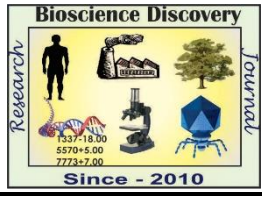
Print & Online, Open Access, Research Journal Available on http://jbsd.in
ISSN: 2229-3469 (Print); ISSN: 2231-024X (Online)
Research Article



Influence of different yeast strains on physicochemical characteristics of banana wine

Pradip D. Satav*[1] and Archana S. Pethe[2]

[1] N.E.S. Science College, Nanded, Maharashtra, India-431 605. Mobile: 09730960780
[2] Shri Shivaji College of Arts, Commerce and Science, Akola, Maharashtra, India-444 001.
*Email: satavpradip@gmail.com

Article Info

Received: 15-06-2017,
Revised: 08-08-2017,
Accepted: 05-09-2017

Keywords:
Banana must, banana wine, physicochemical characteristics, volatile acids and yeast strains

Abstract

Present study was carried out to investigate the effect of different yeast strains on fermentation of banana wine. The must was prepared from banana pulp of ripe banana fruits.For this pectinase enzyme and potassium metabisulphite (KMS) were added to juice. Juice was then chaptalized to 19 ^{O}Brix, Diammonium phosphate (DAP) was added to this and pH was adjusted to 3.5.The inoculum of activated yeast strains (*Saccharomyces cerevisiae* NCIM 3215 and NCIM 3604) were used at a concentration of 1% for the fermentation banana must separately. After inoculation the fermentation was carried out at 20 ^{O}C for about 22 days. Physico-chemical parameters were then analyzedand concentration of volatile acids (VFA) was determined by using gas chromatography (GC). Banana wine produced using NCIM 3215 and NCIM 3604 strains had ^{O}Brix (6.1), alcohol (5.17 and 4.88%) and titratable acidity (0.93 and 0.96%) respectively. All nine volatile acids analyzed were detected in both wines. Significant effect was not observed on physicochemical parameters of banana wine produced by using different yeast strains.

INTRODUCTION

Fermentation of fruit juice is a relatively simple wayof reducing post harvest loses of primarily perishable fruits. One of such fermentation product is fruit wine. Wine is a fermentation product included in alcoholic beverage category andis produced by fermentation of fruit juice. The fruit having good amount of sugar can be used as a substrate for production of fruit wine and the wines thus produced are generally named after the fruit used such as apple, banana, pineapple, orange, coconut, mango and strawberry wine (Reddy *et al.*, 2012; Shweta *et al*., 2016; and Ranjitha *et al*., 2015). Banana fruit is commonly cultivated in a tropical region and is non-seasonal. Beside high production its post harvest loses are also more as it is also a perishable fruit. During fermentation process various cultural parameters and nutritional requirements have fundamental role in the growth of microorganisms and subsequent product formation (Tambekar *et al*., 2013, Nadagouda *et al*., 2016). The influence of different yeast strains on production of banana wine is one of the aspects during fermentation of banana wine.

Various reports on production of banana wine are increasing day by day (Onwuka and Awam, 2001; Akubor *et al*., 2003; Cheirsilp and Umsakul, 2008; and Isitua and Ibeh, 2010). However as per our knowledge very less work is reported in India which focuses on fermentation of banana wine by using different yeast strains as well as on physicochemical characteristics and volatile acid analysis of banana wines.

In view of this here we have made an effort to investigate the effect of fermentation of banana wine by using different yeast strains on physicochemical parameters and volatile acid in banana wine.

MATERIALS AND METHODS

Preparation of banana juice

Ripe banana fruits were procured from local market of Nanded, Maharashtra, India. These fruits washed with tap water, hand peeled, cut in to thin slices and then grind in mixer. This pulp homogenate was then mixed with water in 1:1 proportion. To this 0.02 % of pectinase enzyme to reduce the viscosity and 100 mg/L potassium metabisulphite (KMS), to kill the unwanted microorganisms, were added and the mixture was held at room temperature for 4 h. Pectinase treated juice was then chaptalized to 19 ^{O}Brix using table sugar, Diammonium phosphate (DAP) at concentration of 100 mg/L was added to this and its pH was adjusted to 3.5 using citric acid and calcium carbonate. Then it was kept at 10 ^{O}C until required.

Preparation of inoculum of Standard yeast cultures:

The standard yeast strains of *Saccharomyces cerevisiae* (NCIM 3215 and NCIM 3604) procured from NCIM, Pune, Maharashtra were used for preparation of inoculum. The yeast strains were first inoculated in yeast extract peptone dextrose broth (HiMedia, Mumbai) and allowed to grow at 30^{0}C for 24 h. These activated broth cultures of yeasts were then transferred (at concentration of 1% v/v) separately to prepared banana must and allowed to propagate at 30^{0}C for 24 h.

