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Studies on production of sapota wine with immobilized yeast

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Abstract
The present investigation was carried for production of wine from sapota fruit with utilization of immobilized yeast. In this study the baker's yeast *saccharomyces cerevisiae* was immobilized in sodium alginate beads and this immobilized biocatalyst were used for Sapota wine making. The 4% concentration of sodium alginate was used for immobilization. Wine prepared with 10% of immobilized beads was found to be good in terms of sensorial evaluation. Further, the physico-chemical properties of sapota juice and wine were analysed. Results showed that TSS of wine (with immobilized yeast) had 6 Bx, pH 3.8, Alcohol content 17%, Density 0.99 g/ml), Specific Gravity 0.994 and Viscosity 1.542 cp. In the microbial examination of wine the bacterial count was found to be zero and yeast and mould count was 1.63×10^3 and 1.19×10^3 in the wine stored at ambient and refrigeration.

Keywords: Sapota, immobilized yeast, sodium alginate, physico-chemical properties

Introduction
Sapota is fruit belongs to sapotaceae family. Sapota is mainly known for its high sweetness. Sapota has sugar content in the range of 12- 14%. A 100 g of edible portion of fruit contains moisture (73.7 g), carbohydrates (21.49 g), protein (0.7 g), fat (1.1 g), calcium (28 mg), phosphorus (27 mg), Iron (2 mg) and ascorbic acid (6 mg) as reported by Bose and Mitra (1990) [3].

Sodium alginate is a GRAS (generally recognized as safe) substance deriving from brown algae that has been used as thickener, emulsifier, stabilizer and gelling agent in food production (Gemeiner *et al*, 1994) [6]. Entrapment within calcium alginate is the most widely used technique for immobilising cells. It is especially suited to living cells as it tends not to damage them. Applications of this versatile method include immobilisation of cells in bioreactors, entrapment of plant protoplasts and plant embryos ('artificial seeds') for micropropagation, immobilization of hybridom as for the production of monoclonal antibodies, and the entrapment of enzymes and drugs. The cells or enzymes to be entrapped are first mixed with a solution of sodium alginate. This is then dripped into a solution containing multivalent cations (usually Ca2+). The droplets form spheres as they fall, entrapping the cells in a three dimensional lattice of ionically cross-linked alginate (Dean Madden 2007) [4].

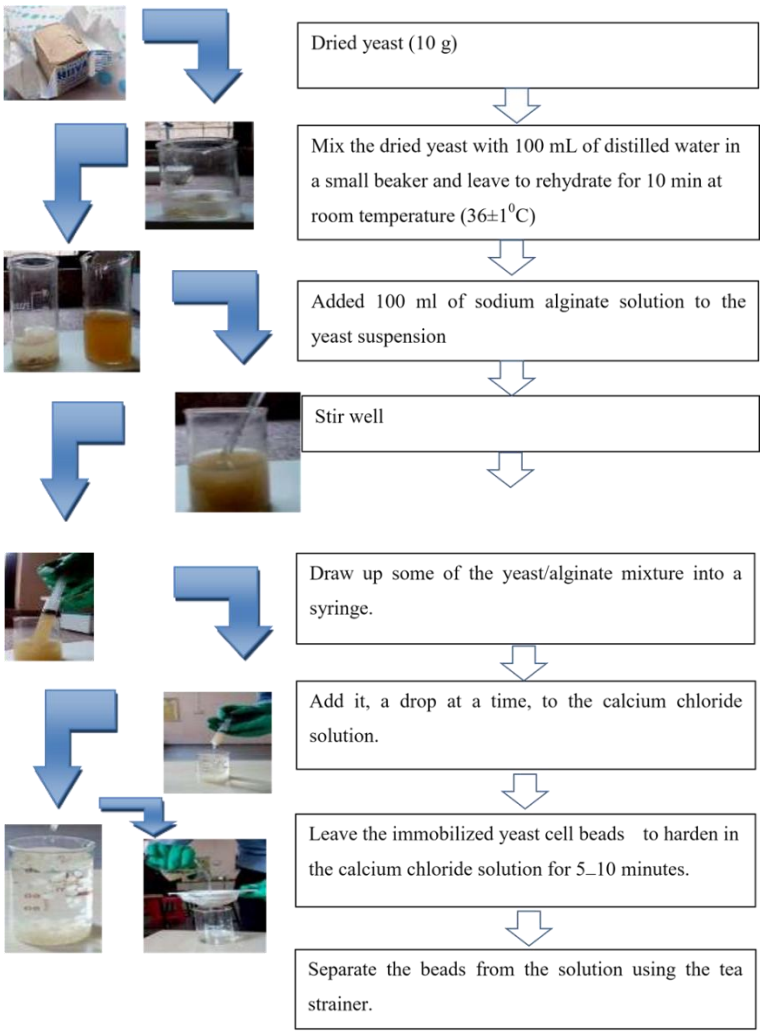
Wine, an alcoholic beverage is prepared by different fruit juices with appropriate processing and additions (Amerine and Singleton, 1968) [2]. Alcoholic fermentation is widely employed for the production of beverages especially wines. Wine is largely produced from grapes. Therefore, by taking into account the sugar content of sapota fruit can be utilized for wine making.

