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Short communication

Screening the efficiency of various strains of yeast for wine production from grapes

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ABSTRACT

Fermentation is the most efficient post harvest, low energy preservation process which enhances the shelf life of horticultural crops. Screening of yeast strains plays a very important role in transforming grape must (fresh juice) to wine by alcoholic fermentation. In the present study, efficiency of various strains of yeast *viz.,* MTCC3604, MTCC3304, MTCC4787 and MTCC170 was assessed and optimized w. r. t. pH, temperature and incubation time, to prepare wine from green (Perlette) and black (Bangalore Blue) grapes. Green grapes fermented with MTCC170 were observed with maximum alcohol content (9.47%) at pH 5 after incubation time of 14 days at 25°C.

Key words: *Saccharomyces cerevisiae*, fermentation, wine.

India is one of the largest producers of fruits in the world. Postharvest loss of fresh fruits is one of the most serious problems of tropical countries like India. Nearly 35 to 40 per cent of horticultural production goes waste due to improper postharvest handling and inadequate processing facilities (Aravindaraj *et al.,* 1). Alcoholic fermentation is a viable post harvest technique for the preservation of horticultural crops. Yeast species metabolize grape juice constituents, especially the sugars, to alcohol and wide range of volatile and non-volatile end-products (Pretorius, 5). In the present investigation an attempt was made to screen the efficiency of *Saccharomyces cerevisiae* of four different strains viz., MTCC3604, MTCC3304, MTCC4787 and MTCC170 for wine production from grapes (Green and Black). Yeast strain MTCC170 was further optimized w. r. t. pH, temperature and incubation time, to prepare wine from green and black grapes.

Fresh and over ripened fruit of green (Perlette) and black (Bangalore Blue) grapes were procured from orchard of Department of Horticulture, CCS HAU, Hisar. Pure cultures of *S. cerevisiae* (MTCC3604, MTCC3304, MTCC4787 and MTCC170) were obtained from Institute of Microbial Technology, Chandigarh. For culture revival, each yeast strain was first inoculated in autoclaved Yeast extract peptone dextrose (YEPD) broth and incubated at 25ºC for 48 hrs. Cultures were sub cultured by streaking on YEPD agar plates and thereafter stored in refrigerator at 4ºC on YEPD slants till further use.

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To determine the efficiency of *S. cerevisiae* yeast cultures (MTCC3604, MTCC3304, MTCC4787 and MTCC170), different grape musts (green and black) were used. Initial sugar concentration of grape juice was adjusted at 20% with sucrose and pH was adjusted to 5 by citric acid. Potassium metabisulphite @ 100 ppm was added, and left for 48 h. Then juice was inoculated with yeast strain 10^5 cells/ml from 48 h old actively growing *S. cerevisiae* strain, each separately from YEPD slants (Carrau *et al.*, 3). Alcoholic fermentation experiments were done in triplicate a controlled temperature of 25°C. TSS was monitored daily by hand refractometer. Fermentations were considered to be finished when steady state total soluble solids values were obtained. The contents of the flasks were then harvested after 14 days and assayed for alcohol content as per Caputi *et al*. (2) method. The strains selected were those with a higher alcohol percent at the end of fermentation. Among the yeast cultures (MTCC3604, MTCC3304, MTCC4787 and MTCC170), grape must inoculated with strain MTCC170 was recorded with maximum alcohol content (9.06%) with green grapes while 8.67 % in black grapes must respectively (Fig.1a). This might be due to better adaptability of MTCC 170 in grape must as compared to othe strains. Therefore, MTCC170 was further optimized w. r. t. pH, temperature and incubation time. The experimental results were conducted in triplicates and the results presented were presented in two way ANOVA using OP STAT software.

