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INVENTIVE PROCESS FOR MANUFACTURING OF BIOFUEL FROM FOOD INDUSTRY WASTE WATER USING MEMBRANE TECHNOLOGY

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Abstract: *The objective of this study is to assess the feasibility of using a laboratory scale Reverse Osmosis (RO) system for treatment of food industry waste water (Case Study: potato- chips industry wastewater). Potato processing manufactures produce deep-frozen chipped potatoes, potato crisps, puree, starch and starch products. These industries use large amounts of water and therefore produce great quantities of liquid waste. The wastewaters from these industries contain high concentrations of organic materials like starch and proteins, and are therefore very prone to fermentation and frothing. Therefore, the potato-processing wastewater is considered as a very good material for the study. Future studies should be the membrane processes appear to be an effective alternative to traditional biochemical wastewater treatments for reducing the environmental impact and improving the efficiency and recovery in the potato processing industry.*

Keywords: *Semisolid, Infant's, Steeping, Kilning, Malt, Alpha-Amylase, Yield.*

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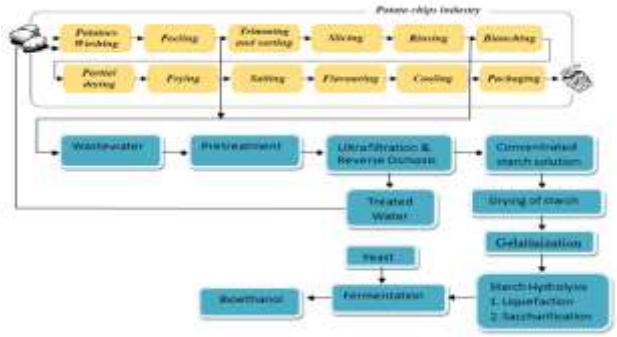
INTRODUCTION

Wastewaters discharged by industrial operations are in some cases among the worst sources of water resource pollution. Although the nature of the pollutants associated with these wastewaters differs greatly from one industry to another, in almost all cases the problems are caused by one or a combination of the following conditions in the wastewater: high Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD), high concentration of suspended solids and / or presence of toxic substances.

Wastewater has been a challenge for the potato processing industry for many years. Potato-processing manufactures produce deep-frozen chipped potatoes, potato crisps, French fries, puree, starch and starch products. The wastewater effluent with high concentration of potassium and chemical oxygen demand (COD) caused by the presence of starch, protein, amino acids and sugars. However this waste effluent contains high amounts of valuable by-products. Starch content of this waste stream that range from 15 to20% is being recovered. Whenever a cut is made in a potato, starch is released. The more cuts that are made, the more starch is released.

Advances in membranes technology have showed many advantages for wastewater treatment of food industry. By implementing membranes, the separated substances and clean water are often recoverable in a chemically unchanged form and are therefore easily re-used. Maximum benefits are obtained when one or both the output streams from the membrane system are recycled or re-used, thereby reducing process materials requirement and minimizing waste disposal costs. The potato chips manufacturing process is as given below.

OVERALL PROCESS:-



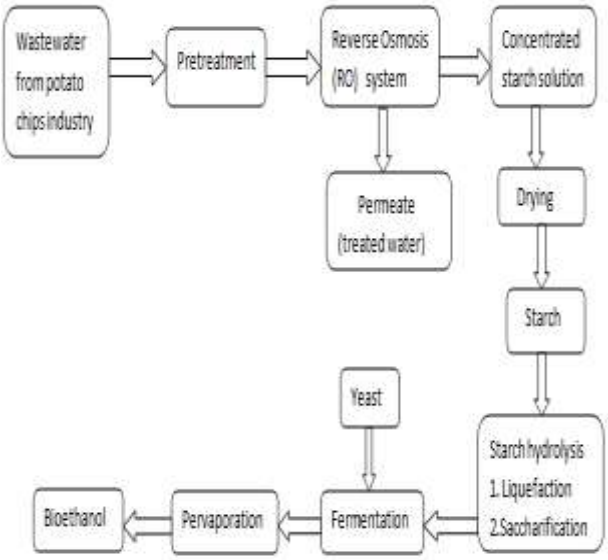


Fig:1 Flowchart of overall process

MEMBRANE PERVAPORATION SYSTEM:

'Polytetrafluoroethylene (PTFE) membrane is used. With the use of pervaporation technique, water from ethanol, can be removed effectively and ethanol concentration & Purification is achieved, this reduces the downstream processing costs .

