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MEMBRANE BIO-REACTOR- AN ADVANCED TREATMENT

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Abstract : *Water is the basic need of human being to serve the different purposes. As the population keep on increasing day by day, the usage of water increases. Moreover, simultaneously the rate of waste of water increases, so in city region the treatment plants are installed. Basically the three treatments involved in waste water treatment plant such as primary, secondary, tertiary treatment. The quality of treated water is not that much of healthy so it can be used to hand out different purposes. The treatments acquire more time to purify the not as much of amount of water. So advanced treatment which is less time consuming and more accurate than the secondary and tertiary treatment called as "Membrane bioreactor – an advanced technology". Membrane is the combination of biological and filtration process. Ultimately the advanced treatment is the replacement of secondary and tertiary treatment. This technology is suitable for high quality demand of water. The processed water can be used in flushing, bathing, irrigation, industry, drinking etc. The membrane process have several processes such as ultra filtration, nano filtration, electro dialysis, microfiltration. The most commonly used process in membrane reactor is ultra and micro filtration, pressure driven processes which are capable of separating particles having size ranges from 1 to 100 nm and .1 to 10 ppm respectively.*

I. INTRODUCTION

Membrane bioreactor (MBR) technology, which is a combination of biological-activated sludge process and membrane filtration. It is widely spread, and accepted in recent years for thetreatment of many types of wastewaters, while the conventional activated sludge (CAS,UASB) process cannot deal with poor sludge settleability MBR technology is also used in cases where demand on the quality of effluent exceeds the capability of UASB.
The idea for coupling the activated sludge process and membrane separation was firstly reported by research conducted at Rensselaer Polytechnic Institute, Troy, New York, and Dorr- Oliver, Inc. Milford, Connecticut, US The first Membrane Sewage System-MST was made by Dorr-Oliver, Inc. with flat sheet ultrafiltration plate and frame membrane. It did not gain much interest in North America but it had considerable success in Japan in the 1970s and 1980s. Although MBR's capital and operational costs exceed the costs of conventional processes, due to

better understanding of emerging contaminantsin wastewater, their biodegradability, and with their inclusion in new regulations, MBR may become a necessary upgrade of existing technology in order to fulfill the legal requirements in wastewater treatment plants (WWTPs). Membrane separation technology is a novel and highly innovative process engineering operation. Membrane processes exist for most of the fluid separations encountered in industry.

II. RELATED WORK

Waste water treatment is a process used to convert waste water which is water no longer needs or suitable for its most recent use into an effluent that can be either returned to water cycle with minimal environmental issues or reused. Waste water treatment plant consists of number of processes such as primary treatment, secondary treatment and tertiary treatment.
There are various process involved in membrane technology as follow :

Membrane process	Function
1.microfiltration	Removal of turbidity, some bacteria and viruses
2.ultrafiltration	Removal of macromolecules , colloids.
3.nanofiltration	Removal of small molecules
4.reverse osmosis	Removal of color,hardness
5.diaysis	Removal of proteins,macromolecules
6.electrodialysis	Lionized salt ions

The objectives of the membrane bio reactor are given below:

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1.80% of treated water is guided in to a river , or lake from the WWTP. That water is reused after processing if the secondary treatment is done by MBR process.
2.The output effluent of the MBR has higher quality in all parameters of pollution control norms. So that water is successfully reused in flushing , bathing , irrigation ,industry etc , providing water conservation and economical.
3.A perfect technology for draught areas (i.e., Middle-east), where reclaimed wastewater should be reused for various purposes to preserve water sources.
4.To get Excellent effluent quality in terms of turbidity ,hardness ,BOD, coliforms ,virus reduction. After treatment water characteristics are show below which are the parameters for reusable water
5.To reduce the footprint of treatment plant also to reduce volume of tanks.
6.To Reduce the amount of sludge produced
7.To get speedy filtration and hence more amount of water to be treated compare to conventional UASB process

III. **LITERATURE REVIEW**

1 .Sewage/Wastewater Treatment Literature Review
The main goal of sewage/wastewater treatment is to protect the environment, socio economic and public health fromthe pollutants. Based on the substances of the wastewater ,it is advised to consider which kind of treatment(Preliminary, Primary, secondary or Tertiary)should be used before the ultimate disposal. Dying the nature of wastewater is essential for designing a suitable process and operation. Sewerage networks also play an enormous role in the treatment process, which should be designed and constructed under scientific circumstances and factors. In summary, the science of sewage/wastewater treatment has developed dramatically, and as a result the number of patients who arising from infectious diseases has dropped significantly. Unfortunately, in contrary to this, the amount of wastes which are being produced have increased too, and so the government should provide the most beneficial environment for engineers to design a proper sewage/wastewater treatment as such concepts in society allow for further progress to take place in multiple ends. The imperative factor of wastewater treatment is its capability to create a system prescient in making vast changes and this can be observed through assessing the fact being that every 30 seconds a child dies from the usage of polluted water.

