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# DEPLOYMENT OF TRUCULENT SPECIES (*PROSOPIS JULIFLORA*) AS A SOURCE OF BIO ENERGY

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## ABSTRACT

Green fuel also known as biofuel which one is ecofriendly and sustainable resources of energy. This one is the vision for green future. *Prosopis juliflora* pods are easily obtain from arid and semi-arid region this plant species grows worldwide. Nearly India covered37% of the area by semi-arid zone. The aim of this study was to explore the prospects of *Prosopis juliflora* pods for bio-ethanol production and its solid waste for soil fertility. Parameters mainly sulphuric acid concentration taken (0.5 - 4 molar), hydrolysis times taken (5-35min), fermentation times taken in broad (6-72 hr.), fermentation temperature generally (25℃ - 40℃) and pH acidic to basic (4-8). Saccharomyces cerevisiae yeast also used in production of bio-ethanol for fermentation. Result evaluated that we obtained the high bioethanol at sulphuric acid concentration was 1.5 M (4.2 % v/v), fermentation time was 48 hour (5.1 % v/v), hydrolysis time was 20 min (5.60%v/v), fermentation temperature was 30℃ (5.60% v/v) and pH was 5 (5.9 % v/v). Sugar contains found at high (93 % v/v) when sulphuric acid concentration is 1.5M. Further that solid waste has more assess value because that solid waste of pods biomass uses as a fertilizer which one increases fertility of soil.

**Keywords:** ***Prosopis juliflora*****, Bio-ethanol, hydrolysis, fermentation, bio char, pH, temperature**

## INTRODUCTION

Sustainable development of the renewable resources is an important of environmental sustainability and, therefore, this thought is gaining a lot of advantages. Meanwhile last year's industrial revolution take their broad platform in environment. Plants are the green perseverance for us during this most adverse time. Sheikh *et al* **[1]** reported that Plants which have capacity to provide all raw material for human as well as environment. With help of plants base human can create whole world. Plants growth need fertile soil but some plants grow in anywhere with their influence. *Prosopis Juliflora* is quick growing and efficient potential for bio ethanol production that was reported and suggested by Julius *et al* **[2]** Juliflora- spices found across a planetary geographical locality. Gujarat is the most favourable for this species and nearly 20% arid area out of which *P. juliflora* covered.

It was reported by Nisha *et al* **[3]** *P. juliflora* is one of the most word wide spread plant species. Which growing in soil or water with very high concentrations of metals, it is a deep-rooted plant. Perennial tree/shrub species, with a member of the family Fabaceae and an indicative species of the Desert ecosystem. It is a deciduous, thorny, spread and deep-rooted shrub or tree that grows up to a height nearly of 10 m, according on the changeability of climatic conditions. Also, it has been indicating to be the only tropical species capable of growing in a more variety of soils and environmental conditions. It has a thick, rough, garish -green bark that show scaly with age. Stem is irregular with sharp thorns. Rajeshwari *et al* **[4]**, reported that *P.juliflora* is seen widely found in arid and semiarid area of Rajasthan, India, it is a fuel wood source in many regions, as well as, used as timber and grain. Zuzarte *et al* **[5]** mentioned that in additional to the above uses, *P. juliflora* is also useful for control of soil erosion in many developing countries, and especially in rural clusters, 2.5 billion people use its wood as a biomass, to their energy needs for cooking There were different Prosopis species available at different region with their specific importance, like livestock feed, timber, fire wood, food, shade, shelter etc.