Fermentation experiment:

The inoculum of yeast strains were used at a concentration of 1% (19 mL inoculum in 1900 mL banana musts) for the fermentation banana must separately. The activated inoculum had cell density of ~1.6 x 10^{8} cfu/mL (NCIM 3215) and ~2.0 x 10^{9} cfu/mL (NCIM 3604). After inoculation the fermentation was allowed to continue at 20 ^{O}C for about 22 days. Progress of fermentation was monitored by observing total soluble solid profile of the must.

Physico-chemical analysis

The pH of the must was measured with a digital pH meter (Systronics, India), pre-calibrated with buffers of pH 4.0 and 7.0. Titratable acidity was determined by titrating with 0.1 N NaOH and alcohol % by specific gravity method as described by AOAC. Total soluble solids (TSS) were determined using Abbey's refractometer (0-32) in terms of °Brix (Jacobson, 2006). Moisture % was determined by oven drying at 100 -105 °C. Volatile acidity was determined by titration of distillate samples and expressed as percent of acetic acid per 100 ml of wine. Concentration of volatile acids (VFA) was determined by using gas chromatography (GC) as mentioned previously (Satav and Pethe, 2017).

RESULTS AND DISCUSSION

Physicochemical parameters

Physicochemical parameters of wines fermented by using two different yeast strains were analyzed and are presented in table. Soluble solid of wine fermented with both strains was found to be same. Alcohol% obtained by using NCIM 3215 was higher than wine produced by using NCIM 3604.Specific gravity was also found to be same in both wines. TA and VA were found to be higher in NCIM 3604.

Table 1: Physicochemical properties of Banana wine inoculated with different Yeast Strains

Parameter	*Saccharomyces cerevisiae* strain used	
	NCIM 3215	NCIM 3604
Soluble solid(^{O}Brix)	6.1	6.1
pH	3.46	3.53
Alcohol %	5.17	4.88
Specific Gravity	0.9977	0.9977
Titratable Acidity(%)	0.93	0.96
Volatile Acidity(%)	0.015	0.019
Moisture %	98.00725	97.84921
Total Solid %	1.99275	2.150791

Concentration of various elements was also analyzed in both wines and no significant difference in concentrations was observed in both wines for almost all elements. Joshi *et al*., (2009) reported the effect of different wine yeast strains on physicochemical characteristics of plum wine. They reported soluble solid in the range of 7.2-7.6 ^{O}Brix, titratable acidity 0.7-0.9% and ethanol up to 12%. Singh and Kaur (2009) also reported the litchi wine fermentation using different yeast strains and ethanol% in the range of 8.5-10.25%. Joshi *et al*., (2013) studied the effect of different yeast strains on the quality of apple wine and also analyzed the mineral content of the produced wine. The concentration of minerals reported in their study was found to be lower than banana wine except for Fe. From present study it could be concluded that alcohol % of wine produced by using different strains could differ slightly. However other parameters and other elements could remain same.

Table 2: Concentration (mg/L) of various elements in banana wine

Elements	*Saccharomyces cerevisiae* strain used	
	NCIM 3215	**NCIM 3604**
Ca	28.62	28.61
Fe	0.45	0.41
Mg	92.36	93.09
Mn	1.14	1.14
P	102.99	112.54
Zn	6.35	7.78

Table 3:Volatile acids in Banana wine inoculated with different yeast inoculum

Acid (mg/L)	NCIM 3215	NCIM 3604
Acetic Acid (AA)	343.17	184.08
Propionic Acid (PA)	2.83	4.02
Iso-Butyric Acid (IBA)	409.75	447.97
Butyric Acid (BA)	68.12	34.44
Iso-Valeric Acid (IVA)	41.35	23.35
Valeric Acid (VA)	1.13	0.96
Iso-Caproic Acid (ICA)	57.29	252.65
Caproic Acid (CA)	2.65	8.01
Heptanoic Acid (HA)	42.43	83.33
Total	**968.73**	**1038.82**

Volatile acids

Nine volatile acids were analysed in banana wines fermented by using two different yeast strains *Saccharomyces cerevisiae* NCIM 3215 (3215) and *S. cerevisiae* NCIM 3604 (3604) (Table). The concentration of iso-butyric acid was found to be higher as compared to other acids in both wines. Its concentration in wine with *S. cerevisiae* strains NCIM 3215 and 3604 was found to be 409.75 and 447.97 mg/L respectively. Acetic acid was present at concentration of 343.17 and 184.08 mg/L in wines with 3215 and 3604 respectively. Propionic acid was present at low concentration in both wines. The concentration of propionic acid (PA) was found to be 2.83 and 4.02mg/L in 3215 and 3604 respectively. Butyric acid was preset at concentration of 68.12 and 34.44 mg/L in 3215 and 3604. Its concentration was found to be two-fold higher in 3215. The concentration of iso-valeric acid was also found to be two-fold higher in 3215 (41.35 mg/L) than 3604 (23.35 mg/L). Concent6ration of Valeric acid in both wines was very low as compare to other acids. Iso-caproic acid was also detected at high concentration in both wines with almost five-fold higher concentration in 3604 (252.65 mg/L) than 3215 (57.29 mg/L). Caproic acid was detected at low concentration in both wines. Concentration of heptanoic acid was found to be higher in 3604 (83.33 mg/L) than 3215 (42.43) and found to be two-fold higher in first one.

