PRODUCTION OF BIOETHANOL FROM AGAVE LEAVES USING MICROORGANISMS

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Introduction: The world’s present economy is highly dependent on various fossil energy sources such as oil, coal, natural gas, etc. These are being used for the production of fuel, electricity and other goods. Excessive consumption of fossil fuels results in the depletion of fossil fuels. Hence the discovery of renewable source is required. Ethanol is a simple alcohol which can replace fossil fuels, production of ethanol using biological source is one of trending concept in this 21st century.

Plant biomass is a source of chemical energy that can be converted to combustible transport fuels and biochemicals by fermentation or chemical conversion of plant-derived sugars. Currently, plant materials from farming-intensive food production systems, such as corn, wheat grain or cane sugar, are being used to make bioethanol and biochemicals. Agave is one of the plant which is independent from food chain, which can replace the crops in the food chain for the production of ethanol. Agave can also be former friendly scene it can be grown in dry and less water conditions.

Agave produces high yields of energy-rich biomass, and the sugar-rich stem tissue has traditionally been used to make alcoholic beverages. Agave leaves are fruit-like rich in moisture consists of soluble sugars, cellulose, non-cellulosic polysaccharides, lignin, acetate, protein and minerals. Since Agave juice sugar it can be fermented by using microorganisms to produce ethanol.

Objectives:
- To estimate the concentration of reducing sugar present in Agave juice
- Identification of organism which can produce maximum amount of ethanol by using the sugar content present in of the Agave juice
- Optimization of environmental conditions for the production of maximum amount ethanol.
- To estimate the amount of ethanol produced for every 12 hours.

Materials and method:
**Extraction of juice from Agave leaves:** The fresh Agave leaves were collected from the region of Chitradurga and Davangere. These leaves are washed and juice is extracted by pressing in a mill. This juice is autoclaved at 121°C for 20 min and then used for fermentation.

**Estimation of reducing sugar content in the juice:** The total concentration of reducing sugar in the juice is estimated using DNS (3,4-Dinitro Salicylic acid) method. The glucose is used as standard.

**Isolation of Yeast strain:** The yeast strain which can yield maximum ethanol is isolated from the jaggery waste.

**Fermentation:** The fermentation was carried out in a glass jars with a working volume of 100ml. The different concentration of Saccharomyces cerevisiae is inoculated into the sterile Agave juice and they are placed at 25°C in a dark place for fermentation. The amount of ethanol produced is estimated for every 12 hours using potassium dichromate method and further conformed by GC analysis.

Result and Conclusion:
- The percentage of reducing sugar in a sterile Agave juice is 2.1%
- Yeast strain is isolated from jaggery waste, isolated yeast strain is used for production of ethanol.
- The ethanol concentration for every 12 hours
<table>
<thead>
<tr>
<th>Time in hours</th>
<th>Concentration of Yeast cells used for production (%)</th>
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<tbody>
<tr>
<td></td>
<td>1g</td>
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<tr>
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<td>0.98</td>
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<td>1.9</td>
</tr>
<tr>
<td>60</td>
<td>2.2</td>
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Scope for future work:

- Instead of sugar agave leaves mainly contains cellulose (47%-50%) which can be used to produce ethanol using yeast cells.
- The microorganism which can produce cellulase enzymes can be isolated and used for pretreatment.
- Cellulase enzyme can be used to degrade cellulose into simple sugars, and finally these sugars can be fermented by yeast to produce ethanol.

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