2.The Application of a Membrane Bioreactor for Wastewater Treatment on a Northern Manitoban Aboriginal Community By Kristinn Cameron Frederickson Membrane bioreactor (MBR) technology is advancing rapidly around the world both in research and commercial applications. Despite the increasing number of studies and full-scale applications of MBR systems, directions and trends in academic research as well as commercial developments require further analysis. This paper aims to critically characterize and review worldwide academic research efforts in the areajournals from 1991 to 2004 and a total of 258 full-scale MBR installations of MBRs as well as focus attention to commercial MBR applications in North America. A total of 339 research papers published in peer-reviewed international in North America were used as the database for the analysis provided in this paper. After a surge of MBR publications in 2002, research appears to have reached a plateau in the last 3 years using both submerged and external MBR units. Although much of the pioneering research occurred in Japan, France and the UK, countries such as South Korea, China and Germany have significantly contributed to the research pool in the last 5 years. The primary research focus has been on water filtration MBRs with limited growth in extractive and gas diffusion MBRs which still hold un-tapped potential. Fundamental aspects studied in academic research predominantly involve issues related to fouling, microbial characterization and optimizing operational performance.Research in North America presents a unique picture as a higher ratio of industrial wastewater treatment and side-stream MBR applications have been studied compared to other parts of the world. For MBR commercial application, the North America installations constitute about 11% of worldwide installations. Zenon occupies the majority of the MBR market in North America, whereas Kubota and Mitsubishi-Rayon have a larger number of installations in other parts of the world. Due to more stringent regulations and water reuse strategies, it is expected that a significant increase in MBR plant capacity and widening of application areas will occur in the future. Potential application areas include nitrate removal in drinking water treatment, removal of endocrine disrupting compounds from water and wastewater streams, enhancing bio-fuels production via membrane assisted fermentation and gas extraction and purification MBRs.

IV. **METHODOLOGY**

Membrane separation technology is a novel and highly innovative process engineering operation. Membrane processes exist for most of the fluid separations encountered in industry. The most widely used are membrane ultrafiltration and

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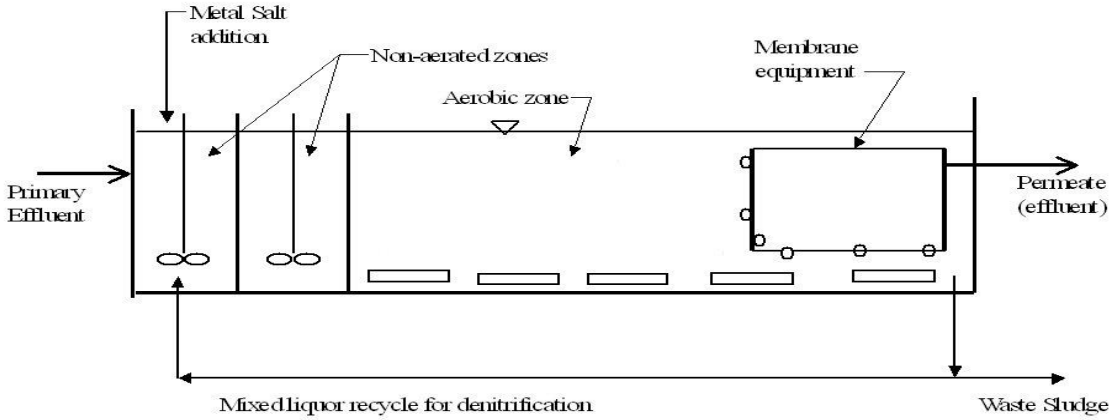
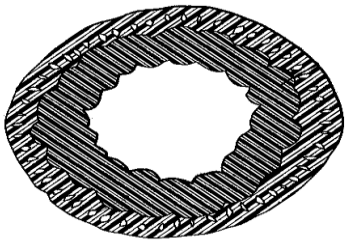
microfiltration, pressure driven processes which are capable of separating particles in the approximate size ranges of 1 to 100 nm and 0.1 to 10 pm, respectively

