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Three Novel Products from Leaves of *Aloe barbadensis* Miller

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Abstract: ***Wine, a fermented alcoholic beverage being famous for its versatility and health benefits have been consumed since ages. Traditionally grapes are used as source of fermentation for wine making. Recent surge in demand for herbal substitutes encouraged the idea of preparing wine from source having medicinal properties. Aloe vera known for its therapeutic properties and medicinal potential was exploited for wine making. The study also focused on waste management by utilizing the Aloe rind in soap and paper production. Aloe vera gel obtained from its leaves was fermented for a period of 21 days using Saccharomyces cerevisiae and by maintaining optimum conditions. A clear pale-yellow liquid obtained at the end of the fermentation period was assessed for the alcohol content, total carbohydrates, proteins and titratable acidity by suitable biochemical methods. Wine with an alcohol yield of 6.8% and titratable acidity of 0.35g of tartaric acid per 100 ml was successfully prepared. Aloe wine also showed high protein content. The Aloe rind obtained as waste was further processed using suitable techniques and was successfully used in production of soap and paper. The paper retained water for 22.20 minutes. The soap was prepared with minimum chemical utilization, thus inculcating natural properties of Aloe vera in it. The study concluded that Aloe vera can be used as a source for production of wine with promising application of Aloe vera rind in soap and paper production.***

Keywords: Novel products, Aloevera, waste management

1. Introduction

Wine being one of the popular alcoholic beverages, always stands out for its health benefits. The wine industry is a very fragmented sector and remains in the hands of small- to medium-sized producers. The art of wine making dates back to 2500 BCE. Egyptian records and numerous biblical references indicate the early origin of the wine industry in the Middle East. Wine is also famous for its versatility, satisfying wide range of individual tastes, occasions and complementing variety of food. Red wine, White wine, Rose wine, Sparkling wine, Sweet wine or Dessert wine and Fortified wine are some types of wine. Red wine is believed to improve cardiovascular and gut health and beneficial in case of type 2 diabetes, high blood pressure, brain damage after stroke, vision loss, cancer and depression. Traditionally grapes are used as source of fermentation for wine making. However, berries, apples, cherries, dandelions, elder-berries, palm, and rice can also be fermented. Recent revolutionary changes in diet plans and beverage preferences resulted an inclination of demand towards herbal formulas and preparations. Aloe vera has been used since ages as the history suggests for its therapeutic properties and medicinal potential. The spectrum of the properties and uses of Aloe vera is wide. It shows anti-ageing, antiseptic, antibacterial, antifungal action and is rich in anti-oxidants. It clears acne and skin allergies, dark spots and skin blemishes, and makes the skin clearer **(R. Rajeswari et al., 2012**). Aloe vera gel have physiologically active substances with biological effects. The gel contains bradykinase, an anti-inflammatory **compound (Kulveer Singh Ahlawat et al., 2011).** In the current study an attempt was made to prepare wine from the Aloe vera gel which inculcates the therapeutic and medicinal properties of natural gel with better palatability.

Any production process generates different types of waste products which needs to be managed well. Waste management might easily be overlooked; however, it has great impact in the world. A good production practice demands proper, simple and feasible management of waste. The waste produced in this case was the outer Aloe vera rind. However, according to the study (Chemical Composition and Antioxidant Activity of Aloe vera from the Pica Oasis (Tarapaca´, Chile) by UHPLC-Q/Orbitrap/MS/MS) several phenolic compounds were identified in the rind and were higher than in the other parts of A. vera. This study highlights that the rind, otherwise considered as waste, can be effectively exploited for product development and contributes to waste management as well.

In the present study, Aloe rind was used for making soap as an application in cosmetic industry with minimum chemical utilization. Also, the rind was utilized for paper making with a sight of waste management and exploiting Aloe vera rind as an alternative to wood in paper production.

2. Materials and Methods

Extraction and processing of Aloe vera gel

The traditional Aloe vera leaf processing method as described by **(Ramachandra and Srinivasa Rao 2008)** was used. Freshly cut leaves were obtained and washed thoroughly under tap water. The washed leaves were allowed to stand vertically for some time and re-washed thoroughly to ensure the yellow sap (latex) is drained out completely.

