International Journal of Current Research in Chemistry and Pharmaceutical Sciences
www.ijcrcps.com Volume 1 Issue: 4 2014 Pages:37-43

(pISSN: 2348-5213; eISSN: 2348-5221)

**RESEARCH ARTICLE**

# ESTIMATION OF REDUCING SUGAR BY ACID HYDROLYSIS OF BOTTLE GOURD (*LAGENARIA SICERARIA)* PEELS BY STANDARD METHODS.

**S.CHANDRAJU[*1], R. VENKATESH[1], AND C. S.CHIDAN KUMAR[2]**

[1]Department of Studies in Sugar Technology, Sir M. Vishweshwaraya Post-graduate Center, University of Mysore,Tubinakere, Mandya-571402, Karnataka, India.
[2]Department of Engineering Chemistry, Alva's Institute of Engineering & Technology, Shobhavana Campus, Mijar, Moodbidri- 574225, South Canara Dt, Karnataka, India.

Corresponding Author: chandraju1@yahoo.com

**Abstract**

Bottle gourd (Lagenaria siceraria) has been part of human diet for ages to their health benefits, but consumption of these fruit generates outer skin wastes that may lead to environmental pollution. The production of sugar evaluated from the non edible (peel) portion of bottle gourd fruit has considerable promise in the future to achieve economical profit. Bottle gourd (Lagenaria siceraria) is polysaccharide source that can be converted to reducing sugar. Bottle gourd peels was hydrolyzed using sulphuric acid at temperature 75°C. It was observed that the degradation has significant effect with respect by varying time (60, 90 minutes) and concentration of (Sulphuric acid and Hydrochloric acid). In turn sugar yield is around 40-50%, each which is estimated by Bertrand's, Benedict's, and Lane-Eynon methods.

**Keywords:** Degradation, hydrolysis, Bottle gourd (Lagenaria siceraria) peels, reducing sugar, estimation.

## Introduction

The bottle gourd can be found in the forests of India Moluccas and Ethiopia. The centre of origin has been located as the coastal areas of Malabar(North Kerala) and the humid forest of Dehradun (North India).The fossil records indicate it's culture in India even before 2000 B. C. It shares its common name with that of the calabash tree used as a bottle, utensils such as cups, bowls, and basins in rural areas, for this reason, the calabash is widely known as the bottle gourd (David et al., 2005). The fresh fruit has a light green smooth skin and a white flesh. The rind of the domesticated calabash, unlike that of its wild counterpart, is thick and waterproof. They come in a variety of shapes, they can be huge and rounded, or small and bottle shaped, or slim and more than a meter long. The calabash was one of the first cultivated plants in the world, grown not primarily for food, but for use a water container (Leqdsberg steven, 2010). The larger fruiting varieties whose fruits are used mostly for making containers or other handicrafts and the smaller fruiting variety whose fruits are more edible. In some Caribbean countries, it is worked, painted and decorated as shoulder bags or other items by artisans, and sold to tourists; calabashes are used as percussion instruments (Prajapathi et al., 2010).The calabash, as a vegetable, is frequently used as either a stir-fly or in a soup (Andrew clarkem et al., 2005). The juice is considered to have many medicinal properties and very good for health. Additionally the gourd can be dried and used to smoke pipe tobacco. Bottle gourd is one of the excellent fruits gifted by the nature to human beings having consumption of all the essential constituents that are required for normal and good human health. Two varieties of this fruit viz., sweet and

 

bitter are available (Leslie et al., 1976). The consumption of bottle gourd juice is help for controlling diabetes mellitus, hypertension, liver diseases, weight loss and other associated benefits (Akinyosoye, et al., 1991). However, in last few years there have been reports of suspected toxicity due to consumption of its juice (Wath et al.,1962, Kudan 1962).

## Materials and Methods

The hydrolysis of Bottle gourd peels was carried out at constant stirring using 2M sulphuric acid in a hot plate equipped with a temperature controller, and continuously shaken during the operation. Initially measured volume of water, sulphuric acid or hydrochloric acid with 1gm Bottle gourd were put into the beaker and kept under hot plate as well as the temperature controller was adjusted such that the temperature (Isothermal), but before that temperature was achieved, reaction has occurred. The hydrolyzed was neutralized to bring the pH 7, the addition of calcium carbonate to neutralize the excess chlorides and precipitated as lead chlorides and activated carbon, followed by filtration. The concentration of reducing sugar was analysed by Bertrand's Benedict's and Lane-eynon standard procedures (Chandraju et al., 2011).