Mukundan *et al* **[6]** reported in his study, the fruiting pods of *p. juliflora* produced are legume. *P. Juliflora* is an exotic lignocellulosic contain species. In many parts of Africa and Asia, People still do not know the other benefits of Prosopis. The Fruits of Prosopis contain a good amount of sugar, protein and carbohydrate so that they are an excellent example of a traditional food for humans and from which the people of north and south America derive flour and edible products. Hailea *et al* **[7]** mentioned that Pods of all *P juliflora* are contain of an exocarp, and sometimes fleshy layer mesocarp, fibrous endocarps and seeds are hard in nature species to species ratio of mesocarp is different, some have high ratio Now the world has great demand for high energy resources of petroleum energy resources and interactive about worldwide climatic changes has necessary to the recreate in the development of alternative source of liquid fuels. Gupta *et al* **[8]** suggested that Ethanol has always been concluding as a better source for environment. Developing ethanol as a liquid fuel its current role for energy fuel oxygenate, as well this one is renewable and low-cost resources for world. The major alkaloid juliflorine contain, used in the treatment of Alzheimer's diseases is found in this *P. juliflora*. Berwa *et al* **[9]** observed that the fruits pod extract from the plant species is effective in synthesis of lepidopteran larval mortality, and has the capacity to increase the antioxidant properties and immune enzymatic activity. The pods of this plant have also used traditionally for of diabetes mellitus.

## 2. METERIAL AND METHODS

### 2.1. Collection of samples

*P. juliflora* pods of were collected from village Bamnasa (Ghed) (21.3796 N, 70.1557 E), Dist. Junagadh, Gujarat, India. The dry pods were selectively collected from Vigorous *P. juliflora* trees. For further work the collected sample pods were taken in zip bag and dispatched to laboratory.

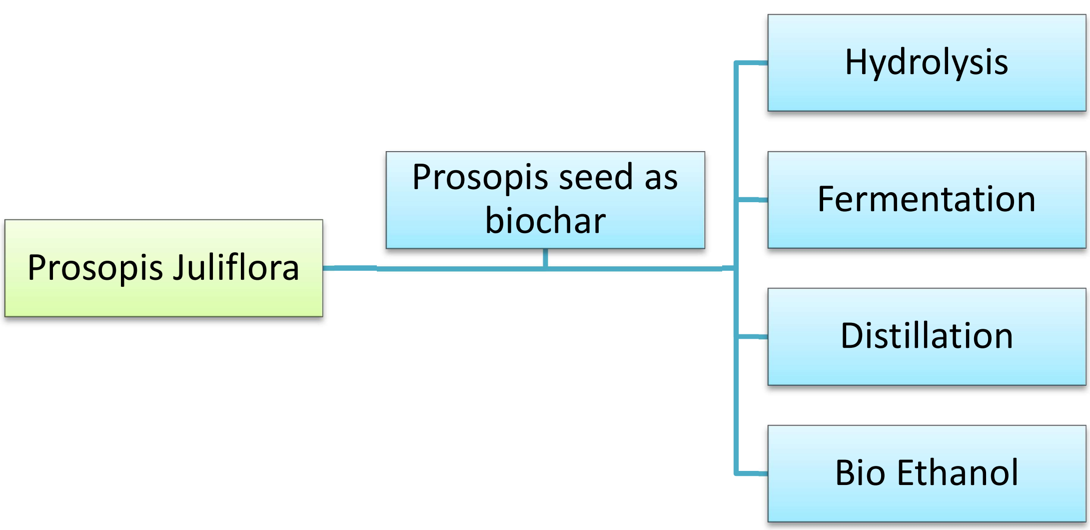


**Figure 1: The schematic route for the extraction of bio-ethanol from *P. juliflora* pods**

**2.2. Dry and Milling**

To find proper fine powder, Collected and naturally dried pods of Prosopis were broken in to small pieces and crushed in hammer mill after separating seeds from it. As per the previous study seeds were used as a feed stock of bio char and only the pods were carried out for experimental study. The fine powder has better surface area and it will help the contact between starch, and acid / water.

**2.3. Determination of Moisture Content**

For the determination of Moisture content, fine powder collected after drying was dried using an oven at 110°C, then put it in a polycarbonate desiccator over hygroscopic material and weight it until a constant weight.