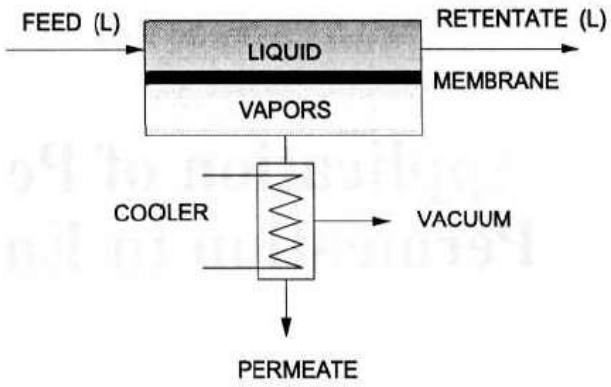


Fig. 2 Schematic of Membrane Pervaporation System

RESULT :

A solution for the recovery of starch in food industry wastewaters resulted at potato washing for chips, snacks or fries production is proposed. The water obtained at washing after peeling

and cutting into slices are sent to sedimentation tank (Sedimentation is a physical water treatment process using gravity to remove suspended solids from water) where large amount of starch is settle down this starch is sent for sun drying & we get a starch powder, the remaining water from sedimentation tank is sent to reverse osmosis (Membrane Treatment Process) for further recovery of starch & clean the waste water for reuse for different operation in plant. TDS of the waste water is change from 1110 to 37 after passing through RO system. The waste water from food industry analysed and a large quantity of organic compounds (around 6334 mg KMnO4), starch (1.64%) and protein (0.6%) is found. No pathogenic microorganisms are found.

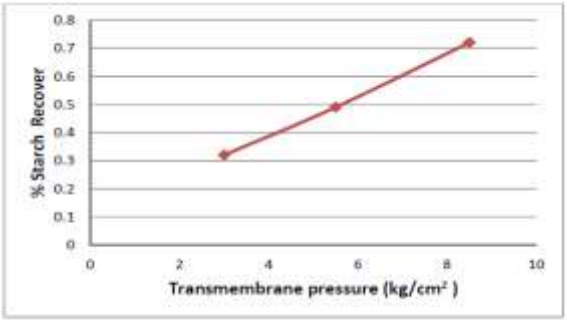


Fig.3: Percent starch recover vs transmembrane pressure.

Above graph shows that starch recovery increases as transmembrane pressure increases. At feed pressure of 5 kg/cm^2 where transmembrane pressure was 3 kg/cm^2 ,0.32% starch was recovered. As feed pressure increase, more dissolved solid molecule get rejected and hence starch recovery rate increases.

ACID HYDROLYSIS:

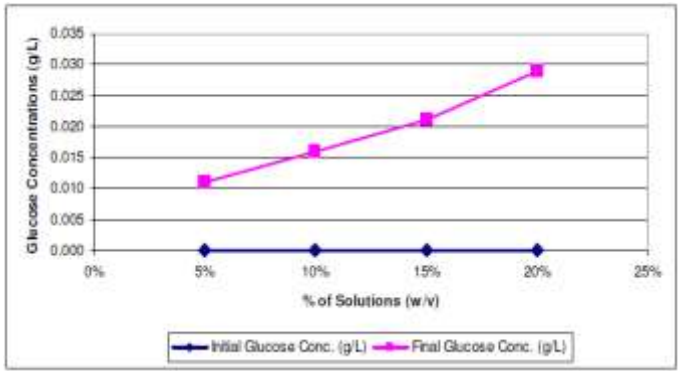


Figure 4. Glucose release from waste potato mash as a result of acid hydrolysis at 121°C for 1 h.

The maximum ethanol yield was with a 90% conversion of sugar. In this study, the glucose concentration obtained by acid hydrolysis was very low for ethanol fermentation.

HYDROLYSIS OF STARCH:

Hydrolysis of starch for converting the starch into glucose was done by enzymatic hydrolysis. Suitable starch concentration is important for getting the highest production of glucose. Therefore, different potato starch concentration (5%, 10%, 15%, 20%, 25% and 30%) was prepared in distilled water.

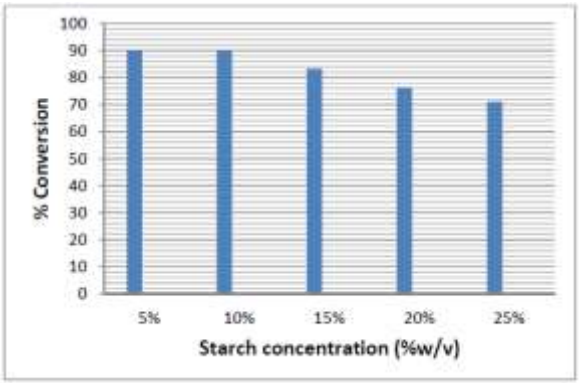


Fig. 5: Comparison of Glucose concentration produced from potato starch

From the above graph it was found that up to 10% (starch concentration) the conversion of glucose is 90%. After 10% starch solution, glucose production was found to decrease because of less production of free glucose for incomplete saccharification of starch. Low concentration of glucose provided a low yield of bioethanol. Hence it is beneficial to use 10% starch solution as a feedstock for biofuel production.

