Sea Water Desalination and Purification by Organic Materials

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Abstract— The basic need of any human is water, without water there is no life. In the world there is 97% of water total water is in sea and only 2% is available for drinking. Since this time more than 125 countries having problem of water and its quality and quantity also in Middle East the liter of water is more expensive than a liter of gasoline.so we are trying to solve the water crisis by using sea water .for it we are using organic materials. By which we can produce drinkable water from sea water. For that no RO (reverse osmosis) or heat transfer system is used. We try to make a simple filtration system in which the filter only produces the pure water.

Key words: Sea Water Purification, Sea Water Desalination

I. INTRODUCTION

Water desalination & purification is the process of removing undesirable chemicals, biological contaminants, suspended solids and gases from contaminated water. Our goal is to produce water filter for a specific purpose. Some water purification may also be designed for a variety of other purposes, including fulfilling the requirements of medical, pharmacological, chemical and industrial applications. The methods used include physical processes such as filtration, sedimentation, and distillation.

Fig. 1: Desalination Introduction

Biological processes such as slow sand filters or biologically active carbon, chemical processes such as flocculation and chlorination and the use of electromagnetic radiation such as ultraviolet light Purifying water may reduce the concentration of particulate matter including suspended particles, parasites, bacteria, algae, viruses, fungi, as well as reducing the amount of a range of dissolved and particulate material derived from the surfaces that come from runoff due to rain.

The minimum and maximum concentration of contaminants, depending on the intended purpose of water use can be specified

A. Requirement of New Purification System

Water stress increases due to population rise and the uncontrolled expansion of industrial and agricultural activities are critical issues in many regions all over the world[1]. For this reason, obtaining new water sources to supply the expected increasing demand, 100 million m3/day by 2015[2], has become an important research and development topic.

Among the several possibilities, seawater desalination (SWD) has been Identified as one of the preferred options to obtain fresh water and the number of desalination plants is continuously increasing. Reverse osmosis (RO) is the most used technology for SWD due to the significant Improvements in new membrane development (new materials, lifetime Lengthening) in addition to advances in energy recovery systems and in the pre-treatment processes [3]. However, one of the drawbacks of this technology is the disposal of the produced brine, which accounts for the 50% volume of treated seawater with approximately doubled salt concentration. Usually, this brine is directly discharged back into the sea, generating environmental impacts in the reception point such as diminishing the amount of flora and creating salinity gradients and, most important, increasing the operating expenses cost of desalination plants due to the energy consumption in pumping the brine [4,5]. For this reason new desalination projects promote the integration of RO desalination plants with other installations using high volumes of water (e.g. waste water treatment plants, electric power generation plants) to achieve dilution factors by blending options (e.g. Spain or California) [6]. from this kind of reason and remedies we are trying to make the sea water purification system by organic material.

B. Desalination Concept

It is the process of removing salt, ions and chemical impurities from water to produce drinkable water. It is generally used for sea water purification to eliminate the problem of sea water.

There is main problem of cost and wastage of water. The part of cost it is very high and the wastage is also very high, so to eliminate this problem we are trying to work with sea water desalination process.

1) Types of Desalination

- by membrane filter
- by distillation of water
- Multistage flash (MSF)
  - Multiple effect distillation (MED)
  - Vapor compression

II. SYSTEM SPECIFICATION

A. Sea Water Desalination System by Organic Material

In the filtration system the sea water purification and desalination by organic material is new concept for research in which we use some organic materials and some ion resins to purify the sea water.

B. Materials used for the Filtration System

1) Organic Materials and its Detail

a) Sand

- A sand bed filter is a kind of surface filter. Broadly,

there are two types of filter for separating particulate solids from fluids:

- Surface filters, where particulates are captured on a permeable surface
- Depth filters, where particulates are captured within a porous body of material.[8]
- In addition, there are passive and active devices for causing solid-liquid separation such as settling tanks, self-cleaning screen filters.[8] in depth filter, some employing fibrous material and others employing granular materials. Sand bed filters are an example of a granular loose media depth filter. They are usually used to separate small amounts (<10 ppm) of fine solids (<100 micrometers) from aqueous solutions.[9] they are usually used to purify the fluid rather than capture solid material. Therefore they find most of their uses in liquid effluent (wastewater) treatment.