The moisture content was calculated by below equation:

$$\text{content of Moisture in } (\%) = \frac{\text{w1} - \text{w2}}{\text{w1}} \times 100$$

Where w2 and w1 are the sample weight before (g) and after drying (g) and weight before (g respectively

**2.4. Hydrolysis**

Hydrolysis is the most important part of this experimental study, first of all arrange in 500ml flask different 08 concentrations of Sulphuric acid ($H_2SO_4$) each of 4, 3.5, 3.0, 2.5, 2.0, 1.5, 1.0, 0.5 M, with 250 ml of D.W. and 25 g fine powder of *p. juliflora* pods were taken and proper heated at 95°C for 15 min. Now the liquid fraction was naturally cooled, filtered and take it for glucose concentration. The pH of solution was adjusted to 4 -5 by adding sulphuric acid and 2N sodium hydroxide, then it was filtered and prepare for fermentation.

**2.5. Fermentation**

**2.5.1. Yeast for fermentation**

Physiological effects of furfural on Saccharomyces cerevisiae growing on ethanol was studied by Taherzadeh *et al* **[10].** The saccharomyces was purchased from retail provision store and were used for experiments. Firstly, *Brewer's Yeast* was dissolved in warm water and after 10-15 min it being used. Now it was taken with the filtrate collected after hydrolysis. As per the review of Thuesombat *et al* **[11]** batch fermentation of hydrolysis was carried out in 500ml flask with 5g/1 *Brewer's Yeast* at 30 ℃ .

**2.5.2. Ethanol Fermentation**

According to Kefale *et al* **[12]**, to select the best treatment for bio-ethanol production, the substrate was ferment under anaerobic condition in *Brewer's Yeast* for 24hr with different concentration of $H_2SO_4$ (0.5, 1, 1.5, 2, 2.5, 3, 3.5 and 4 M). For the best Bioethanol yield, proper optimization with pH, Hydrolysis time, Fermentation temperature, Time would be adjusted and observed.

**2.5.3. Retrieval of Bioethanol**

With the help of fractional distillation method bio-ethanol was separated from fermented sample. The solution of fermentation was heated to force the bottommost boiling substantial into the vapour phase. Steamed vapours convert in liquid and cool with water. The extract was collected in the separate container and the weight was measured.

**2.5.4. Calculations for Yield**

bio-ethanol ratio depends on the weight based. Taken sample in gram and calculate the yield bio-ethanol.

$$Ge = \frac{\mathrm{Ce} \times \mathrm{Ac}}{100}$$

Where Ge, Ce and Ac are the gram of bio-ethanol (g), concentration of bio-ethanol and the amount collected (g)

$$\text{Yield of bioethanol } \% = \frac{\text{Gram of bioethanol g}}{\text{Sample g}}$$

2.6. Sugar Contents in sample

Fehling method used for the concentration for reducing sugar. 2ml of conc. HCl, 50 ml of hydrolysed sample and 10 ml distilled water was heated for 10 min. Add NaOH and prepare 250 ml take it in burette. 90 ml :10 ml Distil water and Fehling solution and add Methyl blue indicator. titrated with solution of burette colour change brick red colour recorded. For every sample the sugar content calculates by below formula.

$$\text{Sugar content in } \% = \frac{250 \text{ mL x } f}{v} \times 100 \ \%$$

Where, v–volume for *the titration (titrate value) (ml), the f*-Fehling factor (0.051).

**3. RESULT AND DISCUSSION**

**3.1. Effect of Acid Concentration on Sugar Content**

In this study, the sugar content found from *P. juliflora* shown in **Graph No. 1**. The sugar content increase with an increase in sulphuric acid ($H_2SO_4$) concentration up to 1.5 M, and at that particular concentration sugar content was obtained 93%. Yoswathana, N. *et al* **[13]** reported that an increase in $H_2SO_4$ conc. led to decrease in sugar content. Complete and quick conversion of cellulose to glucose and hemicellulose to C5-sugar may result an increase of sugar content in acid treated sample with concentration.