By varying the concentration of 2M sulphuric acid and 2M hydrochloric acid, where time 60 minutes and temperature 75˚C are kept constant.

By varying the time 60, 90 minutes respectively keeping temperature 75˚C and concentration at the ratio of 2M sulphuric acid and 2M hydrochloric acid (15ml)/100mL distilled water as constant, the quantitative values are tabulated (Tables 2-5) and their values are plotted in the following (Figures 1-8).beyond the mentioned concentration and heating time limit charring occurs.

From all the above values it is clear that the value does not differ much. After all the analysis the maximum reducing sugar value runs to 40-50% on the whole. There is no absurd difference in the yield to sugar when there is a change of acid weather it is either sulphuric acid or hydrochloric acid.

(i) Bertrand's method (Chidan kumar et al., 2012) 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. This is based on the alkaline solution of tartarate complex of cupric ion.

(ii) In Lane-Eynon method (Badger, 2002) sugar solution is taken in the burette and known volume of Fehling solution is taken in conical flask. This is titrated at a temperature 65-70˚C. Titration is continued till it acquires a very faint blue color. At this stage 3 drops of methylene blue indicator is added. The dye is reduced to a colorless compound immediately and the end point is changing of color from blue to red. In this method it is susceptible for interference from other type of molecules that act as reducing agent.

(iii) In Benedict's method pipette out benedict's quantitative reagent in to a clean conical flask. The contents were heated to a temperature of 65-70ºC. Then it is titrated against unknown sample solution till the appearance of chalky white precipitate. 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(Sausensilmi, 1997).

## Results and Discussion

At constant temperature (75° C), by varying the concentration of $H_2SO_4$ (0.1M, 0.3M, and 0.5M) The reducing sugar estimated by different method, Bertrand's method (0.2164, 0.4021, 0.5962 g) Benedict's method (0.2361, 0.4139, 0.6017g) and Lane-Eynon method (0.2462, 0.4232, 0.6137g). At various time intervals (60mim, and 90min).from Bertrand's method (0.5092, 0.5429g), Benedict's method (0.5041, 0.5214g) and Lane-Eynon method (0.5012, 0.5502g) and in the same way by varying concentration of HCl from Bertrand's method(0.4192, 0.4562, 0.5108g), Benedict's method(0.4261, 0.4692, 0.5249g), and Lane-Eynon method(0.4155, 0.4549, 0.5236 g) At various time intervals (60mim, and 90min). From Bertrand's method (0.4962, 0.5231g), Benedict's method (0.4829, 0.5396g), and Lane-Eynon method (0.4836, 0.5272g) respectively.

## Conclusion

Bottle gourd peels (Lagenariasiceraria) are polysaccharide is hydrolyzed enzymatically. In the present work, the mimicking conversion is exhibited through a simple acid hydrolysis process by the application of various acids like 2M $H_2S0_4$ and HCl under two conditions one is by varying the

**Table 1.** Bottle gourd Sample: Concentration of Strong acids Chosen and Monitored

| Amount of 2M $H_2SO_4$/100mL Distilled water | Amount of 2M HCl/100mL Distilled water |
|---|---|
| 5mL(0.1M) | 5mL(0.1M) |
| 15mL(0.3M) | 15mL(0.3M) |
| 25mL(0.5M) | 25mL(0.5M) |

**Table 2.** Heating time is kept constant [1h] while concentration of sulphuric acid is varied.

| S.No. | Amount of 2M $H_2SO_4$/100mL Distilled water | Bertrand's method(g) | Benedict's method(g) | Lane-Eynon method(g) |
|---|---|---|---|---|
| 1 | 5mL(0.1M) | 0.2164 | 0.2361 | 0.2462 |
| 2 | 15mL(0.3M) | 0.4021 | 0.4139 | 0.4232 |
| 3 | 25mL(0.5M) | 0.5962 | 0.6017 | 0.6137 |

