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RESEARCH ARTICLE

INFLUENCE OF PECTINASE ENZYMATIC MACERATION ON QUALITY OF JAMUN (*SYZIGIUM CUMINI* L.) WINE.

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Abstract

In the current research, effect of pectinase on the quality of the jamun wine was evaluated. Jamun wine was prepared from three different must types viz., juice, pulp+skin and pulp+skin+seed. The must was macerated with 0.25 and 0.50 % of pectinase enzyme. The other must parameters viz., TSS and pH was adjusted to 24°B and 3.2, respectively. The physicochemical and sensory quality of the wine was recorded in fresh and at 3 months interval up to 6 months. The treatment involving 0.25% Pectinase and must containing pulp + skin + seed recorded significantly highest TSS of 11ºB. Treatment T_8 (0.50% Pectinase – Pulp + Skin) registered significantly highest acidity 0.69, 0.71 and 0.70 per cent at intial, three and six months of storage, respectively. In the fresh wine, 0.50 % pectinase-pulp+skin recorded the lowest total sugar of 5.21 %. Treatment containing 0.25% Pectinase – Juice recorded significantly highest phenol content of 492.98 mg/L. The treatment T_6 (0.25% pectinase – pulp + skin + seed) recorded significantly highest alcohol content of 12.10 per cent. Wine prepared with 0.50 % pectinase-pulp+skin received maximum sensory score.

Introduction:-

Jamun is an important unexploited indigenous fruit with an array of medicinal purposes especially for curing diabetes because of its effect on the pancreas (Joshi, 2001). Extensive research has been made on the production of wine from various fruits other than grapes viz., sapota (Gautam and Chundawat, 1998), karonda (Bhajipale, 1997), apricot (Bhutaniet al., 1989) and jamun (Shuklaet al., 1991). Enzymes are widely used commercially for the treatment of fruit pulps to expidite handling, in particular to facilitate extraction and pressing to increase juice yield and to clarify the juice or wine obtained from the fruit (Neubeck, 1981). Jamun posses a very short shelf life and it is highly seasonal crop. In order to utilize the jamun for the production of wine, the present study was attempted. The maceration of the must was carried out with pectinase and fermented on three different must types viz., juice, pulp+skin and pulp+skin+seed. The range of biochemical and sensory qualities were studied in the freshly prepared wine and during the ageing. The main purpose of the research was to produce jamun wine with acceptable sensory quality and to study the effect of pectinase on the quality using the different must types.

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Materials and Methods:-

The jamun fruits were procured from the local market and bought to the laboratory. The fruits were washed and manually squeezed to extract the pulp. To separate seeds and skin, the extract was filtered through a clean muslin cloth to obtain juice. For enzymatic maceration, the three musts viz., juice, pulp + skin and pulp + skin + seed were ameliorated with 0.25 and 0.50 per cent pectinase for 12 hours. The treatment details are follows.

Treatments	Fermentation with
T_1:Control	Juice
T_2:Control	Pulp + Skin
T_3:Control	Pulp + Skin + Seed
T_4:Pectinase at 0.25%	Juice
T_5:Pectinase at 0.25%	Pulp + Skin
T_6:Pectinase at 0.25%	Pulp + Skin + Seed
T_7:Pectinase at 0.50%	Juice
T_8:Pectinase at 0.50%	Pulp + Skin
T_9:Pectinase at 0.50%	Pulp + Skin + Seed

Fig. 1:- Flow chart for illustrating wine preparation from jamun fruit

Jamun fruit
↓
Deseeding
↓
Homogenization
↓
Brix adjustment (24°B)
↓
pH adjustment (3.2)
↓
Addition of sodium benzoate at 50 ppm
↓
Addition of Pectinase enzyme
↓
Yeast inoculation (0.2 g/l of must)
↓
Aerobic fermentation for 1 day
↓
Anaerobic fermentation for 14 days
↓
Addition of bentonite clay (400 mg/l)
↓
Siphoning (2-3 times) to get clear wine
↓
Pasteurization @ 82^0C for 5 min
↓
Filling to sterile bottles & corking
↓
Pasteurization @ 60°C for 15 min
↓
Aging in cold storage (13 ± 1°C)

TSS was measured by using an 'Erma' make hand refracto-meter and expressed as percentage after making necessary corrections. Titratable acidity was measured using standard alkali and phenolphthalein indicator (Srivastava and Kumar, 1993). Sugars were determined by Dinitro-salicylic acid (DNSA) method (Miller, 1972). Total Phenols were estimated as per Folin Ciocatteau Reagent (FCR) method (Folin and Ciocalteu, 1927). Alcohol content of jamun wine was measured by using ebulliometer, is an instrument used for determination of the alcohol content of water-alcohol solutions by determining the difference in boiling points between pure water and the

solution. Based on the comparison, the percentage alcohol (v/v) can be determined by referring to tables or using the calculating dial.