**3.2. Parameters affecting bio-ethanol Production**

**3.2.1. Acid Concentration**

As per the experimental observation, acid concentration, pH, fermentation time, fermentation temperature was kept constant and optimum condition would observe. While keeping all parameters constant, 95 ℃ hydrolysis temperatures, 20 min hydrolysis time, pH 5, 24 hr fermentation time and 30 ℃ fermentation temperatures were applied for all concentration samples; the maximum bioethanol yield of 4.2% *v*/*v* was obtained in 1.5 M of $H_2SO_4$ concentrations. As shown in **Figure No. 2**, on increasing the concentration of acid decreasing bioethanol yield may be due to degradation of monomeric sugars to undesirable by-products.

### 3.2.2. Fermentation Time

For the optimization of fermentation time for bioethanol production adjusted 6-72 hr consider with keeping all parameter constant i.e., 95°C hydrolysis temperatures, 20 min hydrolysis time, pH 5, 1.5 M acid concentration and 30°C fermentation temperatures. **Figure No. 3** indicated the extreme amount of bioethanol was obtained at 48 hr fermentation time. On increasing in time, the yield of bioethanol decreased may be due to microorganisms consume sugar.

### 3.2.3. Hydrolysis Time

Joshi *et al* **[14]** studied the optimum hydrolysis time. As another parameter hydrolysis time was taken and as results showed in **Figure No. 4** that the bio-ethanol yield increases with increasing hydrolysis time and reaches optimum at 20 min hydrolysis time. The bioethanol yield was decreased farther than 20 min as hydrolysis time increases, may be due to the fact that longer residence time makes the sugars further oxidize.

### 3.2.4. Fermentation Temperature

Hoi *et al* **[15]** studied the optimum fermentation temperature previously. At 25, 30, 35, & 40 °C the optimization of fermentation temperature was carried out while taking all other parameter constant i.e., 20 min hydrolysis time, 95 °C hydrolysis temperatures, pH 5, and 1.5 M acid concentration. However, increasing the temperature beyond 30°C decreased the bio-ethanol yield of *P. juliflora* pods mash. As shown in **Fig. No. 5**, the bio-ethanol yield was found maximum at 30 °C (5.60% v/v). High temperature destroys yeast, and low temperature reduces speed down yeast activity **[16]**.

### 3.2.5. pH Value

Hoi *et al* **[15]** studied the optimum fermentation temperature previously. At 25, 30, 35, & 40 °C the optimization of fermentation temperature was carried out while taking all other parameter constant i.e., 20 min hydrolysis time, 95 °C hydrolysis temperatures, pH 5, and 1.5 M acid concentration. However, increasing the temperature beyond 30°C decreased the bio-ethanol yield of *P. juliflora* pods mash. As shown in **Figure No. 5**, the bio-ethanol yield was found maximum at 30 °C (5.60% v/v). High temperature destroys yeast, and low temperature reduces speed down yeast activity **[16]**.

As a final and important parameter pH, the maximum bioethanol yield was observed at pH 5. It is worthwhile to mention that the concentration of bio-ethanol obtained (5.9 %v/v) by the hydrolysis of the *P. julflora* pods mash is satisfactory as shown in **Fig**ure **No. 6 [17, 18, 19]**.