**Table 3.** Concentration is kept Constant (15mL of 2M Sulphuric acid taken per 100mL distilled water) while time period of heating is varied.

| S.No. | Heating time(Hr.) | Bertrand's method(g) | Benedict's method(g) | Lane-Eynon Method(g) |
|---|---|---|---|---|
| 1 | 1 | 0.5092 | 0.5041 | 0.5012 |
| 2 | 1:30 | 0.5429 | 0.5214 | 0.5502 |

**Table 4**.Heating time is kept constant (1hr) while concentration of hydrochloric acid is varied.

| S.No. | Amount of 2M HCl/100mL Distilled water | Bertrand's method(g) | Benedict's method(g) | Lane-eynon method(g) |
|---|---|---|---|---|
| 1 | 5mL(0.1M) | 0.4192 | 0.4261 | 0.4155 |
| 2 | 15mL(0.3M) | 0.4562 | 0.4692 | 0.4549 |
| 3 | 25mL(0.5M) | 0.5108 | 0.5249 | 0.5236 |

**Table 5**.Concentration is kept constant (15mL of 2M hydrochloric acid taken/100mL distilled water) while time period of heating is varied.

| S.No. | Heating time(Hr.) | Bertrand's method(g) | Benedict's method(g) | Lane-Eynon method(g) |
|---|---|---|---|---|
| 1 | 1 | 0.4962 | 0.4829 | 0.4836 |
| 2 | 1:30 | 0.5231 | 0.5396 | 0.5272 |