The Basic diagram for the membrane process is as given below



Basic details about membrane reactor :
1.Membrane reactor consists of number of cassettes.
2.The each cassette having 64 elements/modules consist 2646 fibers of dia 0.04micro.
3.The flat sheets are provided below each cassettes of size 1*2



Typical MBR effluent quality :

BOD	< 2.0 mg/L
Total suspended solids	< 2.0 mg/L
NH3-N	< 1.0 mg/L (with nitrifying MBRs)
Total Phosphorus	< 0.1 mg/L (with inclusion of anaerobic)
Total Nitrogen	< 3-10 mg/L (with inclusion of denitrification)
SDI(silt Density index)	< 3.0
Turbidity	< 0.5 NTU
Total Coliforms	< 100 cfu/100 mL
Fecal Coliforms	< 10 cfu/100 mL
Virus Reduction	< 4 log removal

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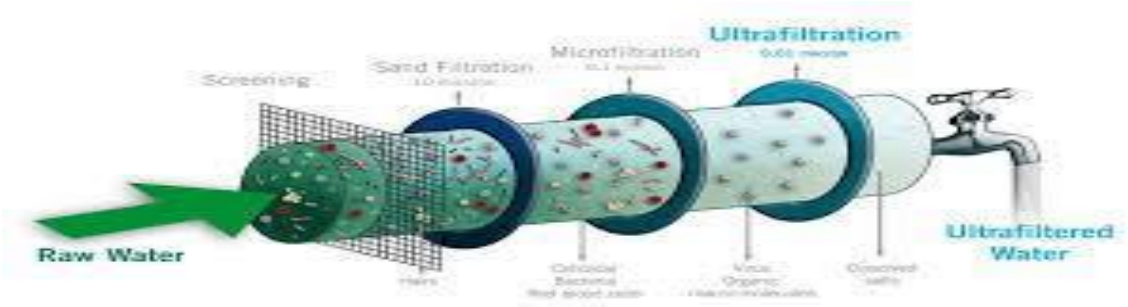

V.EXPERIMENTAL RESULT

The most widely used process is ultra filtration in membrane bio reactor to purify the waste water .
The software which is used to design the different process of membrane is c++ program.
The design of the whole membrane reactor is as per the dimension of Bamroli waste water treatment of surat.

```
#include<stdio.h>
#include<conio.h>
void main()
{
float kw=(1.5*0.000001),psi,Qp,fw,A,E,B=6773.76;
clrscr();
printf("Enter value of discharge = ");
scanf("%f",&Qp);
printf("\n Enter value of pressure differance = ");
scanf("%f",&psi); fw=(kw*psi*6.895);
printf("\n value of Fw = %f",fw);
A=((Qp/fw)*1000.0);
printf("\n total area = %f",A);
E=A/B;
printf("\n total elements in each cassets = %f",E);
getch(); }
```

The design of ultra filtration in C++ program is given below:

