SUMMARY AND CONCLUSION

CHAPTER V

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The chapter contains a summary of all the research and experiments conducted in earlier chapters, together with their findings.

A valuable commodity in certain nations, cocoa (*Theobroma cacao L.*) is well-known around the world for the use of its beans in the making of chocolate. Rich in nutrients, cocoa pulp can be utilized to create byproducts in industrial operations. A collection of mucilaginous, spongy cells that contain water, fructose, glucose, sucrose, citric acid, and a number of inorganic salts make up pulp. Profitability is increased and waste is reduced when produced cocoa is processed properly. Value addition would also guarantee the seasonal supply of this product while giving its growers an extra source of revenue.

Wine was found to be a value-added product with improved nutrition in the current investigation. Using the ICAR AICRP on PHET process, wine was made from a variety of cultivars under ideal conditions. Physico chemical parameters of cocoa mucilage and wine were carried out and compared. The values for TPC, TSS, DPPH activity and reducing sugars of prepared wine showed an increase compared to that of its mucilage. Whereas, the values for pH, titrable acidity and vitamin C dropped as compared to mucilage. The wine was kept ageing for 42 days. The hydrodynamic cavitation effect was then applied to cocoa wine in the reactor that was constructed. Then a comparison was carried out between fresh wine (untreated wine), conventionally aged wine and HC treated wine.

The reactor contained three elements that could produce the cavitation effect. These are slit venturi, orifice and elliptical venturi. The effect of each of these types of cavitation on the physicochemical properties of cocoa wine was studied. The alcohol content of the wine was higher in case of HC treated wine among all three, followed by conventionally aged wine. Reducing sugar content also increased with respect to cavitation treatment but highest increase was found in the case of conventionally aged wine. Vitamin C showed a significant increase upon treatment which also showed a rise in case of aged wine. pH showed a small variation among three kinds of wines but

titrable acidity showed a spike in the case of hydrodynamic cavitation. The pH of fresh and aged wine showed very little difference. TSS content reduced during aging. HC treatment also reduced the TSS content as it resulted in breakdown of suspended solids. In case of colour value, L* and b* values showed an increase where as a* value decreased as aging progressed. Values of HC treated wine showed a middle range among other two.

The effect of TPC, energy release, VFR and cavitation number were studied under three cavitation elements. Among the three cavitation elements, slit venturi showed better results for these parameters compared to orifice and elliptical venturi. The desirability analysis revealed that the optimal experimental conditions for hydrodynamic cavitation were achieved using the slit venturi treatment at a process pressure of 3.26 bar and a time of flow of 47.7 minutes. Under these conditions, the dependent variables were recorded as: cavitation number of 0.4, volume flow rate (VFR) of 19.84 L/h, total phenolic content (TPC) of 321.01 mg GAE/ml, and energy release of 8.24 J/ml. Furthermore, sensory evaluation was conducted on five wine samples, among them, the optimized HC-treated wine received the highest overall acceptability score of 7.93 ± 0.7^{a}, indicating favourable sensory quality. Economic analysis was also carried out, including the calculation of benefit-cost ratio. The production cost of one liter of accelerated aged cocoa mucilage wine using HC treatment was estimated at ₹227.105/-. The benefit-cost ratio comparing conventionally aged wine (10 years) to HC-treated wine was found to be 1.09:1, suggesting that for every ₹1 spent on HC-treated wine production, ₹1.09 is required for conventional aging. It was therefore concluded from the experiments that HC treatment had improved the properties of cocoa wine thus making it more value added.

Scope of future work

- Flavour and aroma profile of treated wine can be studied
- Comparison between ultrasound treated wine and HC reactor treated wine can be done and also studies can be conducted in other liquid foods with HC reactor
- Combined effect of slit venturi, orifice and elliptical venturi can be studied
- The effect of HC treatment on various other parameters like particle size and FTIR analysis