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Nanofiltration Means (Reduced in Pollution, Water Consumption, and Win Money)

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Abstract— This paper portray the consequences and appurtenances of dairy farm process on the water sources and their characteristics, waste material sources, there treatment, and therefore the effects of nano-filtration in dairy farm plant per the waste material treatment, the effects on the value - Conjointly on the opposite hand its describes all the kinds of losses and the way to cut back it.

Index Terms— Nanofiltration, dairy plant, wastewater

I. INTRODUCTION

In dairy processing, there are many uses for water like "heating, cooling, washing, and cleanup". Approximately more than 4 liters of water are used in usual plants to produce each liter of milk. During a careful management, some of the productions processes have successfully minimized the water usage to 1 liter of water per liter of milk processed [1]. In the dairy system, water is used daily for sidewalks and clearing each truck, tank, pipe, and the surface at the factory from home and abroad. In these processes large amounts of this precious material is used. Also, the water used in the transactions should be hot. Also, chemicals should be added.

A tremendous amount of material left over from the production are formed up to (0.2 to 10 liters) / per liter of milk used in dairy farm factory. Water is used for the following purposes: balance, start, cut and rinse the juncture of the various units. The production flow contributes to a clear loss of dairy farms. At the global level, the water supply sources costs are rising and the expenses are increased. The process of water refining and filtered to become a way to offset the reliance on water, so the water resulting from the consumption of dairy farm factory can use completely different form of the membrane used to treat liquid waste to these farms consists of a single-stage or two-stage pattern [2].

The technology used for the operations mature membrane is being used on a large scale all over the planet. It's used in different applications as follows: water purification, food and liquid processing, medical applications, and also, high-value applications, separation of a few common quantities in the pharmaceutical industry. These applications differ from the way the membrane increase [3]. Most of the current membrane systems are used in dealing with contaminated disposal water streams. However, these examples do not focus on the total process advantages of membrane systems, because they usually ignore the prices of the method of water purification and disposal method, in other words:

- The offer cost;
- The value of preparation to method specification, e.i. chemical addition, de-ionization or softening;
- The value of the disposal - most of the liquid waste can take advantage of some of the trade as it includes a large part of the material that can be converted or recycled;
- The energy value - particularly if heating is needed (although this may be minimized by heat recovery).

The key part of a membrane separation system is that the membrane itself. There are large forms of varieties for various applications. In all, a drive is applied to force the permeate through the membrane. Many totally different configurations are accustomed the membrane house [4].

Filtration membranes are divided into four classes depending on the dimensions of parts within the feed resolution that's allowed the water to pass. With some overlap, the categorization, from largest to smallest permeates, is microfiltration, ultrafiltration, nano-filtration and reverse diffusion. All four are utilized in cross-flow configurations [3].

Membrane housings are usually standard thus also could be combined to provide a desired result. The housings give support and protection against operative pressures and daily wear and tear of a production setting. Plate-and-frame, spiral wound, cannula and hollow fiber systems are the foremost common configurations [2].

A. Advantages of Membrane filtration:

1. Applicable to a large vary of processes.
2. Physical method with few moving elements.
3. Straightforward connections and utility needs.
4. Will operate unceasingly or on demand.
5. Often no additives needed.
6. Products may be recovered in associate unchanged chemical type.
7. Equipment is standard and compact.
8. System may be scaled up or down simply and integrated with alternative treatment processes.
9. Membrane properties may be varied.
10. Can be used for single - or multistage separation.
11. Permeate quality typically freelance of feed stream concentrations.

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12. Physical medical aid performed mechanically.

B. Existing Technologies:

There is a proposal that the contraction of sewage from food origin is differed by the biological medical care. The use delirious waste as fertilizer in the ground in addition to the aerobic treatment of ponds and lakes depends on the used aerobic and anaerobic techniques. On the other hand, compensation anaerobic waste as an inexpensive, emerged as a viable and variety of equity the old pneumatic specifically for bulky wastewater.

Aerobic technique involves rotating biological contactors, activated sludge, trickling filtration, oxidization trench, and concatenation batch reactor and even controlled clammy lands. At present, the anaerobic technology is the technology of measurements rate high. In many cases each of aerobic and anaerobic technologies are combined in one treatment system. Anaerobic treatment is employed for removing organic matter in higher concentration streams, and aerobic treatment is utilized on lower concentration streams or as a sprucing step. In higher concentration streams anaerobic remedy were accustomed exclude the organic matter, whereas aerobic treatment is employed on lower concentration streams or as a sprucing step as well exclude the artifact organic matter and nutrients from the waste [5].

The aim of this paper is to demonstrate and explain the importance, advantage, and efficient use of nanofilteration membrane in zero discharge systems which mean no losses in the used water-gets benefits from the plant's waste, and changing it to money. This work is a part of continuous efforts in the Energy and Renewable Energies Technology Center to provide the Iraqi environment with green and friendly energies and products [9-47]

C. Difficulties of Approaching Bioremediation are:

The bioremediation suffers from:

- Problems in starting and restarting.
- Bio-mass segregation, sludge adjustment, frothing, and scum formation.
- Unstable process.
- Toxins.
- Forming huge Odors, also sludge production.
- Extravagant biomass generation.
- Elimination of N2, and phosphorus.
- Bio-degradation of lipid, oils, and flab.
- Eliminate color bodies.
- Extermination of disease.