Optimization: The effect of pH (4.5, 5.0, 5.5, 6.0 and 6.5), temperature (20º-35ºC) and incubation time (7-21 days) on alcohol production was studied

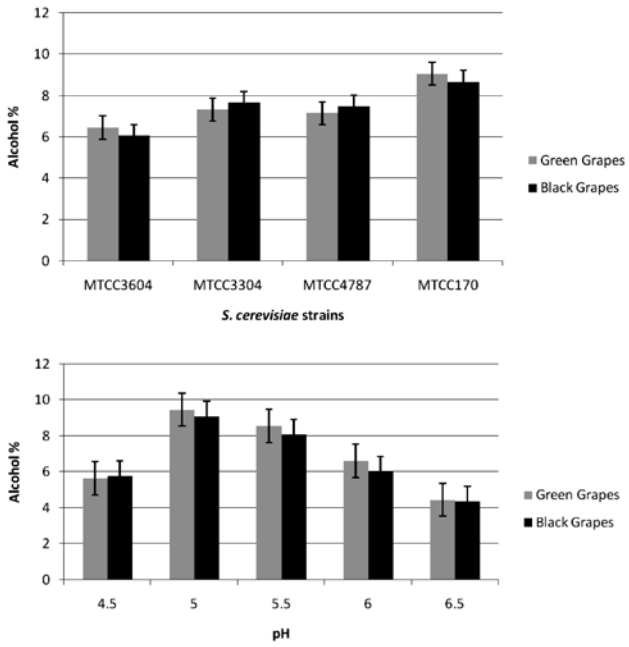

Fig. 1. (a) Alcohol content in wine by different strains of *S. cerevisiae* **(b).** Effect of pH on alcohol production strains of *S. cerevisiae.*

by conducting alcoholic fermentation of grape must by MTCC 170 strain. pH was recorded by using a pH meter. The pH meter was calibrated with pH buffers at 4 and 7. The contents of the flasks were then harvested and assayed for alcohol content.

The maximum alcohol production of (9.47% and 9.08%), was observed at pH 5 in green and black grapes must, respectively (Fig.1b). Most of the yeasts grow very well between pH 4.5 and 6.5 and nearly all species are not able to grow in more acidic or alkaline media since it can cause chemical stress on yeast cell. *Saccharomyces* produced maximum ethanol at pH 4.5-5 (Reddy and Reddy, 6). The maximum alcohol production of 9.5% and 8.86% at 25^{0}C was observed in green and black grapes must, respectively (Table 1). Yeast strains differ in response to temperature, so the optimum temperature for vinification can vary widely. Low temperature fermentations which started more slowly consumed faster all the sugars but resulted in better aroma retention. With increase in temperature, initially fermentation rate increased due to increase in the enzymatic activity of the metabolic pathway. It approximately doubled with every 10˚C rise. Generally yeast viability decreases as the temperature increases (Valentine *et al*., 7).

The maximum alcohol production of (9.06% and 8.57%) with green and black grapes must was observed at pH 5 after incubation time of 14 days

Table 1. Effect of temperature and incubation time on alcohol production in green and black grapes wine.

S. N.	Temperature (^{0}C)	Green grapes	Black grapes	Mean
	20	6.2	5.8	6.0
	25	9.5	8.8	9.1
	30	5.8	5.2	5.5
	35	3.8	3.5	3.6
Mean		6.325	5.840	
C.D.	A=0.004 B=0.003 A × B= 0.006			
	Time (in minutes)	Green grapes	Black grapes	Mean
5.	0	0	0	0
6.	7	8.4	7.2	7.8
7.	14	9.06	8.57	8.8
8.	21	7.14	6.46	6.8
Mean		6.2	5.5	
C.D.	A=0.004 B=0.003 A × B= 0.006			

(Table 1). Fermentation time varies with fruit and other fermentation condition. Most juices under favorable condition ferment completely within 2-3 weeks because of increased acidity as the number of fermentation days increased hamper the alcohol production (Otegbayo *et al*., 4).

Various strains of *S. cerevisiae* could be used for wine production but prior screening and optimization of cultural conditions should be exercised for quality wine production. *S. cerevisiae* MTCC170 could be potentially used for grape wine production to reduce postharvest losses.

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