water manufacturing and using low pressure for smooth operation, which can save energy and improve performance.

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