II. Saving Money by Saving Water

To find out the amount of saved money in dairy plant by reducing water, let deem two factories A and B, and each one used about 75,000 liters of milk daily. The water price is about \$ 2.25 for each m^3 of water. In plant A, the used water to milk proportion is 1:1 while in plant B the ratio is 4:1liters. Figure (1) shows the costs of water and sewer for both A & B plants. Plant A savings about 225,000 liters/day according to plant B, and about \$184,781 yearly. Furthermore savings may be realized from minimizing the costs of heating the water, or sewer charges [1].

Biochemical oxygen demand (BOD) is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period. The period with BOD monitoring an activated sludge plant is that the result takes 5 days to come through. One kg of pollutants, within the style of BOD5, is straight away such as a 1 cubic decimeter of milk lost down the drain. If you knew BOD5 level in wastewater at the station can get the correct concepts rationally, so knows what quantity of the product and the lost money.

The amount of water used and raised, the volume of waste, the production capacity of the plant are considered strong indicators on the efficiency and the quality and level of factory [6, 7].

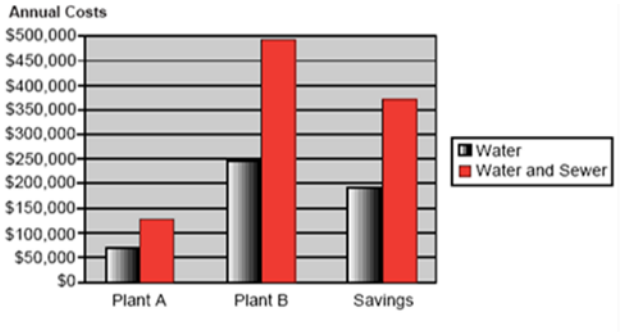

Figure 1. Example water and sewer cost and savings.

Table 1 Wastewater Characteristics of Dairy

Parameter (MG/it)	Milk Processing	Integrated Dairy	Chilling Plant
BOD	657-1016	1634-4953	55-5034
COD	1341-2195	3800-8631	121-6877
Suspended solids	538-657	89-4953	36-899
Nitrogen	50.25	96.32	49.25-72.5
Fat	-	100-6070	-
Phosphorus	2.6-4.8	0.3-0.8	0.14-0.2
Chloride	-	104	-
pH	6.6-6.9	5.6-6.8	2.9-10.7
Oil & Grease	-	280-2207	5-176

Technology is very attractive in the dairy processing because they do not need to be urged to get rid of the water, as it will not consume a lot of energy compared with the condensers or evaporators and involve measures to reduce waste as [5]:

- Diminution of water.
- Minimize the chemicals or mineral salts like, potassium in place of sodium compounds.
- Re-cycling and recovering the raw materials, Chemicals and water.
- Re-processing of off-spec material.

A. Waste Sources

The milk and dairy products create effects in both the nature and concentration of the dairy industry waste. The amount lost

during the production processes depends on operational factors, as [15-23]:

-The vary of technique technologies in use
- The convenience of adequate technique observation, and plant and procedure alarms/interlocks
- The convenience of automatic operation – notably automatic clean-in-place (CIP) systems and procedures.
- Management grade, operator adherence.
-Equipment maintenance routine grade.

B. Losses varieties

Utmost computing machine losses come from the activities connecting with liquid handling and, to a lesser extent, with the discharge of air and solid waste. The losses avert are:

1. Valves leaky, pipelines and or the other fittings – the quantity lost will not be gained; however, the load pollution is to huge boot processes [24].
2. Overflows return off, weak handling procedures that occur over a brief time however the quantity and so the high concentration of milk or product lost is to boot a large increase among the pollution load [9-19]
3. Improvement and technique losses throughout operation of plant and instrumentality include the deliberate discharge of unwanted materials like whey, and diluted product [23-27].

III. Environmental effects on water

A. The Organic components

The organic components (like bacteria) of the farm stuff classified to (proteins, oligosaccharide Associate in Nursing fat) that have an impact on among the atmosphere by alternative ways that in line with their biodegradability associate degree solubility [28, 29].

(a) River substance Levels and BOD5

In waterways the bio-degradation expends oxygen as in this equation:

$$O_2 + \text{Organic Material} \rightarrow CO_2 + H_2O + \text{Bacteria}$$

The amount of O_2 that utilized by organism to mould the waste throw 5 days period at 20ºC, the BOD5 and so the chemical O2 demand (COD), which measured by the waste digesting with boiling acid and salt at intervals in the presence of a catalyst. Then, the result is expressed as O_2 equivalents. COD and BOD5 switch to carbon dioxide and water as they state the organic material, but with the BOD5, it takes a glance at an area of the organic matter that is changed to new organism cells [30].