Results and Discussion:-

The prepared wine was analysed freshly and at three months interval up to six months. Initially, the TSS of the must was adjusted to 24°B with the addition of cane sugar. Chaptalization (addition of sugar) is permitted in wine industry (Zoeckleinet al., 1994). The treatment T_6 (0.25% Pectinase – Pulp + Skin + Seed) recorded significantly highest TSS of 11ºB, 10ºB and 9ºB at initial, three and six months of storage, respectively (Table 1). Total soluble solids (TSS) helps to provide an indication of fruit maturity and potential alcohol yield as well as tool to monitor the progress of fermentation. As per Gay-Lussac relationship, a given weight of fermentable sugar yields 51.5 per cent (by weight) ethanol.

Table1:- Influence of pectinase and must type on total soluble solids of jamun wine during ageing

Treatments	**Total soluble solids (ºBrix)**		
	Ageing in months		
	Initial	**3MAS**	**6MAS**
T_1: Juice	5.85^{cd}	4.80^{cd}	4.10^{cd}
T_2: Pulp + Skin	5.99^{cd}	5.19^{cd}	4.13^{cd}
T_3: Pulp + Skin +Seed	5.49^{d}	4.34^{d}	3.60^{d}
T_4: 0.25% Pectinase – Juice	8.17^{bc}	7.00^{bc}	6.00^{bc}
T_5: 0.25% Pectinase – Pulp + Skin	6.83^{cd}	5.50^{cd}	4.50^{cd}
T_6: 0.25% Pectinase – Pulp + Skin + Seed	11.00^{a}	10.00^{a}	9.00^{a}
T_7: 0.50% Pectinase – Juice	6.83^{cd}	5.67^{cd}	4.67^{cd}
T_8: 0.50% Pectinase – Pulp + Skin	10.33^{ab}	9.33^{ab}	8.33^{ab}
T_9: 0.50% Pectinase – Pulp + Skin + Seed	7.83^{cd}	6.83^{bcd}	5.67^{cd}
Mean	**7.59**	**6.52**	**5.56**
S. Em±	**0.84**	**0.84**	**0.80**
CD at 5%	**2.50**	**2.51**	**2.44**

Different alphabets within the column are significantly different (p=0.05) according to Duncan's Multiple Range Test

The titratable acids increased after fermentation and during ageing in the jamun wine (Table 2). The increase in the acidity during ageing might be due to combination of acids with alcohol to form esters which adds aroma to the wine (Shankar et al., 2004). The fresh wine exhibited a titratable acidity range from 0.42 to 0.69 per cent. Though the ideal acidity in the wine is dependent on the style and preferences of the consumer but, acceptable range for total acidity in most wines is between 5.5 and 8.5 mg/l (0.55 to 0.85%). Treatment T_8 (0.50% Pectinase – Pulp + Skin) registered significantly highest acidity 0.69, 0.71 and 0.70 per cent at intial, three and six months of storage, respectively. However, the changes in pH were not correlated with the changes in titratable acidity because of the buffering capacity of the wines and the relative amounts of various acids influencing the acidity (Amerineet al., 1972).

Table 2:- Influence of pectinase and must type on total soluble solids of jamun wine during ageing

Treatments	**Total soluble solids (ºBrix)**		
	Ageing in months		
	Initial	**3MAS**	**6MAS**
T_1: Juice	5.85^{cd}	4.80^{cd}	4.10^{cd}
T_2: Pulp + Skin	5.99^{cd}	5.19^{cd}	4.13^{cd}
T_3: Pulp + Skin +Seed	5.49^{d}	4.34^{d}	3.60^{d}
T_4: 0.25% Pectinase – Juice	8.17^{bc}	7.00^{bc}	6.00^{bc}
T_5: 0.25% Pectinase – Pulp + Skin	6.83^{cd}	5.50^{cd}	4.50^{cd}
T_6: 0.25% Pectinase – Pulp + Skin + Seed	11.00^{a}	10.00^{a}	9.00^{a}
T_7: 0.50% Pectinase – Juice	6.83^{cd}	5.67^{cd}	4.67^{cd}
T_8: 0.50% Pectinase – Pulp + Skin	10.33^{ab}	9.33^{ab}	8.33^{ab}
T_9: 0.50% Pectinase – Pulp + Skin + Seed	7.83^{cd}	6.83^{bcd}	5.67^{cd}
Mean	**7.59**	**6.52**	**5.56**
S. Em±	**0.84**	**0.84**	**0.80**
CD at 5%	**2.50**	**2.51**	**2.44**