The lower base of leaf and the marginal spines were removed with help of a sharp knife. The blade was then introduced into the middle mucilage layer carefully avoiding the vascular bundles followed by removal of top rind. The solid and colourless gel obtained was cut into pieces and subjected to grinding. The blade was then introduced into the middle mucilage layer carefully avoiding the vascular bundles followed by removal of top rind. The solid and

colourless gel obtained was cut into pieces and subjected to grinding.

The total solid content was adjusted to 20% by addition of cane sugar. The juice thus obtained was used for wine production. The pH was then adjusted to 5 (approx.) to create favorable conditions for yeast growth using citric acid.

1) Wine Making

- **Preparation of primary inoculum**
  The total solid solution of obtained Aloevera juice was adjusted to 20% and seeded with yeast extract and a loopful of Saccharomyces cerevisiae and subjected to batch fermentation.
- **Fermentation**
  One liter of the medium was taken in ceramic jar and fermentation was carried out for 21 days by maintaining optimum growth conditions. The contents of the flask were mixed 2-3 times a day and the progress in fermentation was noted at regular intervals of 24 h by analysing ethanol and pH. After completion of fermentation, the wine was clarified, by repeated siphoning which was carried out 4 times with a sedimentation period of 3 days. A clear pale-yellow liquid obtained at the end of the fermentation period was assessed for the alcohol content, total carbohydrates, proteins and titratable acidity.
- **Alcohol content**
  The alcohol content of wine was determined using alcoholometer.
- **Titratable acidity**
  The titratable acidity of wine was determined according to **Association of Analytical Communities International (2000) method.**10 ml of wine was taken in conical flask. 2-3 drops of phenolphthalein indicator were added. The reaction mixture was titrated against 0.1N NaOH to obtain an end point of colourless to light pink. The titratable acidity of wine was expressed as % of tartaric acid.
- **Total Carbohydrate and Protein content**
  The Anthrone method was used to determine total carbohydrate content. 1000 µl of 5 g% sample was treated with 4ml ice cold Anthrone reagent. It was vortexed and then heated in a boiling water bath for 90 seconds. The solution was immediately cooled in ice bath and absorbance was measured at 600 nm. The amount of carbohydrate was calculated using standard curve of glucose. Folin-Lowry method was used to determine total protein content. 1ml of 5 g% sample was prepared in phosphate buffer (pH 7) and added to 5 ml of freshly prepared alkaline copper sulphate. The reaction mixture was mixed well and allowed to stand for 10 minutes. Followed by addition of 0.5ml phenol reagent (Folin-ciocalteu reagent). After 30 minutes of incubation the absorbance was read at 620 nm. Amount of protein was estimated using standard curve of bovine serum albumin (BSA).

2) Crude Paper Production

- **Isolation and processing of Aloe vera rind nanofiber**
  The rind obtained from wine making as a waste was processed to obtain nanofiber for crude paper making using method described in earlier study **(Cheng et al., 2014)** with certain modification. Rind obtained from aloe vera was dried at 60ºC for 3-4 hours and subjected to grinding to obtain a fine powder. The dried powder was then exposed to mild acid hydrolysis treatment. The powder was boiled in 0.01N HCl at 70ºC for 2 hours. pH of 9.5 was maintained using NaOH. Following pH adjustment, the reaction mixture was filtered to obtain the digested pulp. The pulp obtained was thoroughly washed under normal tap water to get rid of acid if present and later air dried. The dried pulp was then bleached for 4.5 hours at 50ºC in 2% acidified sodium chlorite solution (solid/liquid: 1/20 v/v). The ratio of glacial acetic acid to sodium chlorite was maintained to be 1/1 (v/w). Post bleaching the pulp was again washed to remove the remnant of bleaching reagents. The pulps then undergo grinding to defibrillate the fibres and obtain nanofiber suspension.
- **Casting of paper**
  The defibrillated nanofiber suspension was then poured onto a petri plate uniformly. The casted plate was kept in a hot air oven at 100ºC till the paper was dry. After complete drying the paper was carefully peel off the petri plate. The paper thus obtained was tested for water retention capacity and ash content.
- **Water Retention Capacity**
  The paper obtained was arranged as filter paper in filtration apparatus. Water was then poured onto the paper. The time taken for the first drop of water to fall into the beaker was recorded.

3) Production of Soap

Making of the soap was performed by hot process using boiling water bath as heating medium. The production of soap was done by combining aloevera & soap base, particularly for the blend ratio in samples 50:50 along with locally sourced natural ingredients and essential oils as required for skin treatment. Mix the contents well, pour into mould let it set for 30-45 minutes.

