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Research Article

BIOCHEMICAL ANALYSIS AND PRODUCTION OF WINE FROM CHRYSANTHEMUM, IXORA, LOTUS, HIBISCUS AND NERIUM FLOWERS

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Abstract- Wine is an alcoholic beverage made by the fermenting fruit juice with sugar and yeast. Wines are commonly manufacturing from different types of grape fruits. Investigations on the production of wines from flowers are very limited. Hence, the aim of present study was to evaluate the non-distilled alcoholic beverage (wine) from chrysanthemum, ixora, lotus, hibiscus and nerium flowers. The ethanol content five different flower wine was ranged between 0.75 - 2.55 % (v/v). Among the five different flowers wines, the maximum alcohol (ethanol) content (2.55%) was occurred in nerium followed by hibiscus (2.08%), chrysanthemum (1.89%), ixora (0.94%) and lotus (0.75%). Additionally, the percentage of tartaric acid in wines prepared from ixora, chrysanthemum, nerium, lotus, and hibiscus are 0.045, 0.015, 0.03, 0.015 and 2.4, respectively. The presence of tannin content in each wine was determined by ferric chloride test and results showed that tannin was detected only in nerium and hibiscus, and absent in ixora, chrysanthemum, and lotus. However, it is the first report of production of wines from chrysanthemum, ixora, lotus, hibiscus and nerium flowers. The present study suggests that nerium might be best alternative raw material for commercial production of non-alcoholic beverages (wines) from flowers in a cost-effective way.

Keywords- *Alcohol, Flower wine, Chrysanthemum, Ixora, Lotus, Hibiscus, Nerium, Chemical analysis*

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Introduction

Wine is an alcoholic beverage naturally made of fermented juice of variety of fruits, vegetables and flowers[1]. A typical wine contains ethyl alcohol (ethanol), sugar, tannins, aldehyde, esters, amino acids, minerals, vitamins, anthocyanins and other minor constituents. Alcohol, acetic acid and lactic acid fermentations are important for quality in production. Out of these, alcoholic fermentations are widely employed for the preparation of beverages in which alcohols is the major constituent. Distilled alcoholic beverages are produced by distilling ethanol by fermentation of grains, fruits, vegetables or flowers. Flower wines are undistilled alcoholic beverages usually made from flowers such as water lily, tulsi, dahlia, marigold, banana blossom and others. Which are nutritive, more tasty and mild stimulants. Fruits and flowers undergo a period of fermentation and ageing and have an alcohol content ranged between 5 and 13 percent [2]. The flower based fermented and un-distilled product; wine contains most of the nutrients present in the original flower juice. The nutritive value of wine is increased due to the release of amino acids and other nutrients from yeast during fermentation. The flower and fruits wines also contain 2 to 3 percent sugar with energy value ranging between 70 and 90 kcal per 100 ml [2]. The quality of wine produced greatly depends on yeast strains [3]. Many tropical and subtropical fruits, including grapes, tomato, watermelon, papaya, gooseberry and others yield good amounts of juice. Upon fermentation, fruit juices can be changed into wines [2-4].

In previous studies, wine has been produced from zobo flower (*Hibiscus sabdariffa*) juice using yeast extracted from palm wine. The maximum alcohol productivity of 2.6 percent (v/v) was achieved by the fermentation of zobo flower juice [5]. Fermentation involves a reaction that converts the sugars in the juice into alcohol and carbon dioxide. Yeast utilise the sugars during the fermentation period. Clarification may be achieved by racking, filtration and/or centrifugation. Wine undergoes continued changes during maturation and at an appropriate stage; the wine is filtered and bottled [6]. Investigations on the production of wines from flowers are very limited or not reported. Therefore, the present investigation was carried out to study the biochemical analysis and production of non-distilled alcoholic beverage (wine) from chrysanthemum, ixora, lotus, hibiscus and nerium flowers juice extract.

