**THE PRODUCTION OF DISTILLED LIQUOUR (SPIRIT) FROM HIBISCUS SABDARIFFA PETALS**

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**ABSTRACT**

An experimental procedure was conducted so as to indigenously obtain distilled liquor (spirit) from *Hibiscus sabdariffa* petals with the aim of producing affordable and enjoyable hard liquor from a promising medicinal tropical plant. Juice was extracted from dried dark red cultivar of Roselle calyx (*Hibiscus sabdariffa*) using boiling water for about 30minutes. The juice was sieved out and refined sugar was copiously added to raise the sugar content of the juice thereby deliberately increasing the potentiality for alcohol yield. Pure wine yeast strains (*Saccharomyces cerevisiae* AS2.316; brewer’s type strains) obtained at FIIRO was inoculated into the juice to initiate controlled fermentation. After about two weeks of fermentation, the product (alcoholic beverage) was then subjected to double distillation. The mean values taken for the proximate analyses of the five liquor samples employed indicated a pH of 3.4, temperature of 270C, Brix of 16.750, moisture of 55% and alcohol by volume of 45%, which falls within the acceptable standard hard liquor range of 15-98%. This study showed that alcoholic beverage of good quality can be made from *Hibiscus sabdariffa* petals, while its industrial potentialities could be further harnessed and exploited.

**Keywords:** *Hibiscus sabdariffa*, *Saccharomyces cerevisiae*, distillation, hard liquor.

**INTRODUCTION**

*Hibiscus sabdariffa*, a dicotyledonous plant, has over 300 species which are distributed in tropical and subtropical regions around the world (El-sherif and Sarwat, 2007). Most of them are ornamental plant species but many are believed to have certain medicinal properties; among them is *Hibiscus sabdariffa* (Yadong *et al.,* 2005). In many tropical areas, the red, somewhat acidic calyxes of *Hibiscus sabdariffa* varieties, are used locally for beverages, jellies, sauces and preservers; the leaves and stalks are consumed as salad or cooked vegetables. The fresh calyx (the outer whorl of the flower) is eaten raw in salads, is cooked and used as a flavoring in cakes etc and is also used in making jellies, soup, sauces, pickles, puddings etc. (Scoh, 2003).

*Hibiscus sabdariffa,* commonly known as Roselle, is an aromatic astringent cooling herb that is much used in tropics. It is said to have the diuretic effect to help lower fever and it is also anti-scorbutic. The leaves and flower are used internally as tonic tea for digestive and renal functions (Chen *et al*., 2003).

Although, a perennial Roselle is usually grown as an annual plant and propagated from the seed, it grows best in loamy soil mainly in tropical climate and requires rainfall averaging about 10 inches (25 cm) each month throughout the growing session. Their stalks and leaves are dark green to reddish in colour while their flowers are creamy white or pale yellow (Scoh, 2003).

Zobo drink, an indigenously non-alcoholic local beverage, is produced from the dried petals of *Hibiscus sabdariffa*. Zobo drink has been shown to be a good source of natural carbohydrates, proteins and vitamin C (Oginehor *et al.,* 2007). These calyces can also be used to produce herbal concoctions and other foods products (Akanya *et al.,* 1997). The juice drink which is usually obtained by the extraction of the calyx of *Hibiscus* contains about one percent solid.

Imported wines have very high duty imposed on them thus making it expensive to be purchased by an individual. Zobo drink has a great potential as a local alternative to imported red wine in particular and alcoholic beverages in general (Egbere *et al.,* 2007).

The production of this and similar local beverages has become the main source of income in many homes in the rural communities and more recently in the urban area where these have grown to enterprising business proportions due to the support from the government through poverty alleviation programmes and incentives being provided to the people (Essien *et al.,* 2011).

Wine is an alcoholic beverage made from fermented fruit or vegetables, usually grapes. Due to natural chemical balance, grapes ferment without the addition of sugar, acid, enzymes, water or other nutrients (Caton *et al*., 2004). Yeast consumes the sugar in grapes and converts it to ethanol and carbon dioxide. Fermentation is begun by inoculating the juice with the chosen wine yeast. This yeast catalyze a series of reactions that result in the conversion of glucose and fructose of ethanol;

C6H12O6 2C2H5OH + 2CO2

The driving-force behind this reaction is the release of energy stored in the sugars to make it available to other biological process (Adesokan, 2005). The yield of ethanol is affected by such factors as temperature, extent of agitation, sugar concentration, acidity, strain of yeast and yeast activity. Some yeasts can produce 18% alcohol in wine, however, extra sugar is added to produce a high alcohol content. If the natural sugar content of the substrate is too low to obtain the desired alcohol percentage, synthetic sugar may be added; a process called [chaptalization](https://en.wikipedia.org/wiki/Chaptalization). For every gram of sugar that is converted, about half a gram of alcohol is produced (Cheesbrogh, 2000).

