Abstract—Substitute the excessive use of conventional fuels with biofuel.

Keywords—Water hyacinth; Ethanol; Batch fermentation and hydrolysis

I INTRODUCTION

Water hyacinth is a troublesome aquatic weed and has spread in almost all lakes, ponds and rivers and therefore attention has been focused on its environmental impacts, since its increasing growth in water bodies creates problems for both mankind and aquatic life. This water hyacinth can be used to produce ethanol as a by-product, and this is pre-treated with different concentration of sulphuric acid, detoxified with CaOH and NaOH and then fermented [1]. Batch fermentation and hydrolysis simultaneously to be performed and ethanol is to be produced. With rapidly growing industrial development creating a need for environmentally sustainable energy source, ethanol from biomass is a better option. Ethanol being an attractive sustainable energy source for transportation and other uses can be a substitute for present day fuel consumption.

OBJECTIVES

• To substitute the excessive use of conventional fuels this is a non-renewable resource.

• To reduce the troublesome pollutant aquatic weeds so as to stabilize the amount of dissolved oxygen and to improve quality of aquatic life by converting it as a biofuel.

• To reduce the amount of carbon emissions evolving from the usage of fuels.

• To stabilize the excessive use of renewable resources.

• To rectify the economical imbalance in the availability and demand of fossil fuels.

II BENEFIT OF THE PROJECT

Economical and societal development has driven the demand for alternative energy sources. Fossil fuels are still the dominant sources of energy, but they cannot support the global energy demand due to inherent defects such as non-renewability and atmospheric carbon emissions [1]. These issues have taken a step towards sustainable energy sources. Among various options, biofuel produced from biomass appears to be a feasible alternative energy source. The extraction of ethanol from water hyacinth, which is a rapidly growing unwanted aquatic weed which depletes the amount of dissolved oxygen and affects the aquatic life, is a sustainable solution.

Major advantages of this method are:

1. End-product inhibition of the hydrolysis can be avoided.

2. Risk of contamination is reduced

3. Product yield is increased.

Micro-organism used in fermentation process is yeast which has the ability to utilize sucrose, glucose and fructose and hence ethanol is distilled at a certain temperature.

Ethanol has more advantages over the market gasoline:

(1) Ethanol is a renewable fuel

(2) Ethanol has the high-octane number

(3) Ethanol is less toxic than gasoline

(4) Ethanol burn reduces the greenhouse-gas emissions significantly

(5) Ethanol provides more oxygen in the combustion process, which assists in complete burning.

Economical and societal development has driven the demand for alternative energy sources. Fossil fuels are still the dominant sources of energy, but they cannot support the global energy demand due to inherent defects such as non-renewability and atmospheric carbon emissions [2]. These issues have taken a step toward sustainable energy sources. Among various options, biofuel produced from biomass appears to be a feasible alternative energy source. The extraction of ethanol from water hyacinth, which is a rapidly growing unwanted aquatic weed which depletes the amount of dissolved oxygen and affects the aquatic life, is a sustainable solution.
III METHODOLOGY

Biomass is collected and transported to the processing area. It undergoes a pre-treatment process so that the components of the biomass are easier to breakdown with enzymes. These added enzymes perform a chemical reaction called hydrolysis. During this process, enzymes break the cellulose chains into glucose and hemicellulose into xylose. Glucose and xylose are the sugars that can be readily fermented to ethanol or other biofuel. During the fermentation process, the mixture is inoculated with microbes such as yeast or bacteria that digest the sugar and secrete the compounds that can be used as biofuel components. Total conversion takes place in 3 to 5 days here the ethanol is separated using distillation. The resulting ethanol is collected and purified for the use in blending with fuels.

Table 1.1: Content in Water Hyacinth [2]

<table>
<thead>
<tr>
<th>Organ</th>
<th>Cellulose</th>
<th>Hemicellulose</th>
<th>Lignin</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf</td>
<td>15.42</td>
<td>29.75</td>
<td>9.79</td>
<td>45.04</td>
</tr>
<tr>
<td>Stem</td>
<td>17.14</td>
<td>21.82</td>
<td>8.01</td>
<td>53.03</td>
</tr>
<tr>
<td>Whole</td>
<td>18.07</td>
<td>28.21</td>
<td>7.03</td>
<td>46.69</td>
</tr>
</tbody>
</table>

3.1 CHEMICALS, REAGENTS AND MICROORGANISMS

Water hyacinth, sulphuric acid (10%), whatmann filter paper No.1, CaOH, NaOH, microorganism yeast are Microorganisms Chemicals and Reagents that are used in the process [4].

3.2 PREPARATION OF WATER HYACINTH

Fresh water hyacinth with long stem is used for the experiment. The water hyacinth must be washed thoroughly for several times with tap water to remove adhering dirt, and then chopped into small pieces (2–2.5 cm), blended to small particles (4–5 mm) and finally dried in a hot air oven at 100–105 °C for 5–6 hour. The dried material needs to be stored at room temperature until used.