Acids are presented in table 3 from both yeast strains NCIM 3215 and NCIM 3604. Some authors reported the volatile fatty acids from other wines (Shinohara, 1985, Perestrelo *et al*., 2006, Duarte *et al*., 2010, Reddy *et al*., 2010).

REFERENCES

Akubor PI, Obio SO, Nwadomere KA and Obiomah E, 2003. *Production and quality evaluation of banana wine. Plant Food Hum. Nutr.,* **58**(3):1-6.

AOAC, 1980. Official methods of analysis. Association of official analytical chemist, 13th Edn. Washington DC.

Cheirsilp B and Umsakul K, 2008. Processing of banana-based wine product using pectinase and *α*-amylase. *J. Food Proc. Eng.,* **31**(1):78–90.

Duarte WF, Dias DR, Oliveira JM, Teixeira JA, de Almeida e Silva JB and Schwan RF, 2010. Characterization of different fruit wines made from cacao, cupuassu, gabiroba, jaboticaba and umbu. *LWT - Food Sci. Technol.,* **43**(10):1564–1572.

Isitua CC, and Ibeh IN, 2010. Novel method of wine production from banana (*Musa acuminata*) and pineapple (*Ananas comosus*) wastes. *African J. Biotechnol.,* **9**(44):7521-7524.

Jacobson JL, 2006. Introduction to wine laboratory practices and procedures. Springer Science & Business Media, New York, pp 164-166, 269-271.

Joshi VK, Sandhu DK, and Kumar V, 2013. Influence of addition of insoluble solids, different yeast strains and pectinesterase enzyme on the quality of apple wine. *J. Inst. Brew.,* **119**(3):191–197.

Joshi VK, Sharma S, and Devi MP, 2009. Influence of different yeast strains on fermentation behaviour, physico-chemical and sensory qualities of plum wine. *Indian J. Nat. Prod. Res.,* **8**(4):445–451.

Nadagouda MG, Lingappa K, VS Bheemareddy and Malipatil SG, 2016. Optimization of Solid State Fermentation Conditions for the Production of Cellulase by Using Trichoderma viride GSG12. *Bioscience Discovery*, **7**(1):01-06.

Onwuka U, and Awam FN, 2001. The potential for baker's yeast (*Saccharomyces cerevisiae*) in the production of wine from banana, cooking banana and plantain. *Food Serv. Technol.,* **1**(3-4):127-132.

Perestrelo R, Fernandes A, Albuquerque FF, Marques JC, and Câmara JS, 2006. Analytical characterization of the aroma of Tinta Negra Mole red wine: Identification of the main odorants compounds. *Anal. Chimi. Act.,* **563**(1):154-164.

Ranjitha K, Narayana CK, and Roy TK, 2015. Process standardization and quality evaluation of wine from Cavendish banana (*Musa*, genome AAA) cv. Robusta. *Indian J. Horti.,* **72** (1):153-155.

Reddy LVA, Joshi VK, Reddy OVS, 2012. Utilization of tropical fruits for wine production with special emphasis on mango (*Mangifera indica L.*) wine. In: Microorganisms in Sustainable Agriculture and Biotechnology. *Springer Publisher*, Netherland, pp 679-710.

Reddy LVA, Kumar YS, Reddy OVS, 2010. Analysis of volatile aroma constituents of wine produced from Indian mango (*Mangifera indica L.)* by GC-MS. *India J. Microbiol.,* **50**(2):183-191.

Satav PD and Pethe AS, 2017. Production and physicochemical characterization of wine from banana (*Musa acuminata*). *Asian J. Microbiol. Biotechnol. Envi. Sci*., **19**(2):425-431.

Shinohara T, 1985. Gas chromatographic analysis of volatile fatty acids in wines. *Agri. Biol. Chem.,* **49** (7):2211-2212.

Shweta H, Joshi P and Valmiki S, 2016. Wine production from over ripened banana. *World J. Pharma. Pharmaceu. Sci.,* **5** (6):1461-1466.

Singh RS, and Kaur P, 2009. Evaluation of litchi juice concentrate for the production of wine. *Indian J . Nat. Prod. Res.,* **8**(4):386–391.

Tambekar D H, Raut N S and V R Dhundale, 2013. Partial characterization and optimization of alkaline amaylase production by *Bacillus circulans* from Lonar Lake. *Bioscience Discovery*, **4**(2):202-207.

How to cite this article

Pradip D. Satav and Archana S. Pethe, 2017. Influence of different yeast strains on physicochemical characteristics of banana wine**.** *Bioscience Discovery*, 8**(4):** 712-715**.**