The term ‘spirits’ refers to distilled beverages that contains no added sugar and has at least 20% alcohol by volume and ranges between 15% and 98%. A distilled beverage (spirit) is an alcoholic beverage produced by distillation of a mixture produced from alcoholic fermentation. This process purifies it and removes diluting components like water, for the purpose of increasing the proportion of alcoholic content (commonly expressed as alcohol per volume) (Plotto *et al.*, 2004). Distilled beverages contain more alcohol, that they are considered ‘harder.’ In general, all alcoholic beverages other than beer and wine are referred to as ‘spirits.’ Beer and wine which are not distilled beverages are limited to a minimum alcoholic content of about 20% alcohol by volume since yeast strains cannot reproduce when the concentration of alcohol is above this level; as a consequence, fermentation ceases at a point (Omemu *et al*., 2006). Distilled beverages (spirits) are alcohol-containing fluids (ethanol, also called ethyl alcohol) obtained through distillation of fermented juice from plant. Examples of these distilled beverages include brandy, whiskey, rum, gin and vodka. The most commonly used plants are sugarcane, potatoes, sugar beets, corn rice and barley; various fruits such as grape peaches and apple can also be used (Adebayo-Tayo and Samuel 2000).

Spirits are used for pleasurable consumption by human beings, as stimulants, as well as being an [apéritif](https://en.wikipedia.org/wiki/Ap%C3%A9ritif); any alcoholic beverage usually served before a meal to stimulate one’s [appetite](https://en.wikipedia.org/wiki/Appetite). The increased demand for alcoholic beverages such as ‘spirits”, particularly among the male Nigerian youths and men who derive pleasure in taking them also require that the safety of their health be given needed attention (Adesokan, 2005). This calls for a hygienic way of ensuring that the hard liquors do not pose a great threat to public health. The medicinal uses of the crop are great and cannot be over emphasized. Despite its quality and quantity (i.e. availability of raw materials in abundance), Nigeria has been spending much on the importation of exotic wine (Mahadevan and Shivali, 2009). Nigeria has spent about N171.56 million on importing of wine. However, the very high duty imposed on imported wines has stimulated interest in producing wines from tropical fruits. Since Roselle is a promising crop for medicinal use, making alcoholic beverage with it will produce a drink with high medicinal content which is readily available in the market and affordable too (Omemu *et al*., 2006).

**MATERIALS AND METHODS**

**Sample Collection**

Dried *Hibiscus sabdariffa* petals were purchased at a local market (Sayedero market) in Ilaro, Yewa South local government, Ogun state, Nigeria. They were kept dry; moisture free, until the commencement of work on them.

**Medium Preparation**

Pure cultures of *Saccharomyces cerevisiae* AS2.316; brewer’s type strains were obtained at The Federal Institute for Industrial Research, Oshodi, Lagos State (FIIRO) and were maintained on Potato dextrose agar slants in the laboratory, at the Federal Polytechnic, Ilaro. The PDA was prepared according to the manufacturer’s instruction which is to dissolve 39g of dehydrated PDA in 1litre of distilled water and then autoclaved at 121°C for 15 mins (Cheesbrough, 2000). The Streptomycin used was first dissolved in 5ml of sterile water and then sterilized by passing it through a commercial membrane filter of 0.45mm pore size. The medium was allowed to cool to about 45°C and the antibiotic was then incorporated to prevent bacterial contamination. Approximately 12ml of the molten PDA was aseptically dispensed into sterile McCartney bottles, then allowed to gel before inoculating them with the yeast strains and then kept refrigerated (Okigbo and Emeka, 1993).

**Distillation of Zobo Wine**

About 600g dried calyces of *Hibiscus sabdariffa* was briefly rinsed and then boiled with some clean water for 30 minutes before sieving. Copious amount of granulated sugar was added (about 1.75kg), stirred homogenously to dissolve while the drink was warm and then left in a clean bowl to cool.