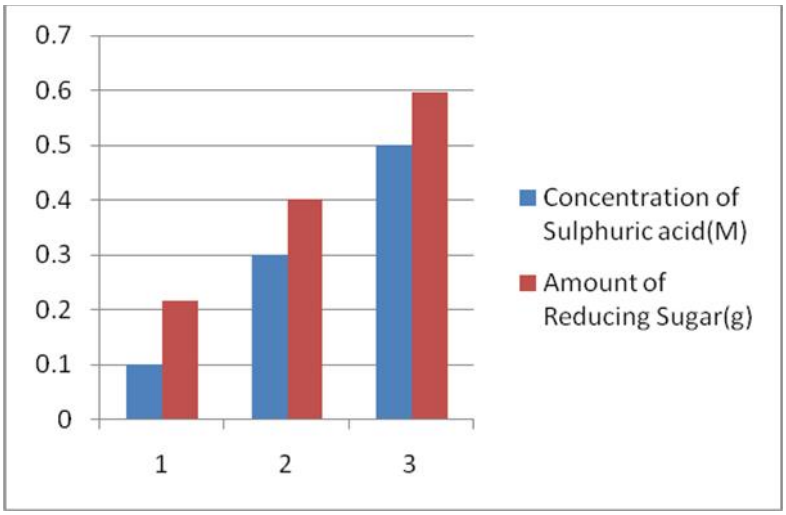


**Figure 1.** Estimation of reducing sugar by Bertrand's method by varying [$H_2SO_4$]

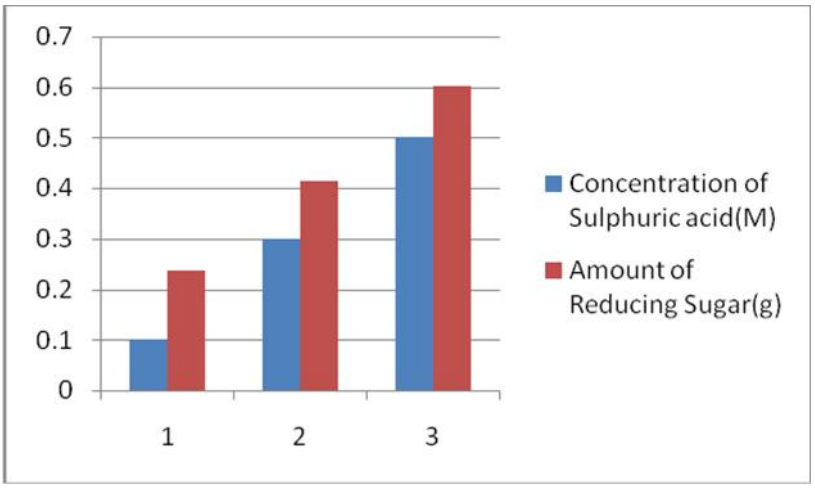


**Figure 2.**Estimation of reducing sugar by Benedict's method by varying [$H_2SO_4$]

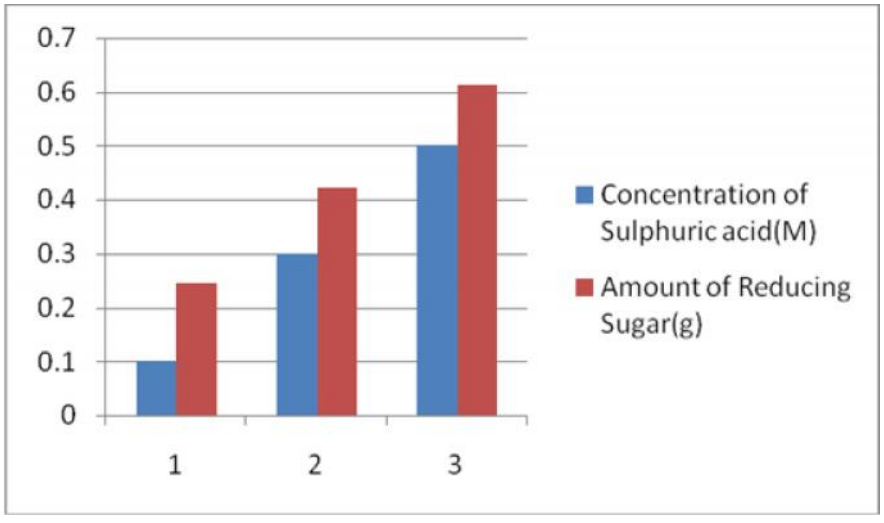


**Figure 3:** Estimation of reducing sugar by Lane-Eynon method by varying [$H_2SO_4$]

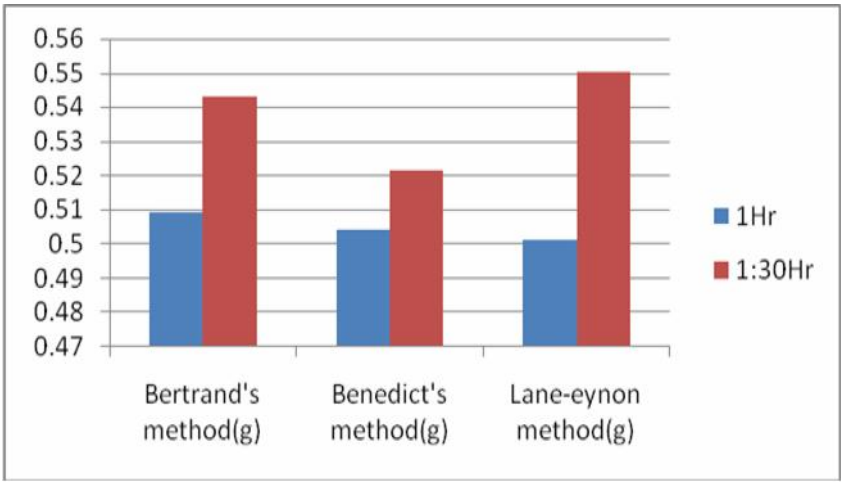


**Figure 4.**Estimation of reducing sugar by Bertrand's, Benedict's, and Lane-eynon method by variation of heating time ($H_2SO_4$) constant.