3.3 PRE TREATMENT

Water hyacinth needs to be hydrolyzed using different acids to produce xylose, glucose, and acetic acid by the splitting of the linkages of glucose or xylose monomers, acetyl groups [5]. Diluted acid process has to be conducted under temperatures of 120–200°C and pressures of 103 kPa to 517 kPa, and have reaction times in the range of 30 min to 2 hour by continuous processes. The concentrated acid in the processes is used for producing higher yield of sugar. This process typically involves the use of 10 -20% concentration sulphuric acid, mild temperatures, and moderate pressures. The advantage of the concentrated acid in the process is to improve the efficiency of the sugar recovery or production. After pre-treatment, it is autoclaved at a temperature of 121 °C for 10 -20 min. The mixture is then cooled at room temperature for few minutes and filtered using whatman filter paper and the hydrolysate is separated.

3.4 DETOXIFICATION OF ACID HYDROLYSATE

Acid hydrolysate was heated to 50°C for 15 min to reduce the volatile components concentrations. The 100ml calcium hydroxide was added to the hydrolysate and is constantly stirred for 10-20 min in order to detoxify harmful materials presented in the hydrolysate. Then it is filtered through whatman filter paper inorder to remove calcium sulphate as sludge [6]. Addition of calcium hydroxide to the acid hydrolysate to increased and it is adjusted and controlled by using 10ml NaOH.
3.5 FERMENTATION
Fermentation is a metabolic process that produces chemical changes in organic substrate through the action of enzymes. In biochemistry it is narrowly defined as extraction of energy from carbohydrates in the absence of oxygen. Here pH value of the pre-treated water hyacinth has been increased from 1 to 10 this is done for the feasibility of yeast for its generation and replication. Then add 10 gm. of yeast to this pre-treated water hyacinth. Yeast contains the enzyme catalyst. After the addition of yeast it takes 2 hours to adapt to the surrounding condition and it starts the conversion of glucose and xylose present in the pretreated water hyacinth into ethanol within 2-16 hours of activity period.

3.7 DISTILLATION
Distillation is the process of separating the components from a liquid mix by using selective boiling point and condensation. This may be complete separation or partial separation, which could increase the components in the mixture. The distillation setup consist of heating mantle, condenser, round bottom flask, conical flask, bent tubes. First we fill 3/4th of our conical flask with hydrosylate and place it in the heating mantle with 70-80°C setup, for the distilled product to be ethanol [6]. The distillation process takes up 1 hour for the distillation to take place. Hence distilled ethanol is produced.

IV IDENTIFICATION TESTS FOR ETHANOL

The laboratory tests that are used to identify the presence of ethanol are given below:

1. **Smell Test**: Ethanol react with ethanoic acid in the presence of few drops of concentrated sulphuric acid, it produces ethyl ethanoate, sweet smelling ester.

2. **Miscibility**: Ethanol is completely miscible with water at all ratios.

3. **Boiling point**: 78 °C

4. **pH**: Ethanol is a neutral compound and does not change the colour of litmus paper.

5. **Specific gravity**: 0.7893 at 20°C (Absolute) and 0.8096 at 25°C (94.9% by volume)

6. **Flame Test**
Transfer about 5 ml ethanol to a large test tube, add a boiling chip, hold with a test tube holder and heat until the liquid is boiling. Hold the open end of the test tube to the flame and ignite the ethanol vapors. Ethanol burns with a pale blue flame with no smoke.

7. **Ceric ammonium nitrate test**
Reagent: 0.4 g ceric ammonium nitrate in 2M nitric acid. Dilute 1:2 in water. Procedure: To 1 mL of the ceric ammonium nitrate reagent, add 5 drops of ethanol and mix thoroughly. The yellow colour of the reagent changes to red.

8. **Iodine Test**
   - Add 25 drops of iodine solution.
   - Add 10 drops of sodium hydroxide solution.
   - Gently swirl the test-tube a few times. The dark colour of the iodine should start to fade.

The solution in the test-tube becomes cloudy and a yellow precipitate of triiodomethane (iodoform) is seen in case there is presence of ethanol. It has an antiseptic smell. In case of presence of methanol solution remains clear.

FIGURE 4: DISTILLED ETHANOL

V RESULTS AND DISCUSSION

Water Hyacinth is one of the worst weeds causing the major problem to the aquatic ecosystem which is here being used as a source for bio ethanol production, where the cellulose portions of the herbs such as stem leaves root etc, are hydrolyzed into glucose sugar that are fermented to bio ethanol. Here we use simultaneous saccharification and fermentation (SSF), sulphuric treated with WH for both pretreatment and saccharification. Base solution such as CaOH and NaOH was used for Saccharification (hydrolysis) and baker’s yeast was used for fermentation. A number of methods were developed for this purpose – focusing on physical, chemical or biological processes. The parameters such as pH, time and enzyme concentrations were optimized. As per our project calculation 20g of dried water hyacinth is treated with chemicals which forms a solution of 200ml, produces approximately 80ml of ethanol. After distillation, the mixture may consist of ethanol and water. For obtaining pure ethanol distillations should be carried out for number of times at boiling point of 78°C. We also performed certain different tests which includes visibility, flame test, odour test and also performed certain chemical tests.
VI CONCLUSION

There are many ways of bio fuel production, but bio fuel from water hyacinth is one unique step where the energy input (water hyacinth) is less compared to the output product (biofuel). As his is the best way to produce biofuel as it does not involve any toxic elements or any such chemical mixtures. As the water hyacinth is abundantly available in nature and it keeps on regenerating so source is not an issue.

REFERENCES