b) Soil

- Soil consists of a solid phase of minerals (the soil matrix) and organic matter, as well as a porous phase that holds gases (the soil atmosphere) and water (the soil solution). Accordingly, soils are often treated as a three-state system of solids, liquids, and gases.[10]
- Most soils have a dry bulk density (density of soil Taking into account voids when dry) between 1.1 and 1.6 g/cm3, while the soil particle density is much higher, in the range of 2.6 to 2.7 g/cm3.
- Pore space is that part of the bulk volume of soil that is not occupied by either mineral or organic matter but is open space occupied by either gases or water. In a productive, medium-textured soil the total pore space is typically about 50% of the soil volume.[10] Pore size varies considerably; the smallest pores (crypto pores; <0.1 µm) hold water too tightly for use by plant roots; plant-available water is held in ultramicropores, micro pores and mesopores (0.1-75 µm) and macro pores (>75 µm) are generally air-filled when the soil is at field capacity.
- Soil texture determines total volume of the smallest pores; clay soils have smaller pores, but more total pore space than sands. Soil structure has a strong influence on the larger pores that affect soil aeration, water infiltration and drainage.[10]

c) Gravels

It is used for remove solid ion particles and removal of some bad impurities from the Sea water

- in the gravels the impurities are stick on the material
- And make the impurities out from another layer.
- the size of the gravels is from 5 to 15 mm and can be
- Set with high dense structure.

d) Activated Carbon

- Activated carbon, also called activated charcoal, is a form of carbon processed to have small, low-volume pores that increase the surface area available for adsorption or chemical reactions.[11] Activated is sometimes substituted with active.
- Due to its high degree of micro porosity, just one gram of activated carbon has a surface area in excess of 3,000 m2 (32,000 sq ft),[12]as determined by gas adsorption.[13] An activation level sufficient for useful application may be attained solely from high surface area; however, further chemical treatment often enhances adsorption properties.
- Activated carbon is usually derived from charcoal and is sometimes utilized as biochar. Those derived from coal and cokes are referred as activated coal and activated coke respectively it affect the color, Odour and taste after filtration.
- Activated carbon is used in gas purification, decaffeination, gold purification, metal extraction, water purification, medicine, sewage treatment, air filters in gas masks and respirators, filters in compressed air and many other applications.

e) Green Sand

- it is the processed mix material which is used in molding process but, with some good advantages we use it here.
- The synthetic zeolite ion exchange material was soon replaced by a naturally occurring material called Greensand. Greensand had a lower exchange capacity than the synthetic material, but its greater physical stability made it more suitable for industrial applications [7].
- It is the mixture of silica and iron material Green sand is "Flow able".Green sand should be "Permeable "at the beginning of pouring Green sand must get "Dry Strength" to prevent erosion by liquid metal during [14]

f) Mix Ion Exchange Material

- Ionizable groups attached to the resin bead determine the functional capability of the resin; here we are discussing about our mix ion resins which we will use for our system.
- in the mixed exchange resins there is mix ions of weak and strong acid solutions which are useful to remove the impurities of sea water.

C. Applications of Ion Exchange Materials

1) Water Softening

Hard waters, which contain principally calcium and magnesium ions, gray curd and a waste of soap. Water softening involves the interchange of hardness for sodium on the resin. Typically, hard water is passed through a bed of a sodium cation exchange resin and is softened.

2) Dealkalization

Dissolved solids are removed to the extent of the alkalinity in the raw water by passing the raw water through a bed of weak acid cation resin in the hydrogen form. It is used to remove the solids like Na, Cu, Cl, Mg etc..[15]

3) Nitrate Removal

Ion exchange is used for the removal of nitrates from nitrate polluted waters [16]chloride removal- Strong base anion exchange resins operating in the chloride ion form (salt solution regenerated) have been successfully used for this service.

4) Chemical Processing

Catalysis. Since ion exchange resins are solid, insoluble (but reactive) acids, bases, or salts, they may replace alkalis, acids and metal ion catalysts in hydrolysis, inversion, hydration or dehydration, polymerization and hydroxylation reactions. The advantages of ion exchange resins as catalysts include easy separation from the products of reaction

repeated reuse, reduction of side reactions and lack of need for special alloys or lining of equipment.