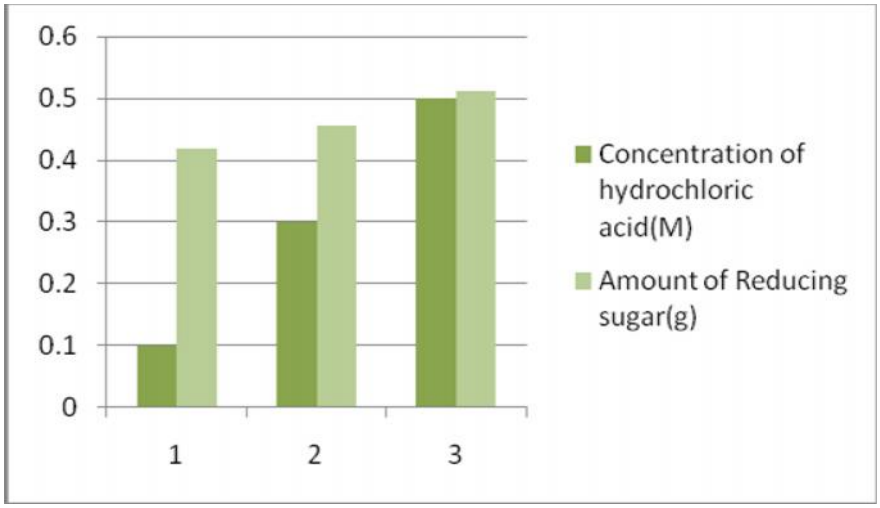


**Figure 5.** Estimation of reducing sugar by Bertrand's method by varying [HCl]

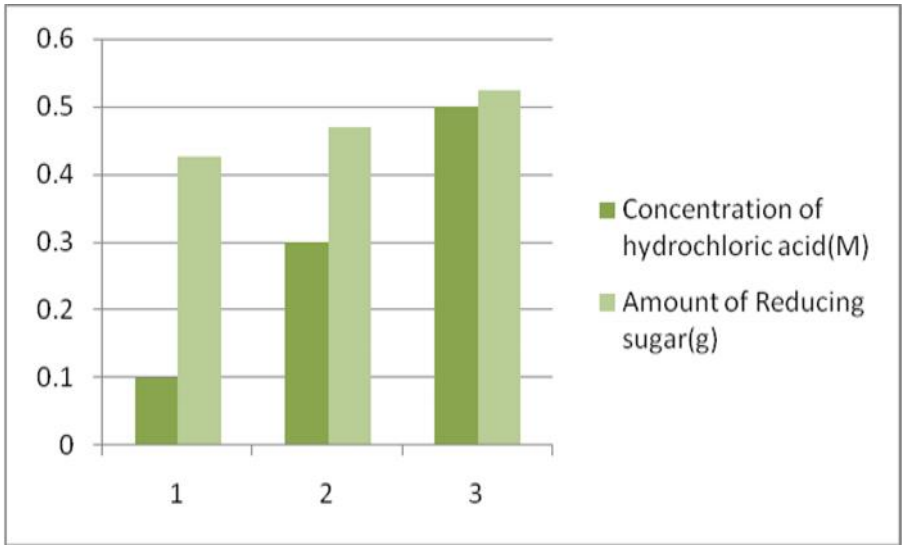


**Figure 6.** Estimation of reducing sugar by Benedict's method by varying [HCl]

 