Different alphabets within the column are significantly different (p=0.05) according to Duncan's Multiple Range Test

The use of pectinase enzyme (0.25 and 0.50%) significantly influenced the total sugar, reducing and non-reducing sugars content (Table 2 and 3). Significantly highest total sugar and reducing sugar (5.91% and 5.50%) during initial stage, respectively. Whereas, highest non-reducing sugar were (2.60) found in T_1.During fermentation of red wine, oxygen may be absorbed during pumping over. Several studies have recorded similar sugar content in the wines. Kotecha (2010b) recorded total residual sugar of 4.30 per cent in pomegranate wine and 7.17 per cent in banana wine whereas, Bhajipaleet al. (1998) in karonda wine recorded a maximum of 12.82 per cent and in grape wine Chikkasubbanna *et al.*(1990).

Table 3:- Influence of pectinase and must type on titratable acidity and total sugars of jamun wine during ageing

Treatments	Titratable acidity (%)			Total sugars (%)		
	Ageing in months			Ageing in months		
	Initial	3MAS	6MAS	Initial	3MAS	6MAS
T_1: Juice	0.42^{e}	0.47^{e}	0.45^{e}	5.81^{a}	4.76^{c}	4.25^{c}
T_2: Pulp + Skin	0.45^{de}	0.49^{e}	0.47^{de}	5.34^{c}	4.07^{e}	3.49^{e}
T_3: Pulp + Skin +Seed	0.44^{de}	0.48^{e}	0.46^{e}	5.61^{b}	4.57^{d}	3.76^{d}
T_4: 0.25% Pectinase – Juice	0.55^{b}	0.59^{bc}	0.57^{b}	5.16^{c}	5.05^{b}	4.85^{b}
T_5: 0.25% Pectinase – Pulp + Skin	0.49^{cd}	0.53^{d}	0.51^{cd}	5.23^{c}	5.12^{b}	4.88^{b}
T_6: 0.25% Pectinase – Pulp + Skin + Seed	0.66^{a}	0.71^{a}	0.69^{a}	5.91^{a}	5.68^{a}	5.50^{a}
T_7: 0.50% Pectinase – Juice	0.51^{bc}	0.55^{cd}	0.53^{bc}	5.33^{c}	5.09^{b}	4.80^{b}
T_8: 0.50% Pectinase – Pulp + Skin	0.69^{a}	0.71^{a}	0.70^{a}	5.21^{c}	4.79^{c}	4.16^{c}
T_9: 0.50% Pectinase – Pulp + Skin + Seed	0.55^{b}	0.59^{b}	0.57^{b}	5.53^{b}	5.21^{b}	4.92^{b}
Mean	**0.53**	**0.57**	**0.55**	**5.46**	**4.93**	**4.51**
S. Em±	**0.01**	**0.01**	**0.01**	**0.06**	**0.05**	**0.03**
CD at 5%	**0.04**	**0.04**	**0.04**	**0.18**	**0.16**	**0.14**

Different alphabets within the column are significantly different (p=0.05) according to Duncan's Multiple Range Test

The phenol content of the wine was maximum in the T_5 (0.25% Pectinase – Juice) i.e. 492.98 mg/Land 515.84 mg/L at initial and three months after storage, respectively (Table 4). Whereas, after six months of ageing T_9 shows highest phenols 545.06 mg/L. Arnous and Meyer (2009) found that the phenolic composition of grape skins are released by the random liberation of phenols from the grape skin cell wall matrix in a response to progressive enzyme catalyzed degradation of the cell wall polysaccharides. The rapid sedimentation of must by using pectinase enzyme will induces a decreasing in the extraction of phenolic compounds in wine (Ituet al., 2011).

Table 4:- Influence of pectinase and must typeon phenols and alcohol content of jamun wine during ageing

