Process optimization of Sohiong fruit juice extraction with better quality using RSM

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Abstract

Sohiong (*Prunus nepalensis*) is an underutilized fruit grown in Meghalaya, India. It is very perishable and is a rich source of β-carotene, anthocyanins, phenols and antioxidants. Lack of storage facilities and processing machinery leads to minimum utilization of the fruit. Converting the fruit in to value added products will help in increasing the popularization of the fruit in domestic and international markets. Sohiong fruit has high amount of pectin, hence extracting the juice from the fruit is tedious and time consuming. Therefore, response surface methodology (Box-Behnken model) was employed for analysing the effect of pectin concentration, incubation time and temperature on juice yield, anthocyanins and total phenols. The coefficient of determination (R^2) value for all the models for dependent variables were greater than 95%. The maximum juice yield (49.5%), anthocyanins (1735mg/L) and total phenols (6445mg GAE/L) were obtained when treatment was conducted at optimal conditions of pectin concentration (0.05%), incubation time (90 min) and temperature (45ºC).

Keywords: Sohiong, pectin, juice yield, anthocyanins, total phenols

Introduction

Sohiong is also called as Khasi cherry and can be eaten raw or may be preserved further for processing. This fruit comes under one of the under utilized fruits of India due to the lack of facilities for storage and processing leads to the huge post-harvest losses. This fruit is unknown to many people apart from people residing in Meghalaya. Therefore, there is an urgent need to commercialise and improve the utilisation of Sohiong fruit, being a potential source of many essential nutrients besides natural colourant.

Objective

- To optimize the juice extraction process with pectinase enzyme.

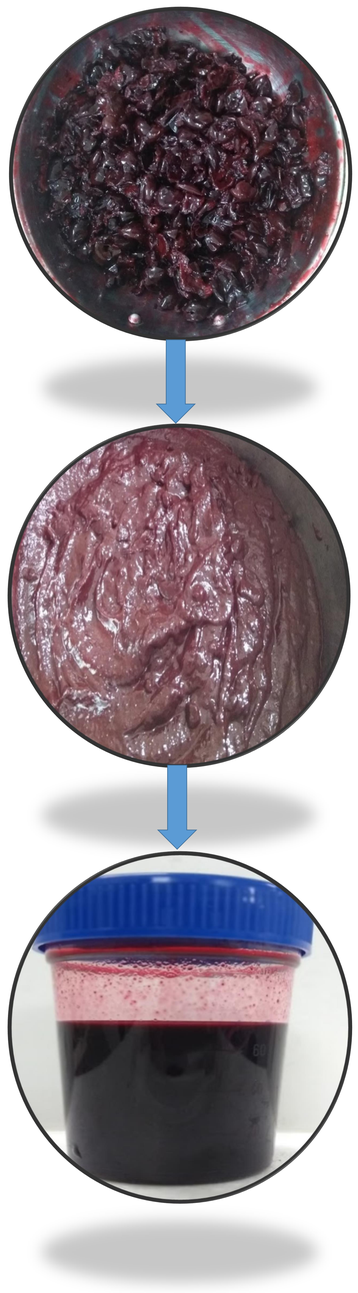
Independent variables and their limits

Independent variables		level	
	-1	0	+1
Enzyme Concentration (X1)	40	65	90
Enzyme treatment time (X2)	7	11	15
Incubation Temperature (X3)	0.01	0.03	0.05

Changes in various physico-chemical properties

S. No	Responses	Raw fruit	Enzyme treated juice	p-value
1.	Juice yield (%)	20.04±0.80	49.00±0.15	0.000*
2.	TSS (ºBrix)	11.43±0.28	12.16±0.05	0.057
3.	pH	3.720±0.005	3.523±0.03	0.030*
4.	TA (%)	0.874±0.03	0.972±0.01	0.010*
5.	Anthocyanin (mg/L)	1172.67±27.54	1735.00±4.78	0.001*
6.	Total phenols (mg GAE/ L)	3897±70.31	6411.67±16.45	0.000*
7.	DPPH radical scavenging activity (%)	78.99±1.09	82.67±0.21	0.032*

Process flow diagram



Real values of the experimental design

Expt. No	Enzyme concentration (% w/w)	Enzyme treatment time (min)	Incubation temperature (ºC)	Juice Recovery (%)	Total Anthocyanins (mg/L)	Total Phenols (mg/L)
1	0.01	30.00	45.00	31.98	1225.06	4577.12
2	0.05	30.00	45.00	36.90	1470.11	5455.44
3	0.01	90.00	45.00	36.90	1519.04	5644.36
4	0.05	90.00	45.00	49.82	1763.33	6550.12
5	0.01	60.00	40.00	23.37	1274.10	4744.71
6	0.05	60.00	40.00	37.64	1518.41	5635.11
7	0.01	60.00	50.00	35.26	1421.21	5270.00
8	0.05	60.00	50.00	43.05	1665.36	6178.63
9	0.03	30.00	40.00	19.68	1127.11	4183.55
10	0.03	90.00	40.00	33.21	1420.55	5275.10
11	0.03	30.00	50.00	31.98	1274.21	4730.61
12	0.03	90.00	50.00	44.28	1568.06	5829.33
13	0.03	60.00	45.00	46.74	1568.00	5831.25
14	0.03	60.00	45.00	45.51	1470.10	5459.66
15	0.03	60.00	45.00	46.74	1440.60	5360.12
16	0.03	60.00	45.00	44.00	1617.60	6049.55
17	0.03	60.00	45.00	45.51	1543.50	5790.23

Results and discussion

- Optimised values obtained at 0.05%, 90 min and 45ºC, pectin concentration, incubation time and temperature, respectively.
- The enzymatically extracted juice shows significant positive effect on Juice yield, Anthocyanins, total phenols and antioxidant capacity.
- Juice yield increased by 145%; TSS increased by 6 %; pH decreased by 5%; TA increased by 11%;Anthocyanins increased by 48%; Total phenols increased by 68%; Dpph radical scavenging activity increased by 6% compared to raw fruit.

Conclusion

- Fruits are rich in anthocyanin, antioxidant capacity and total phenols compared to raspberry, blackcurrant and blackberry. .
- Due to lack of proper handling and processing technology, the fruit could not be commercialized as per its potential.
- There is a need to develop processing technology to add value to the fruits and its products.
- This research focuses on targeting the underutilized fruits (Sohiong) of India for the probiotic formulation to increases the diversity of food choices in the public health domain.

References

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