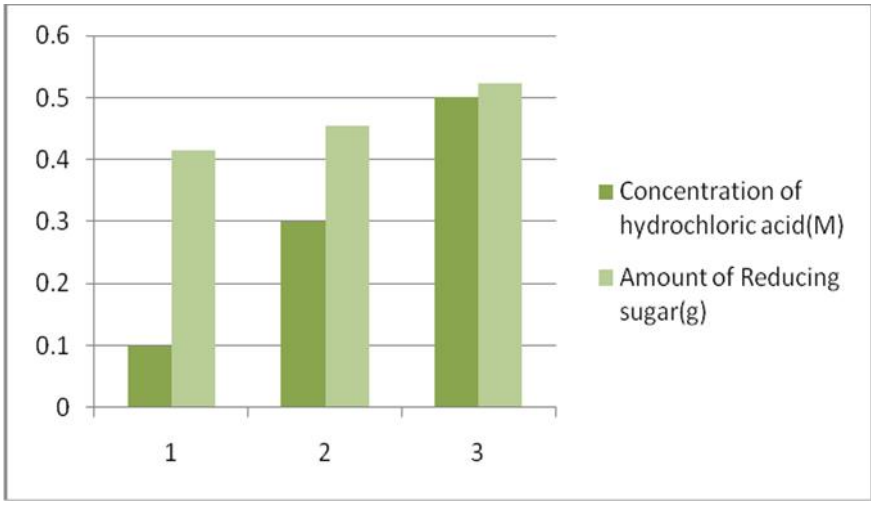


**Figure 7.** Estimation of reducing sugar by Lane-Eynon method by varying [HCl]

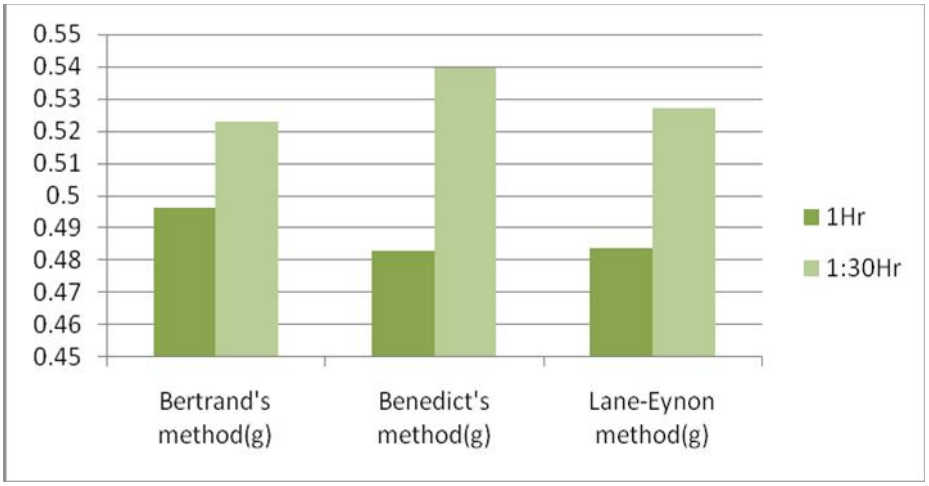


**Figure 8.** Estimation of Reducing sugar by Bertrand's, Benedict's, and Lane-eynon method by variation of heating time [HCl] constant.

concentration of acid at constant temperature and time of heating. Another one is by varying the time of heating at constant concentration and temperature the amount of reducing sugar are monitored and the yield percent also runs up to 40-50% which is authentically reported by analytical standard procedure in a cost effective manner.

## Acknowledgement

The authors (V.R) thank the financial support from University Grants Commission (UGC) Delhi, and Department of Sugar technology. Sir. M. V. Post Graduate Centre, University of Mysore, Mandya (Where the research work carried out).

## References

Akinyosoye, VO., 1991. Macmillan Publishers Limited, Tropical Agriculture, 65 – 68

AndrewClarkem, Micharl K., Burtenslaw, Particia, A., Lenachan, M C., David, L., Erickson, Davidpenny, 2005. Reconstructing the origins and dispersal of the polynsian Bottle gourd(lagnaliasiceraria),58 501-508

Badger, PC,, 2002. Trends in New Crops and New Uses, ASHS Press. Alexandria 17-21.

Chandraji, S., mythily, R., Chidankumar, CS., 2011. J.chem.Pharma.Res, (3) 422-429

Chidankumar, CS., mythily, R., and Chandraju, S., 2012. J.chem.Pharma.Res., 4(7) 3588- 91.

David, L., Smith, Bruce, D., clark, Andrew, C., Sandweirs, Daniel, H., Turors, Noreen, 2005 An Asian origen for 10000-yearold domesticated plant in the Americas,102 (51) 18315-18320.

Kudan, MJ., 1962. From Parker Publishers Inc. Hattiesburg Maryland. Encyclopedia of fruits, vegetables, nuts and seeds for healthful living.

Laqdsberg Steven, 2010. The history of an Indian musical instrument maker.

Leslie, S., Cobley, 1976.From Longman Group Limited London. An Introduction to the Botany of Tropical Crops, 153

Prajapati, RP., Kalariya,M., Parmar,SK., Sheth,NR., 2010 Phytochemical and pharmacological review of Lagenaria siceraria. J Ayurveda Integr Med; 1 266-72.

SausenSilmi, HS., 1997. Canarsie., Brooklyn, Summer Research Programe for Teachers, Determining the Concentration of Solution: Beer's Law 1-5.

Wath, JN., Brayer-Brand Wijk, MG., 1962. From E and S. Livingstone Ltd. Edinburgh and London, The Medicinal and Poisonous Plants of South and Easthern Africa..

 