Soap for glowing skin Treatment: Add 5 ml of honey and 2 ml of coconut oil to the blend of Aloevera and soap mixture.

Soap for dry skin Treatment: Add 3 ml of honey, 5 drops of olive oil and 1 ml of glycerol to the blend of Aloevera and soap base.

Soap for Acne Treatment: Add 1gm of nutmeg powder and 1ml of lemon juice to the blend of Aloevera and soap base.

Soap for exfoliating action Treatment: Add 1 gm of coffee extract to the blend of Aloevera and soap base.

3. Results and Discussion

1) Wine Preparation

Wine was successfully prepared using Aloe vera as a source for fermentation.

2) Alcohol Content

The alcohol yield obtained was 6.80 % by alcoholometer.

Figure 1: Raw Aloevera Gel

Figure 2: Aloevera Wine

Figure 3 & 4: Testing with Alcoholometer

3) Titratable Acidity

The Titrable acidity of the wine was 0.35g of tartaric acid/100 ml wine. The titratable acidity of juice ranges between 0.4-1.2 g/100 ml of liquid. The Aloe wine showed moderate titratable acidity that indicated freshness and flavour of the wine.

4) Total Carbohydrate content

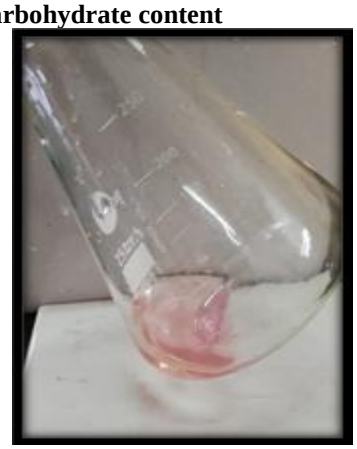

Figure 5: Titrable Acidity of Wine

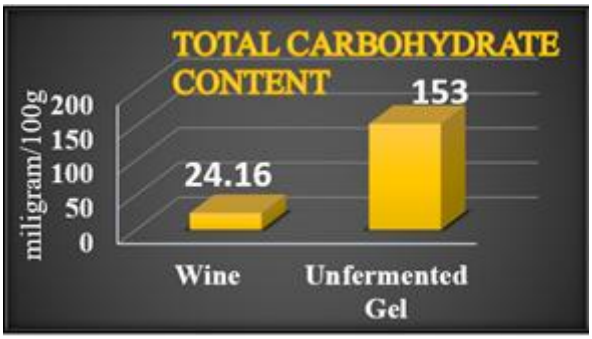

Figure 6: Total Carbohydrate Content

The total carbohydrate content of Aloe vera wine (24.16 mg%) .

5) Total Protein content

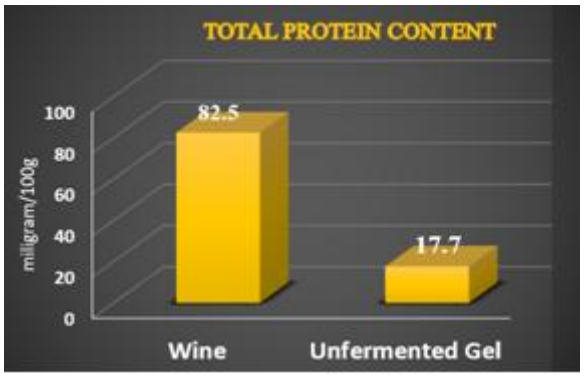

Figure 7: Total Protein Content

The total protein content of Aloe vera wine (82.5 mg%).

6) Paper Making

Figure 8: Paper made from Waste aloevera rind

7) Water Retention Capacity

The water retention Capacity of the paper made from Aloe vera rind was found to be 22.20 minutes.

Figure 9: Testing the Water retention Capacity.

8) Production of soap

Product development was studied by manufacturing soaps for dry skin, oily skin and acne related problems.

Figure 4: Aloevera Soap from Natural Product

4. Conclusion

It is important to note that product development, product innovation and high levels of performance do not come easy. Research has shown that product development and innovation initiatives are a prime objective to meaningful utilization of resources. The active usage of waste generated from aloevera consuming industry can prove to be a beneficial factor for sustainable development by marginally reducing carbon footprint of the region. Novel products like soap and paper can be used in respective industries as natural alternatives involving fewer chemicals. Developments of such novel products have opened new avenues for research.

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