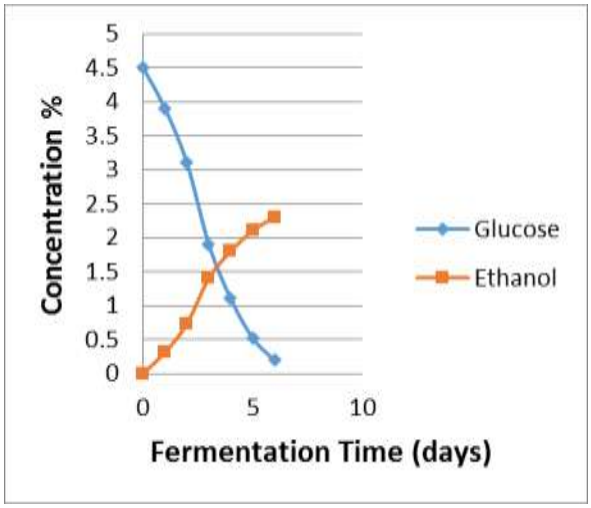


Fig 6: Glucose concentration and ethanol concentration the fermentation period for 5% starch solution.

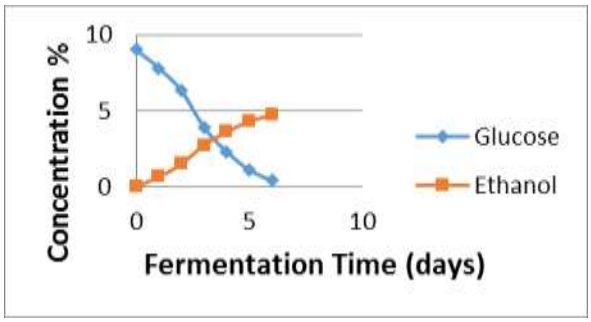


Fig.7: Glucose concentration and ethanol concentration with fermentation period for 10% starch solution.

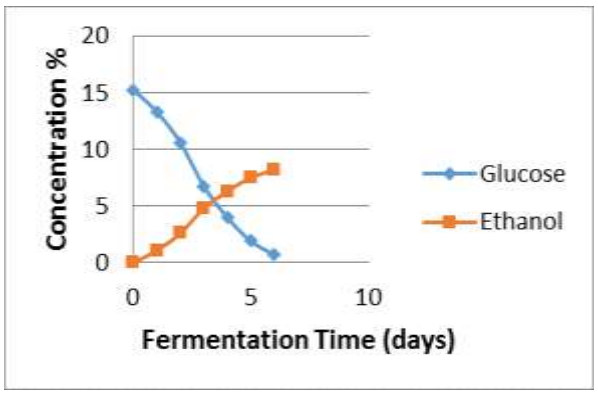


Fig:8 Glucose concentration and ethanol concen-tration with fermentation period for 20% starch solution.

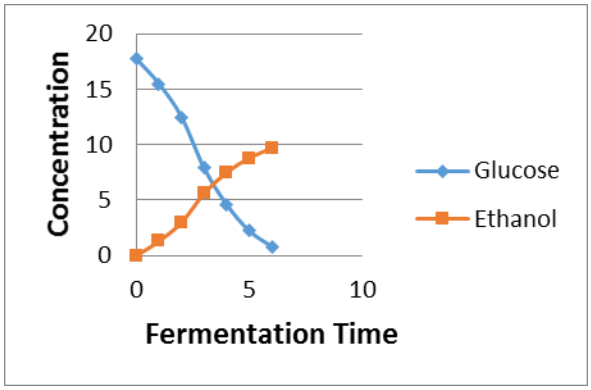


Fig:9 Glucose concentration and ethanol concentration with fermentation period for 25% starch solution

The above Graphs shows that as fermentation time increases glucose concentration decrease & by increasing Glucose concentration bioethanol concentration increases.

CONCLUSIONS:

1. This research successfully demonstrated that waste water from Food Industry can be used for ethanol production by *Saccharomyces cerevisiae*.

2. 95% starch present in food industry waste water is separated by Sedimentation Process. & remaining water present in sedimentation tank is passing through RO System were TDS is changing from 1110 to 37 and also recovered 5% starch.

3. As feed pressure increase, more dissolved solid molecule get rejected and hence starch recovery rate increases.

4. the glucose concentration obtained by acid hydrolysis was very low for ethanol fermentation.

5. It was found that up to 10% (starch concentration) the conversion of glucose is 90%. After 10% starch solution, glucose production was found to decrease because of less production of free glucose for incomplete saccharification of starch.

6. From this work it is clearly indicated that waste water from food industry can be an effective fermentation medium for production of ethanol under conditions of. In order to improve starch hydrolysis and fermentation conditions and decrease the cost of ethanol.

7. by using Membrane pervaporation system 99.99% purity of ethanol is achieved.

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