Materials and Methods

Wine production

The 50g of each matured flowers of hibiscus, ixora, nerium, chrysanthemum and lotus were collected from various farmers' fields and tribal area of Idukki district, Kerala, India. The collected flower was washed with distilled water and soaked in 300ml of water separately containing 0.5g potassium metabisulphite to prevent the growth of other contaminants and then mixed samples was pasteurized at 82-85°C for 20 minutes and cool down at room temperature. Flowers were ground with help of electric blender and the extract is filtered through muslin cloth to obtain fresh juices[1]. 200 ml of filtered and pasteurized juices was taken in separately labelled conical flasks and add 150ml of sugar syrup and mixed it well. Two teaspoon of lemon juice was added instead of citric acid and mixed thoroughly. A pinch of pure culture *S. cerevisiae* strain NCIM 3215 was inoculated under aseptic condition by using laminar air flow system and mixed it well. The flasks were incubated at 25°C for 21 days with constant agitation at 160 rpm. During incubation period the mouth of conical flasks were covered with balloons for observing CO_2 formation during fermentation. After 21 days of fermentation, matured wine was filtered using muslin cloth and racked to settle down the debris and cell biomass. The wine samples were clarified through using gelatin (400mg/ml).

All the wine samples purified by centrifugation at 5000 rpm for 20 min [7]. After filtration wine was stored in appropriate labeled glass bottles and stored at room temperature for aging and further biochemical analysis like estimation of % of tartaric acid, % of acetic acid, alcohol and tannin content.

Determination of titrate acidity

The 10 ml aliquots of each fermenting wine were taken and add 10 ml of distilled water and 5 drops of 1 % methyl orange solution. Mix it thoroughly and titrate to the first persistent yellow colour with 0.1N sodium hydroxide [8].

Estimation of ethanol content

The 10 ml of wines was taken in test tube and add equal amount of water and boiled it. Reduced volume was noted and again makeups the volume to 20 ml in each test tube and boil the contents and reduce the volumes to half and note down the volumes. The ethanol in the fermented sample was determined by using the specific gravity (SG) method [9]. Ethanol % [v/v] was calculated using following formulae, Ethanol % [v/v] = SG2 – SG1/ 2.11

Estimation of tannin content

The 5 ml of the sample was boiled with 5 ml distilled water for 5 minutes in water bath and was filtered and cool it. 1 ml of cool filtrate was distilled to 5 ml with distilled water and few drops of 2 to 3 ml of ferric chloride were observed for any formation of precipitate or any colour change a bluish black or brownish green indicated the presence of tannin [10].

Results and discussion

Wine is a product of the natural fermentation of the juices of fruits/flowers by the action of *Saccharomyces cerevisiae*. This biochemical conversion of juice to wine occur when the yeast cells become enzymatically degrade the fruits/flower sugars sucrose, maltose, glucose and fructose, first converted to aldehyde and then to alcohol. Carbon dioxide (CO_2) gas is released during this process. Extracting fermentable sugars from flowers are critical to the success of yeast fermentation, and production of alcohol could not occur without the work of amylase enzyme to breakdown starch into simple sugars that are usable by yeast. Present investigation was carried out for preparation of wine form different flower juices such as ixora, chrysanthemum, nerium, lotus and hibiscus. The production stages wine from flowers were schematically explained in [Fig-1].

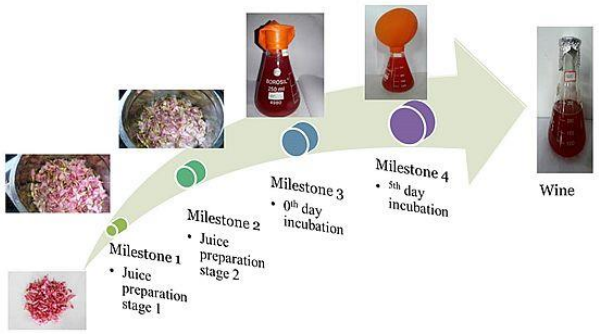

Fig-1 Stages of wine production from flowers (e.g., Nerium)

Results revealed that *S. cerevisiae* action was found higher in nerium, followed by chrysanthemum, lotus, hibiscus and ixora. The concentration of tartaric acid, acetic acid, alcohol and tannin were evaluated in five different flower juice fermented using *S. cerevisiae* for five days. Also, present study observed that the percentage of tartaric acid in wines prepared from ixora, chrysanthemum, nerium, lotus, and hibiscus are 0.045, 0.015, 0.03, 0.015 and 2.4, respectively.