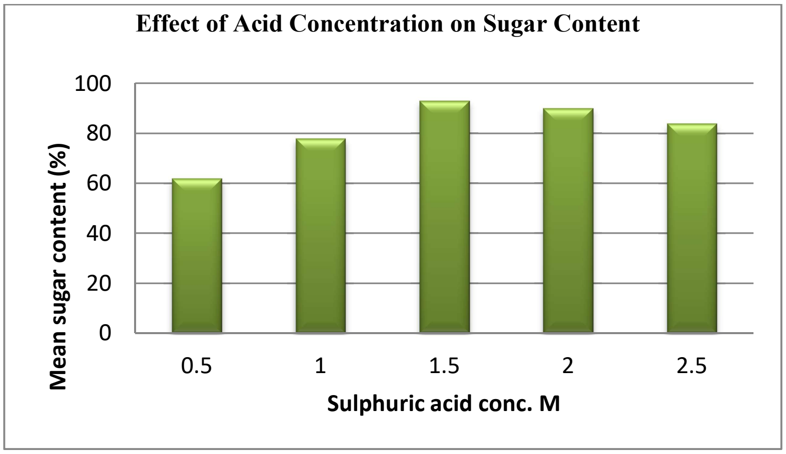


**Figure 1: The effect of acid concentration on sugar content**

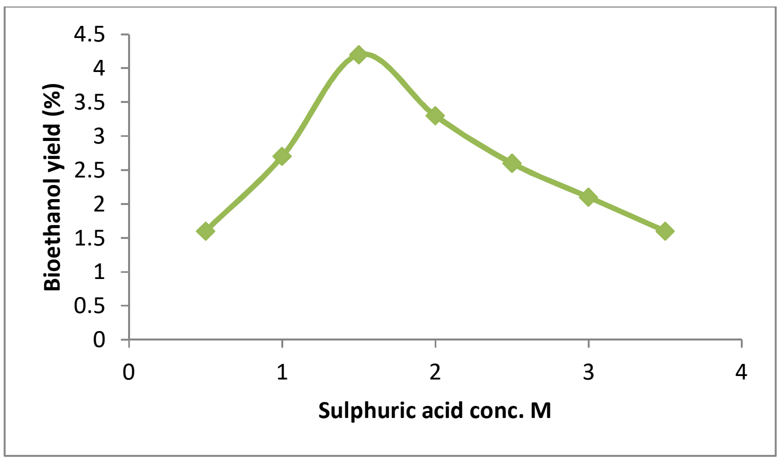


**Figure 2: The effect of acid concentration on bio-ethanol production**

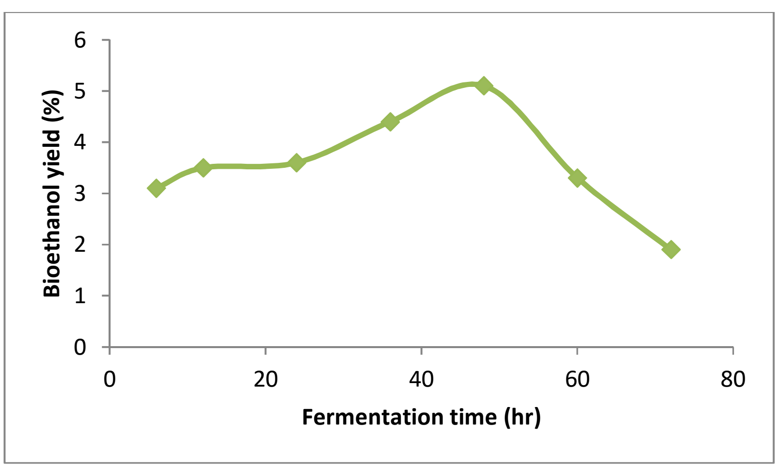


**Figure 3: The effect of fermentation time on bio -ethanol production**

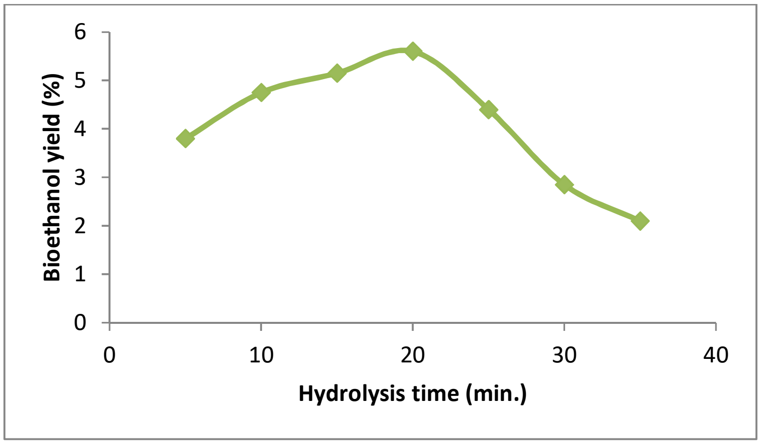


**Figure 4: The effect of hydrolysis time on bio-ethanol production**

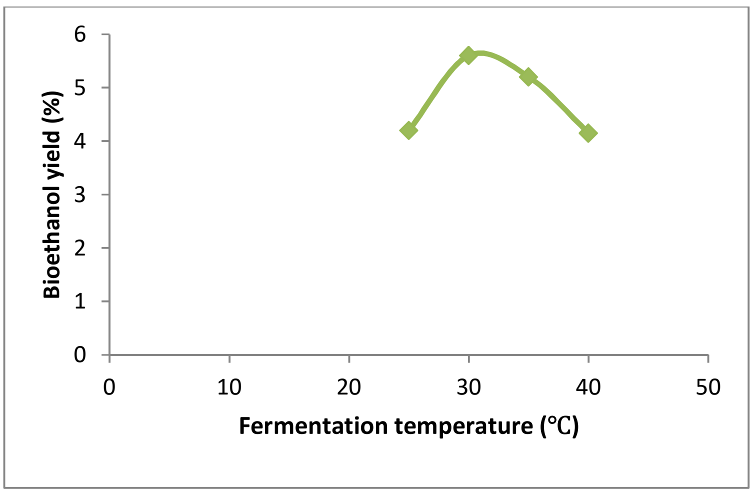


**Figure 5: The effect of fermentation temperature on bio-ethanol production**

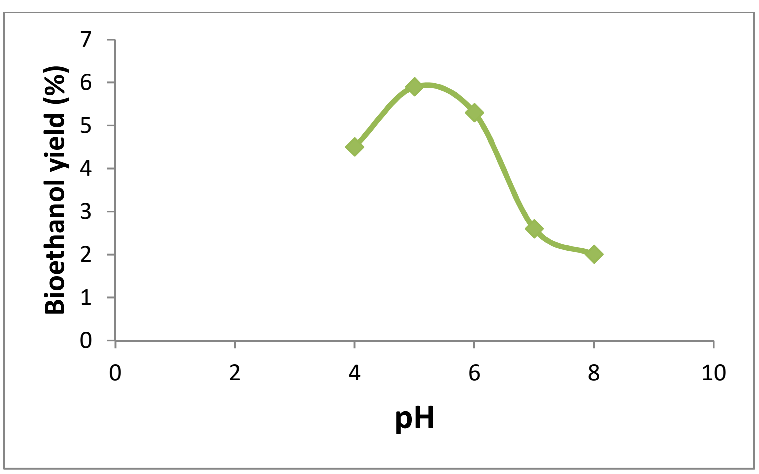


**Figure 6: The effect of pH value on bio-ethanol production**

**CONCLUSION**

In this proposed work we would like to develop a suitable methodology that would provide biofuel by fermentation method with higher calorific value. This will result in the value addition of less explored *P. juliflora* which is abundant in Gujarat state. The main objective of this paper will give an idea about which plant species found in bare area which is more valuable for society. In present situation fuels cost increased day by day, with help of this we try to give some methods for production of eco-friendly fuel with low cost. Bio char is one of the valuable by-products of this method, which is more efficient for fertility of soil and growth of plant. The ratio of bioethanol production is high with sulphuric acid concentration is 1.5M, maximum fermentation time is 48 hours and pH are 5. Bioethanol production ratio is not increased with decreased different parameter like concentration of acid, pH, fermentation time etc. We can use bioethanol in primitive level for as a fuel with low cost. This study provides a green revolution for alternative source for fuel.

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