The yeast strains were then introduced into the Zobo beverage and then left covered for about a week for the purpose of controlled ethanolic fermentation. A simple glucose broth fermentation test was carried out by introducing the strains into a 5ml glucose broth (1g of glucose + 4ml of distilled water) in a test tube containing Durham’s tube to confirm or ascertain their ability to ferment a simple sugar.

The fermented beverage was filtered to remove the spent yeast cells and then subjected to double distillation using a distillation column to increase the alcohol yield of the liquor. The distillate (spirit) was bottled afterward.

**Proximate Analyses**

Five samples from the distillate were subjected to analyses to determine their pH using a pH metre, brix using a refractometre, temperature using a thermometre, moisture content and alcohol by volume (ABV) using an alcohol metre. Mean values were recorded for the five samples.

**RESULTS AND DISCUSSION**

After the prepared alcoholic beverage was left for about seven days to allow for sufficient fermentation to occur, it was subjected to some analyses. Table 1 shows the results of the proximate analyses tests carried out on five samples obtained from the Zobo wine.

**TABLE 1: Proximate analyses of the Zobo wine after Distillation**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameters/Sample | A | B | C | D | E | Mean |
| pH | 3.4 | 3.3 | 3.7 | 3.4 | 3.2 | 3.4 |
| MC | 54.8 | 55.2 | 54.0 | 55.1 | 55.9 | 55.0 |
| Brix (0) | 16.10 | 17.5 | 10.15 | 19.8 | 20.2 | 16.75 |
| ABV (%) | 45.2 | 44.8 | 46.0 | 44.9 | 44.1 | 45.0 |
| Temp. (0C) | 26.9 | 26.5 | 26.9 | 27.4 | 27.3 | 27.0 |

**Keys:** MC = Moisture content, ABV = Alcohol by volume

The table shows that the temperature (mean) of the spirit as at the time of the analyses was 270C, the pH recorded had a mean value of 3.41 which clearly indicates that the liquor is moderately acidic. The mean value of the brix was 16.750 which suggest that there was still some fermentable sugar left unfermented while the alcohol content or alcohol by volume (ABV) was 45% (mean), this is within the range of the category of liquor referred to as ‘spirit’ i.e. within the acceptable standard hard liquor range of 15-98%.

It can be extrapolated that the pH of the drink decreases as the sugar content dissolved to produce alcohol. Some soluble solids were left unfermented (ºBrix) and the moisture content indicates the importance of water in Zobo beverage production. A report suggests that alcohol content increases as pH decreases.

Amin *et al.* (2008) observed that many factors can affect the ethanol content of sugary substrates and suggested that the maximum ethanol content of beverages fermented with *Saccharomyces cerevisiae* yeast could be achieved under the optimal condition of temperature.

The percent ethanol obtained in this investigation is at variance with some workers who reported that wine made from fruit fermentation contained about 8-10 ($^{v}/\_{v}$)% ethanol (Yadeng *et al.,*2005). The difference in alcohol content obtained may be attributed to the sugar added (Chaptalization) and the double distillation in other to deliberately increase its alcohol content.

Alcoholic beverages are generally classified as fermented or distilled. The principle of alcoholic distillation is based upon the different boiling points of alcohol (78.50C or 173.30F) and water (1000C or 2120F). By this process, a liquid containing ethyl alcohol is heated to a temperature above 78.50C but below 1000C and the vapor covering off the liquid is condensed; the condensate will have higher alcohol concentration or strength.

**CONCLUSION**

Due to the continuous increase in people’s desire for good quality of alcohol, the medicinal and nutritional benefits of alcohol made from nutritional Zobo drink cannot be over emphasized. It is easier and cheaper to produce indigenously. Its introduction into the market will definitely change the views of many alcohol-critics, as long as the intake is not overdone, that is, taken in moderation.

**RECOMMENDATIONS**

Further studies on how to limit the concentrations of formaldehyde which may cause alcohol poisoning could be carried out, in order to establish safety when consuming alcohol. Supposing alcohol poisoning did occur, possible methods, equipment, facilities and potential drugs or antidotes for suppressing the effect of this poisoning should be available and provided. The possibility of producing vinegar (acetic acid) from this plant, which is very useful as condiment or preservative, could also be investigated.

Lastly, it is recommended that ‘spirit’ from calyces of *Hibiscus* should be responsibly consumed as an enjoyable [apéritif](https://en.wikipedia.org/wiki/Ap%C3%A9ritif) and because of its medicinal potentialities.

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