Material and Methodology
Raw material
Raw materials required during present study for preparation of sapota wine such as sapota, sugar, yeast were purchased from local market of Sangamner.

Chemicals and glass wares
The chemicals of analytical grade and glass wares required were available from the Department of Food Chemistry and Nutrition, Shramshakti College of Food Technology, Maldad.

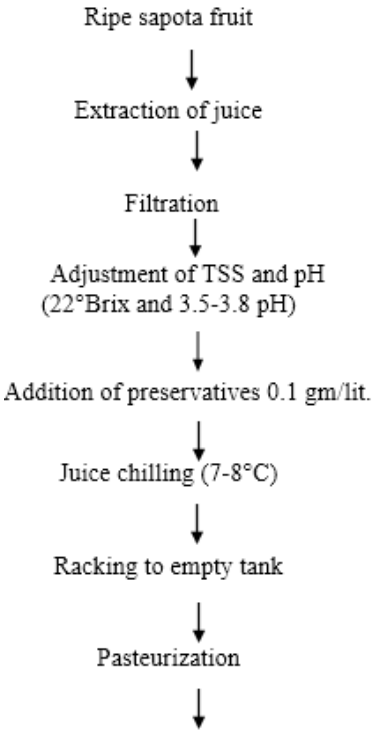
Methodology

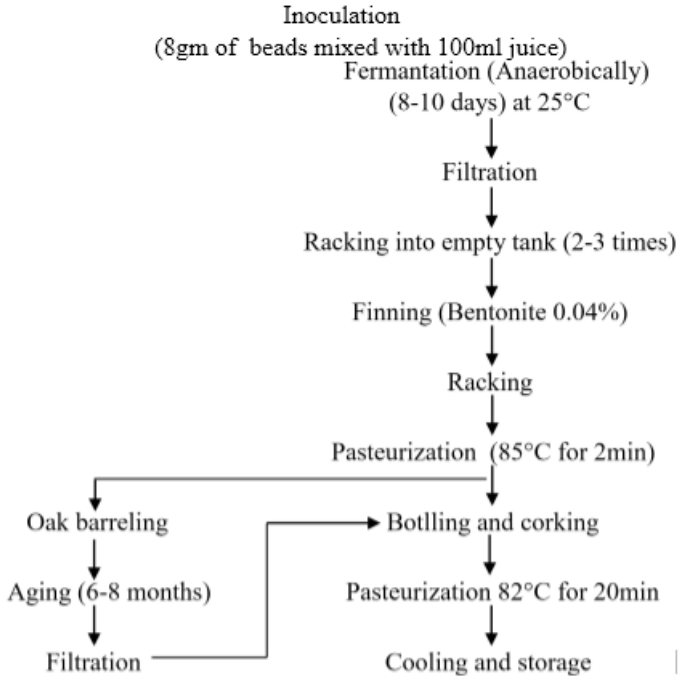
Methodology of making Immobilized yeast



(Dean Madden 2007)

Methodology for wine preparation from Sapota





Physico-Chemical Analysis of raw juice and wine

Different physico-chemical constituents like TSS, density, specific gravity, viscosity, pH, titratable, Reducing, Non-reducing Sugar, acidity and alcohol content were determined as per the method given by AOAC, (1990) [1] and Thimmaiah (2012) [8].

Microbial examination of wine

Microbial analysis with respect to total plate count and yeast and mould count were examined as per standard methods of FSSAI, (2012) [5].