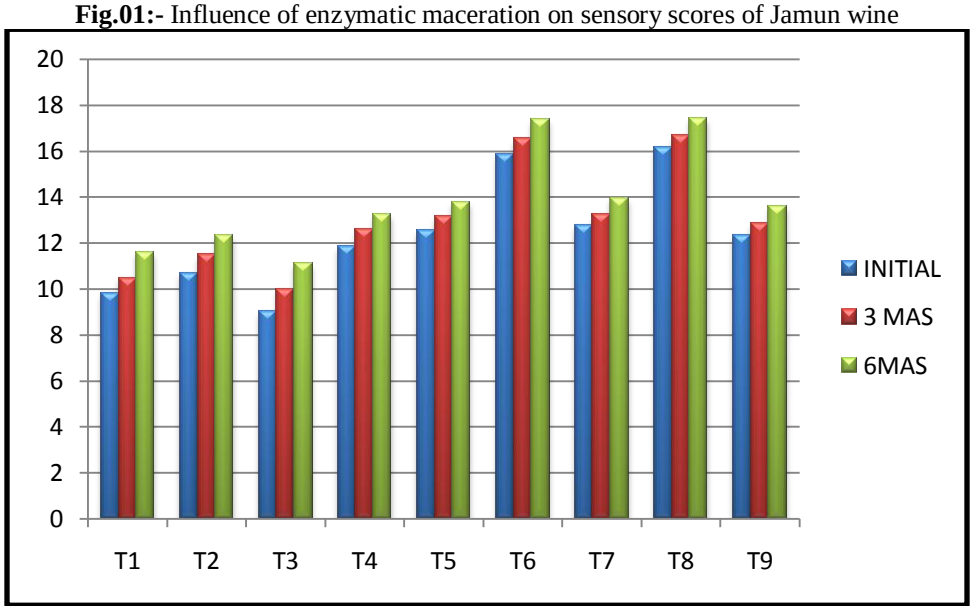
Treatments	Phenols (mg/L)			Alcohol content (%)		
	Ageing in months			Ageing in months		
	Initial	3	6	Initial	3	6
T_1: Juice	287.50^{g}	302.24^{h}	311.80^{i}	10.06	10.86^{d}	11.26^{e}
T_2: Pulp + Skin	323.18^{ef}	334.50^{g}	323.03^{h}	10.08	10.94^{cd}	11.36^{e}
T_3: Pulp + Skin +Seed	384.12^{d}	399.96^{e}	399.57^{f}	10.01	10.59^{e}	11.09^{f}
T_4: 0.25% Pectinase – Juice	315.22^{f}	349.37^{f}	386.29^{g}	10.20	11.11^{abc}	11.88^{bc}
T_5: 0.25% Pectinase – Pulp + Skin	492.98^{a}	515.84^{a}	528.83^{b}	10.30	11.17^{ab}	12.01^{ab}
T_6: 0.25% Pectinase – Pulp + Skin + Seed	427.33^{c}	449.53^{c}	476.77^{d}	10.10	11.12^{abc}	12.10^{a}
T_7: 0.50% Pectinase – Juice	339.67^{e}	395.04^{e}	423.96^{e}	10.10	11.00^{bcd}	11.87^{c}
T_8: 0.50% Pectinase – Pulp + Skin	455.62^{b}	493.53^{c}	508.47^{c}	10.33	11.24^{a}	12.02^{a}
T_9: 0.50% Pectinase – Pulp + Skin + Seed	480.27^{a}	506.30^{b}	545.06^{a}	10.37	11.08^{abc}	11.71^{d}
Mean	**389.54**	**416.2**	**433.75**	**10.17**	**11.01**	**11.7**
S. Em±	**6.94**	**3.03**	**3.21**	**NS**	**0.06**	**0.05**
CD at 5%	**20.61**	**9.00**	**9.56**	**NS**	**0.19**	**0.14**

Different alphabets within the column are significantly different (p=0.05) according to Duncan's Multiple Range Test.

Alcohol content of the wine was maximum in the treatment T_6 (0.25% Pectinase – Pulp + Skin + Seed) i.e. 12.10 per cent, which was found to be on par with T_8 (12.02%) and T_5 (12.01%) at six months after storage (Table 4). Itu et al. (2011) reported that wines obtained from must clarified by enzymatic treatment, are distinguished by higher contents of alcohol. The variation in alcohol production depends on several factors such as initial sugar content, initial pH, amount of by product formed, temperature maintained during fermentation, amount of quality sugar, pH maintained during fermentation and alcohol tolerance limits of the yeasts could cause variation in the alcohol production (Thippesha et al., 1997).

Different treatments significantly influenced the total scores of fresh jamun wine (Fig. 01). Treatment T_8 (0.50% Pectinase – Pulp + Skin) recorded significantly highest score for total score of 17.41, followed by T_6 (17.36). However, T_3 (11.09) recorded significantly lower total score, followed by T_1 (11.61) after six months of ageing. During maturation, the complex chemical reactions involving sugar, acid and phenolic compounds in wines can alter the aroma, colour, mouth feel and taste of the wine in a way that is more pleasing to the taster (Pawar, 2010). Reports of improvement in sensory quality due to ageing have also been recorded in strawberry wine (Someshet al., 2009) and guava wine (Shankar et al., 2004).

Fig.01:- Influence of enzymatic maceration on sensory scores of Jamun wine



Conclusion:-

Treatment combination of 0.50 per cent pectinase with must of pulp + skin (T_8) is rated as the best performing with respect to various quality attributes of wine. In conclusion, the general quality of jamun wine can be improved by adopting novel maceration techniques and there is a great scope for utilization of jamun fruits for wine making to reduce the postharvest loss.

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