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# Estimation of Reducing Sugar by Acid Hydrolysis of Sunflower (*Helianthus annuus*) Husk by Standard Methods

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## Abstract

**Sunflower husk consists the primary and secondary plant nutrients—phosphorus (10.94% $P_2O_5$), potassium (25.84% $K_2O$), calcium (19.07% CaO), magnesium (18.58% MgO), and also some micronutrients (zinc, copper, cobalt, manganese, iron, and molybdenum). The sunflower husk has low plasticity, and the granulation process occurs better when binding materials (sugar factory lime, molasses, urea formaldehyde resin) are used. Sun flower husk is a polysaccharide source that can be converted to reducing sugars. Sunflower husk was hydrolyzed using sulphuric acid (0.2N) at a temperature of 65˚C - 70˚C. It was observed that the degradation has significant effect with respect to amount of husk taken and in turn sugar yield is around 40% - 50%, each of which is estimated by Bertrand's, Benedict's and Lane-Eyon method.**

## Keywords

**Degradation, Hydrolysis, Sunflower Husk, Sugar, Estimation**

## 1. Introduction

During the industrial processing of sunflowers, sunflower husks remain unused. Depending on growing condi-

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tions and fertilizer as husk application, the husk contains a variety of plant nutrients and micro elements [1]. The sun flower grows in various soil conditions [2]. Sun flower husk is the outer most layer of sunflower grain. Burning of sun flower husk produced sunflower husk ash (SHA). The annual production of Sunflower Husk in India is 1.8 million metric ton and this amount is predicted to increase in the future [3].

The northern part of the state of Karnataka, India is a semi arid tropical region, well known for the production of pulses and oil seeds (sunflower). It has been reported that because of their high content of reducing sugars, it is possible to produce furfural and ethyl alcohol from sunflower hulls. As a lignocellulosic waste material, sunflower hulls was hydrolyzed with acid to yield chemical *i.e*. furfural [4]. The hull which is byproduct of oil extraction, contain 22% - 28% of the total weight of oilseed sunflower and may be removed before or immediately following oil extraction or may remain in the meal. Sunflower hulls contain: 4% crude protein; 5% lipid material, including wax, hydrocarbons, fatty acids, sterols, and triterpenic alcohols; 50% carbohydrates, principally cellulose and lignin; 26% reducing sugars, of which the majority is xylose; and 2% ash. The high fiber content and low protein and energy content of sunflower hulls reduce their nutritional value [5]. According to Badger [6] there are two types of hydrolysis *i.e*. enzymatic and chemical hydrolysis. Chemical hydrolysis was selected because it is relatively low cost and fast [7] [8]. The dilute acid hydrolysis of lignocelluloses biomass was run with operating condition of 0.2 N Sulphuric acid Concentration, 65˚C - 70˚C, at various amount of Sunflower husk.

## 2. Materials and Methods

The standard methods adopted for estimation are;

(i) Bertrand's method [9] is based on the reducing action of sugar on the alkaline solution of tartarate complex with cupric ion; the cuprous oxide formed is dissolved in warm acid solution of ferric alum. The ferric alum is reduced to $FeSO_4$ which is titrated against standardized $KMnO_4$; Cu equivalence is correlated with the table to get the amount of reducing sugar

(ii) In Lane-Eynon method [10] sugar solution is taken in the burette and known volume of Fehling solution is taken in conical flask. This is titrated at a temperature 65˚C - 70˚C. Titration is continued till it acquires a very faint blue color; add 3 drops of methylene blue indicator. The dye is reduced to a colorless compound immediately and the color changes from blue to red (at the end point).

(iii) Benedict quantitative reagent gives a visual clear end point which turns blue to white by using potassium thiocyanate which converts the red cuprous oxide to white crystals of cuprous thiocyanate, it helps in visual view [11].