5) Purification

Purification by ion exchange is used to remove contaminating acids, alkalis, salts or mixtures from non-ionized or slightly ionized organic or in-organic substances. Examples include formic acid removal from 50 percent formaldehyde solutions, removal of amines from methanol, removal of iron from steel pickling operations, purification of aluminum bright dip baths and removal of iron in the purification of hydrochloric acid [17].

6) Metal Extraction, Separation and Concentration

In aqueous or solvent mixtures containing large amounts of contaminants and small amounts of a desired solute, ion exchange resins can be used to selectively isolate and concentrate the desired solute, for example, the recovery of uranium from sulfuric acid leach solution with strong base anion resins can be used for metals recovery such as copper, nickel, cobalt and precious metals

7) Desiccants (Demoisturizer)

Ion exchange resins, particularly strong acid cation exchange resins in the dry state, are useful as desiccants [18]. Ion exchange resins show their greatest capability as desiccants in the drying of hydrophobic solvents, for example, hydrocarbons, chlorinated hydrocarbons. In dashing, a bed of strong acid cation resin is typically followed by a bed of weak base anion resin. The resins used are macro porous, as their large porous structure allows syrup components to move freely into the bad.

III. LITERATURE REVIEW

The cost of purification of sea water by RO water with desalination is 38-50 RS/m3 of water. And there is also 50% of water waste but it is less costlier then multi storage distillation and multi stage flash. [19]

However, because desalination costs still remain high, Many countries are unable to afford these technologies of water desalination system by reverse osmosis. Therefore, there is a need to emphasize and revitalize R&D in technology improvements that will eventually lead to substantial reduction of Desalinated water production costs. The ultimate Objective is to supply readily available low-cost fresh water by seawater 0desalination.[20,21]

In the sea water desalination there is two phases for desalination which are ultra filtration and reverse osmosis. in ultra filtration the organic and solid particles are removed and then after in reverse osmosis the concentrated water is purify.[22]

There is multimedia filtration is the process of filtering river or brackish water by organic materials which is better than the conventional sand water filtration. The sand filtration is capable to 25-50 microns but the multimedia filter is capable to filter 10-25 microns. [23] in water desalination by nano membranes filter

We need to Remineralization the purified water by adding require contains.[24]

IV. DATA AND SAMPLE ANALYSIS FOR SYSTEM DESIGN

While working with sea water we collect the data and it is given.

Parameter	Sea water	Hard water	Boring	Packaged water	Reference of standard
Ph	4-5	7-8.5	6.5-8-	-	6.5-8.5
TDS	14,065	468	699	23.8	500-2000
Color	-	Nil	Nil	nil	Nil
Turbidity	1370	0.93	2.34	0.70	1-5
Hardness	3000	400	280	16	200-400
Chloride (mg/l)	7800	52	96	8	100
Sulphate	630	34	57	6	200
Alkal alk alkalinity	340	304	456	16	600-max
Amonial (Nh4-N)	Nil	nil	Nil	nil	-
Dissolve oxygen	6.57	7.34	7.30	8.11	6.5
Conductivity	23.248	757	1156	39.6	-------

Table 1: Analysis for system design

A. Analysis and study of problem and solution

There are many problems in the parameter of the sea water sample, which is

1) Low PH,
2) High TDS
3) More Hardness,
4) More turbidity
5) High level of Chloride
6) High level of sulphate

B. Solution

In this system there are many problems of water parameter and to solve

1) To decrease the TDS –there is biochar material which can reduce the TDS (charcoal, carbon)
2) Turbidity – to decrease the turbidity there is a falcium powder which can reduce the turbidity
3) hardness- to decrease the hardness there is bricks, chips, shelts, and pebbles
4) Cloride –to reduce the chloride level there is bri- 31
5) (Material) is required which has high absortibity
6) Sulphate –to reduce the sulphate there is a iron exchange material which can reduce the sulphate level

V. CONCLUSION

To overcome the problem of shortage of water by providing clean or drinkable water from sea at low cost by organic filtration and its better then nano mamerance filter water quality.

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