In the water course, the concentration of O_2, which is settled for the number of O_2 that consumed by microorganisms to boot the speed of reiteration from the atmosphere. Soluble O_2 is prop fish and else aquatic organisms, so, the soluble O_2 concentrations supported the potential of good fish kind to survive. The emptying to the water course mustn't increase water course BOD5 by quite 3 g/m^3 [31-35].

(b) Waste matter vegetation

Low mass organic compounds raise the evolution of certain skinny ooze in waterways. This organism constitution unit named as waste matter vegetation. This unit is to be used with two main borders in a day:-.

(i) BOD5 concentration ought to be not more 2 g/m^3.

(ii) Component BOD5 with a mass ought to be one g/m^3.

Sewage vegetation growth has been related to oligosaccharide concentrations in rivers by below equation that accustomed prophecy the extent of waste matter vegetation growth in associate extremely receiving waterway:

$$\text{Growth/g m}^{-2} = 0.333 + 2.479 \text{ m (lactose)/g/m}^3$$

(c) Color and murkiness

Particulate elements in the waste have a great role in the wastewater color change. Causing brownish water and change its color to a dark color or murkiness.

B. Inorganic elements

(a) Phosphorus & element.

Proteins that are the basis of the organic component recovered from the water and wastewater to reborn into marketable goods. The proteins elements are transformed by being to associate in nursing inorganic forms like ammonia, ammonium, radical and nitrate ions. Those forms have altogether totally different environmental effects on humans and ethereal. Nitrate ions unit nephrotoxic at high level affect the young child where nitrate modify to point out into too radical kind, absorbed into the blood and convert hemoglobin to methaemoglobin which an able to carry elements [36].

The condition of methaemoglobinaemia affects infants up to six months in age. As a result, they lack the obligatory catalyst to convert the methaemoglobin back to compound protein. Several conditions must be prepared to avoid wasting lots of humans an equivalent previous limit ought to be relating to 10 g m-3 of nitrate-nitrogen cultivate nutrients [37].

(b) pH

In waterways several methods must be used to avoid wasting lots of aquatic life, pH square measure [6 – 8].

(c) Temperature

Most hydrated ecosystems unit prone to the temperature that's a really necessary to provides water to be used for drinking uses and not alter the natural temperature of a waterway higher than 1-2 degrees [38, 39].

VI. Effects on the atmosphere

Throughout operations some types of emissions are released to the atmosphere.

A. *Gaseous Emissions*

Boiler emits gaseous pollutants to the atmosphere, from these gases (carbon compound, sulfur oxides and element oxides). The aliphatic compounds were discharged from anaerobic waste treatment but inhalation general an aesthetic were discharged from the soil. Apart of these gases cause the greenhouse phenomena, the mandatory gases unit (nitrous compound, aliphatic compound and Carbon dioxide) [40-45].

B. *Dust/Odors*

Powder dryers' boiler emits particulate matters normally, and if the operational unit in high buildings and the building coated with mud, such particles are undesirable, as it may cause solvents, corrosive and foul odors.

C. *Visual Effects*

Because of the smoke and steam plumes from factories, the Resource Management Act is required. As a result, its agricultural environments could be as a sort of visual pollution [46-47].

V. Value of Water

To understand and appreciate the value of water, it is essential that the costs relating to the limitation of $ 1.10 (1000 liters) to be delivered to the house by the water transport network in the municipalities. This amount includes service charges, riders rate, fees and waste land fees, taxes and other handling, and this is the majority of private housing final value of the water, the water bill and added a tenth of one cent per liter of water.

Table 2 shows the 1000L of different liquids and costs of these examples show the difference between connecting water to homes through a pipeline network for the municipalities compared with many different consumables completely. The big difference between the price of water and these consumables is what encourages the tendency is often to extravagance as a result. Clean and safe water that supplies our home involves a fancy system of filtering, processing, and distribution that nearly all the people holding the granting [8].

Table 2: Cost of one cubic meter of various liquids [8]

One 355 ml can if Coca Cola (on sale) =$0.25	One cubic meter of Coca Cola=$700.00
One liter of skim milk =$0.88	One cubic meter of skim milk = $880
One medium cup of Tim Hortons coffee =$1.14	One cubic meter of Tim Hortons coffee =$ 3800
One liter of regular gasoline (current price=$0.70)	One cubic meter of regular gasoline (current price=$700.00)
One liter of bottled water (average price=$2.00)	One cubic meter of bottled water (average price=$2000)

IV. CONCLUSION

Widely NF used membrane method for water and waste product treatment additionally to alternative applications like 1- cut back capital and in operation prices and energy demand. 2- Treating and recycling produced water for agriculture and irrigation uses are at early stages of research and development in the world.3- Reduce the volumes of waste effluent from water, 4- Recycle and harvest valuable components from the effluent waste, where its application is increasing plays an important role to partially replace commercially Water treatment and desalination technologies.

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