Acetic acid percentage was recorded 0.036, 0.012, 0.012, 0.024, and 0.92 in ixora, chrysanthemum, nerium, lotus, and hibiscus, respectively [Table-1]. Hibiscus had richest acetic acid and tartaric acid than found in other flower wines including control (grapes). In earlier studies reported that acetic acid concentration of strawberry fruit wine varied from 0.027 – 0.030 % [11, 12] and it was supported present study results. The alcohol concentration of wine is calculated separately by substituting specific gravities in equation, after boiling methods and it was found that nerium flowers has the highest ethanol content with 2.55% (v/v) followed by hibiscus (2.08%), chrysanthemum (1.89%), ixora (0.94%) and lotus (0.75%), [Table-1]; [Fig-2] and it was lower concentration than found in mahua flower (9.9%), [13]. However, alcoholic content of nerium flower (2.55%) was within the range of zobo flower wine (2.6%) [5]. The existence of tannin content in each wine was determined by ferric chloride test and results showed that tannin was detected in nerium and hibiscus, and absent in ixora, chrysanthemum, and lotus [Table-1]; [Fig-3].

Table-1 *Alcohol and biochemical analysis in five different flower wines*

Material	Alcohol (%)	Acetic acid (%)	Tartaric acid (%)	Tannin
Grape (Control)	0.47	0.0096	0.012	Present
Ixora	0.94	0.036	0.045	Absent
Chrysanthemum	1.89	0.012	0.015	Absent
Nerium	2.55	0.024	0.030	Present
Lotus	0.75	0.012	0.015	Absent
Hibiscus	2.08	0.920	2.400	Present

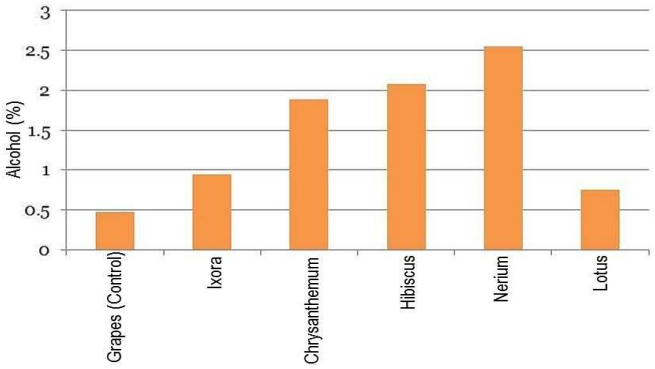

Fig-2 Alcohol percentage of five different flower wines

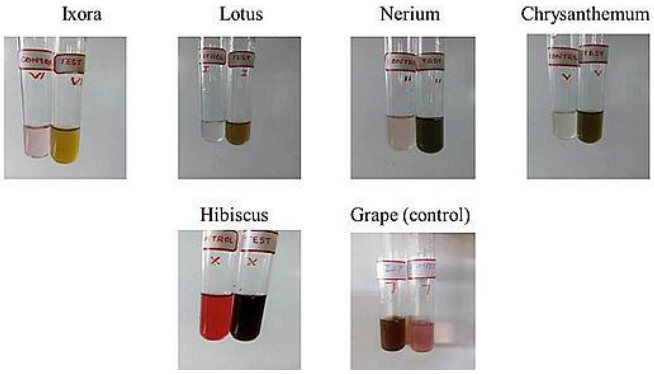

Fig-3 Presence or absence of tannin content in five different flower wines

Conclusion

Wine is an alcoholic beverage made by the fermenting the flower juice with sugar. It is a complex mixture of chemical compounds in a hydro alcoholic solution with pH4.5. Most common yeast associated with wine production is *Saccharomyces cerevisiae*. Tartaric acid is the key indicator of total acidity of wine and Hibiscus has recorded highest tartaric acid concentration compare to the other flower wines of ixora, chrysanthemum, lotus, and nerium. Acetic acid is enhancing flavour and complexity in small amount, however, it spoils the wine at high concentration, produce naturally by yeast in small amounts. Acetic acid content is higher in hibiscus than other four different flower wines. Alcohol concentration was greater in nerium wine than found in another flower. Hence, nerium might be best alternative raw material for commercial production of non-alcoholic beverages (wines) from flowers in a cost-effective way. Additional studies also need to optimize the fermentation condition for production of wines from flowers.

Application of research: Identify the best alternative raw material for commercial production of non-alcoholic beverages (wines) from flowers in a cost-effective way

Research Category: Wine production

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Study area / Sample Collection: Thodupuzha, Adimali and Idukki, Kerala, India

Cultivar / Variety / Breed name: Chrysanthemum, Ixora, Lotus, Hibiscus, Nerium

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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