The hydrolysis of sun flower husk was carried out at constant stirring using 50 ml of 0.2N sulphuric acid temperature in a hotplate, equipped with a temperature controller, and continuously shaken during the operation. Initially, 50 mL of 0.2 N sulphuric acid solution (20 mesh) sunflower husk were put into the beaker and kept under hot plate as well as the temperature controller was adjusted such that the temperature of the mixture is about 65˚C - 70˚C. The reaction was expected to be at constant temperature (isothermal), but before that temperature was achieved, reaction has occurred. The hydrolyzate was neutralized to bring the pH to 7 by the addition of calcium carbonate and activated carbon, followed by filtration. The concentration of reducing sugar was analyzed by Benedict's Bertrand's and Lane-Eynon standard procedures.

## 3. Result and Discussion

By varying the amount of sun flower husk (1, 2, 3, 4 and 5 g) respectively at constant temperature (65˚C - 70˚C) and concentration of sulphuric acid is 0.2N is fixed constant. The experiment resulted in the data of reducing sugar concentrations at 3 h were reported below **Table 1** and there corresponding data are plotted which are shown in **Figures 1-3** respectively.

## 4. Conclusion

While there are some uses generally, sunflower husk is used as fuel and fertilizer, but it is still often considered a waste product in the mill and therefore often either burned in the open or dumped on wasteland. In the present work, we have applied simple hydrolysis process to obtain reducing sugar which is very good consumable source of energy and the yield percent also runs up to 40% - 50% which is authentically reported by analytical standard procedures in an economical way.

**Table 1.** Amount of reducing sugar estimated by different methods.

| Weight of sun flower husk (g) | Sugar Estimation Benedict's Method (g) | Sugar Estimation by Bertrand's Method (g) | Sugar Estimation by Lane-Eynon Method (g) |
|---|---|---|---|
| 1.021 | 0.221 | 0.226 | 0.225 |
| 2.002 | 0.446 | 0.452 | 0.438 |
| 3.038 | 0.668 | 0.625 | 0.662 |
| 4.021 | 0.892 | 0.815 | 0.874 |
| 5.008 | 1.126 | 1.026 | 1.098 |

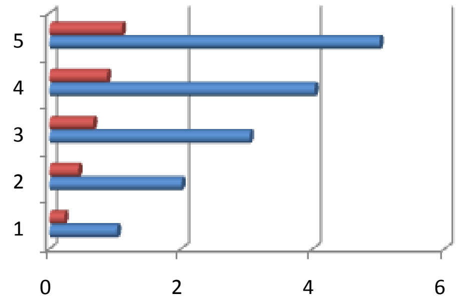


**Figure 1.** Estimation of reducing sugar by Benedict's method.

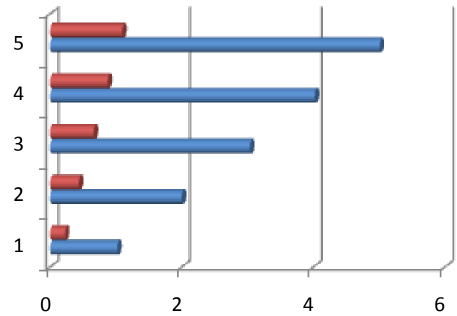


**Figure 2.** Estimation of reducing sugar by Bertrand's method.

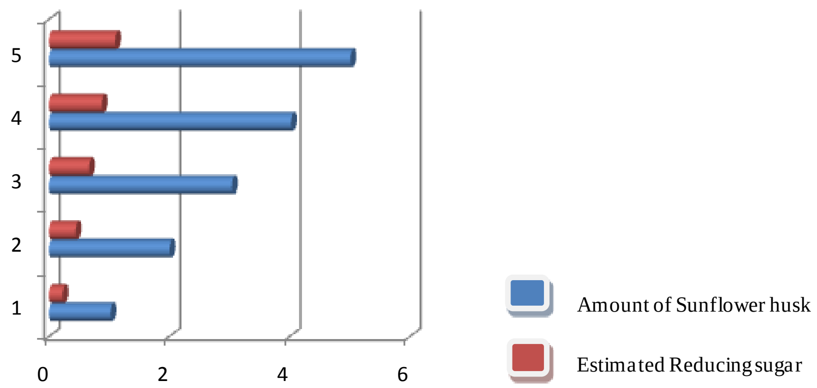


**Figure 3.** Estimation of reducing sugar by Lane-Eynon's method.

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