Result and Discussion

Sensory evaluation of sapota wine

The sensorial evaluation of wine revealed that wine prepared from sapota juice inoculated with strains of *S. Cervisiae* having pale to brown colour and taste were harmonious like typical wine.

Fermentation of sapota juice was efficiently carried out with varied concentration of inoculum, pH, TSS shown to have profound effect on sensorial characteristics of wine as well as alcohol content. From sensorial score it can be revealed that wine prepared with 10% of inoculum with having 22 ^{0}Brix TSS was found to be acceptable as per sensorial evaluation.

TSS of natural fruit juice was adjusted with addition of fructose sugar.

Table 1: Sapota wine with varying levels of immobilized beads

Sample	TSS (ºBrix)	Immobilized Beads (%)	Alcohol content (%)
S_1	14	2	8.26
S_2	16	4	10.70
S_3	18	6	12.50
S_4	20	8	14.41
S_5	22	10	17.00

*Each value is the average of three determinations

Physico-chemical analysis of Sapota must and Wine

Sapota juice, prepared wine with immobilized and free yeast were analysed for its physicochemical characteristics. The results pertaining are given in table 2.

Table 2: Physico chemical properties of sapota juice

Physicochemical Properties	Sapota juice
TSS (°Bx)	22.00
pH	4.50
Density (g/ml)	1.02
Specific gravity	1.08
Reducing sugar (%)	9.04
Non-reducing sugar (%)	5.06
Total Sugar (%)	14.10

*Each value is the average of three determinations

Data from the table 2 revealed that the average results of physicochemical properties were TSS 22 °Bx, pH 4.5, Density 1.02 g/ml, specific gravity 1.08, reducing sugar 9.04%, nonreducing sugar 5.06% and total sugar 14.10%. It can be clearly observed that the juice contained highest reducing sugar compared to non-reducing sugar. The highest sugar content of sapota juice signifies its importance in preparation of wine.

Table 3: Physico chemcial properties of sapota wine added with free yeast

Physicochemical Properties	Sapota Wine (With free yeast)
TSS (°Bx)	5.0
pH	4.1
Alcohol (%)	14.0
Density (g/ml)	0.93
Viscosity (cP)	1.52
Specific gravity	0.99

Table 4: Physicochemical properties of wine prepared with Immobilized yeast

Physico-Chemical Properties	Spota Wine (With Immobilized Yeast)
TSS	6.0˚bx
pH	3.8
Alcohol (%)	17.00
Density (gm/ml)	00.99 gm/ml
Specific Density	00.99
Viscosity(cp)	1.54

It can be revealed from the above table that sapota wine prepared with addition of free yeast had average value of TSS 5.0 (°Bx), pH 4.1, alcohol 14 (%), viscosity 1.52 (cP) and specific gravity 0.99. Whereas, the wine prepared using immobilized yeast were analysed and found high alcohol content i.e. 17% which was comparatively higher than wine with free yeast.

Microbial examination of Sapota wine

Microbial examination was carried out for selected wine i.e. wine prepared from immobilized yeast. Wine was stored at ambient and refrigeration temperature. Wine were analysed for its bacterial count and yeast and mold count after completion of fermentation period i.e. after 15 days. The results for microbial examination of prepared wine are illustrated in table 5.

Table 5: Microbial analysis of sapota wine

Microbial parameters (cfu/ml)	Wine at Ambient Temp. (37^0C)	Wine at refrigeration temperature (4^0C)
Bacterial count	Absent	Absent
Yeast and mold	1.63×10^3	1.19×10^3

Results of microbial analysis of sapota wine stored at different condition of storage viz., ambient and refrigeration temperature were analysed. The results revealed that there was no any evidence of bacterial count was observed in prepared wine. Moreover, the yeast and mold count were examined and reported that wine at ambient temperature had maximum count (1.63×10^3) compared to wine stored at refrigeration temperature (1.19×10^3) cfu/ml.

Conclusion

It can be finally concluded sapota fruit was utilized in preparation of wine by using immobilized yeast at 10% level showed good results with respect to the sensory quality as well as alcohol content. The wine prepared with immobilized yeast had good yeast recovery and resulting wine was spark clear in appearance. The sapota fruit can be well utilized in preparation of good quality of wine.

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