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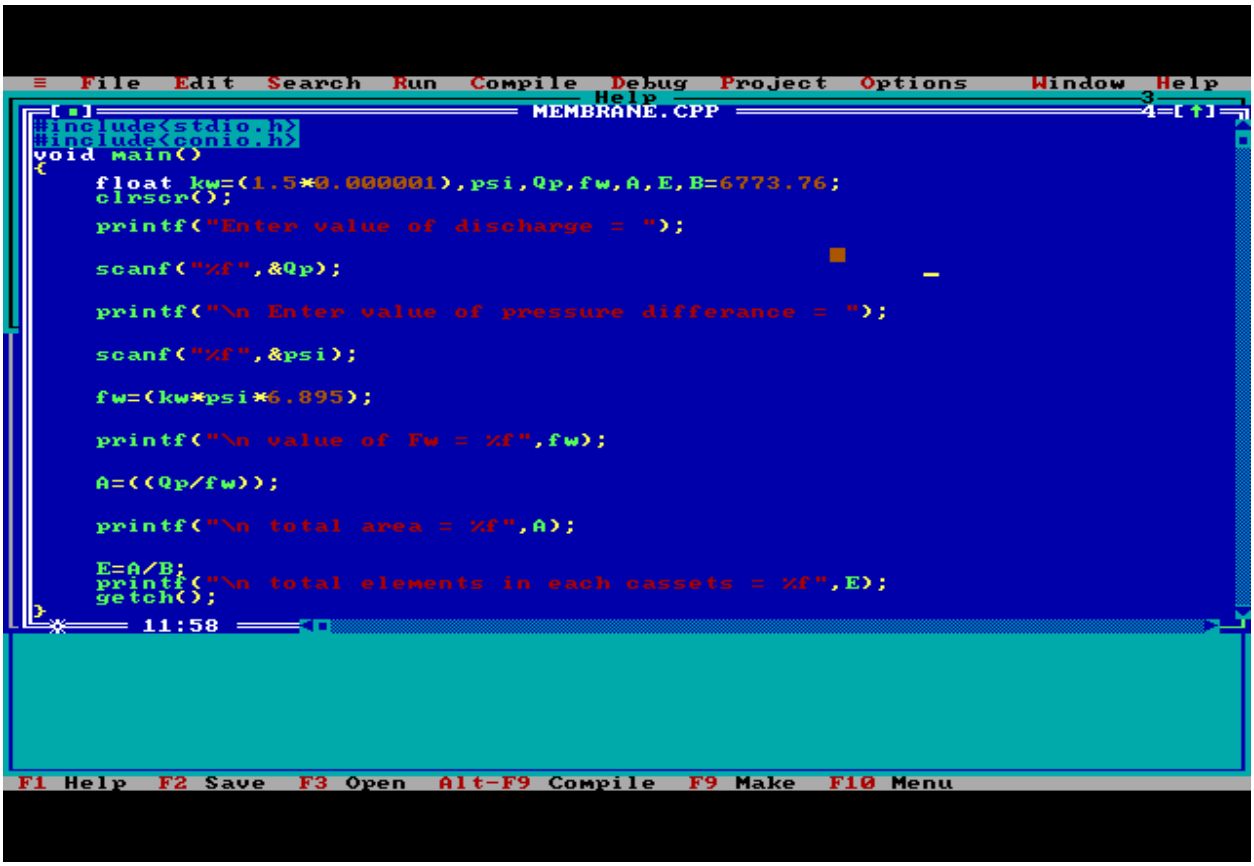

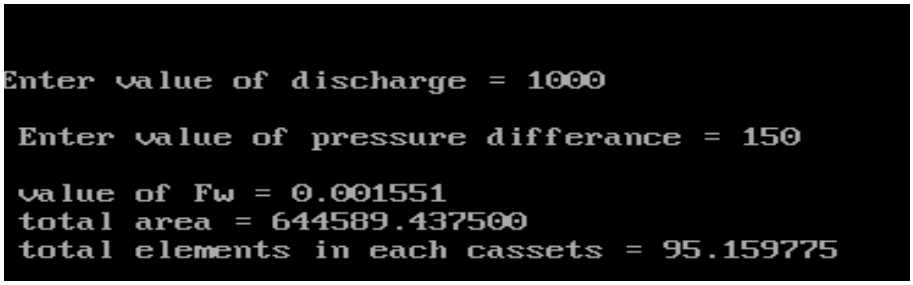

As per the calculation , with change in the discharge and the pressure difference the total required has changed with those cassettes may changed.

Disadvantages of the membrane :

1.However the development of MBRs has been limited by problems of membrane fouling during filtration of activated sludge. Membrane fouling is the most serious problem affecting system performance.

2.Various techniques are used to reduce fouling. Basically fouling of membranes in MBR systems can be minimized by a reduction of flux, periodical application of cleaning measures to remove the layers of foulants.

Maintenance :

The cleaning of membrane reactor is mainly on weekly basis around 30-60mins and the filterations are no longer durable so cleaning of those occur twice or once in a year.

Alternative :

When the reactor is under maintenance work at that time alternative of membrane can be used to treat the water known as aerated lagoons.

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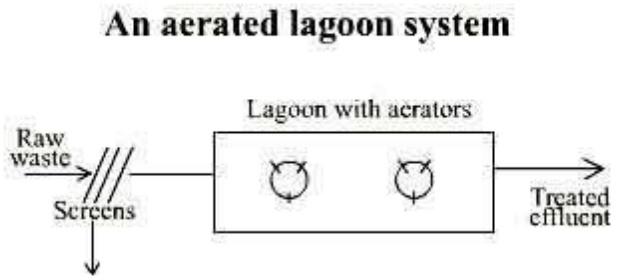
Aerated having smaller area with the depth of 2-5m with mechanical aerators on floats or fixed platforms.



V. CONCLUSION

The purified water is generated from the membrane bio reactor has the quality which is higher than the primary units.

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