

**FEASIBILITY STUDY OF MILLETS  
AS AN ADJUNCT IN THE BREWING  
INDUSTRY**

BY

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# **FEASIBILITY STUDY OF MILLETS AS AN ADJUNCT IN THE BREWING INDUSTRY**

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requirements for the Degree in Masters of Food Science  
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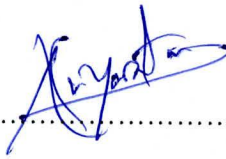
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## DECLARATION

The work described in this thesis was carried out by me at Lion Brewery Ceylon PLC, Biyagama, under the supervision of Mr. Udaya Padmakumara, (QA Manager, Varun Lanka Beverage (Pvt) Ltd.) and Professor K.K.D.S.Ranaweera, (Director, Bandaranayake Memorial Ayurvedic Research Institute, and Professor of the Department of Food Science and Technology, Department of Applied Science, University of Sri Jayewardenepura, Sri Lanka,). I confirm that report on this has not been submitted in whole or in part to any University or any other institution for another Degree or Diploma.

25/01/2014

DATE



P.N.K.ARIYARATNE

We Prof K. K. D. S. Ranaweera and Mr. Udaya Padmakumara jointly here by certify that the statement in the preceding page made by the candidate is true and that this thesis is suitable for submission to the university for the purpose of evaluation.



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BY

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## **ABSTRACT**

Adjuncts are an additional source of carbohydrate extract used to partially replace or supplement the malt in beer. They are also used to reduce the overall material costs and to utilize indigenous sources. Millet is also used to produce ethanol in some countries in the world. Starch being the main ingredient in millet can be converted in to sugars which are then subjected to fermentation by yeast to make ethanol. The ratio of malt to adjunct must fall within an acceptable range. Each brewer according to the quality specifications for the final beer and the cost estimation sets adjunct ratios. Thus the major objective of this project was to study the possibility of use of millets as an adjunct for producing beer at its optimum ratio where the qualities of the product as well as the requirements in cost aspects are met.

Three millets milled separately and cooked then mashed with  $\alpha$ -amylase and  $\beta$ -amylase respectively in the three separate containers of mash bath. Filtered mash was adjusted to 12% Plato level and fermented by pitching yeast. Real degrees of the fermentation were determined through Anton paar alcolyzer. 100 % fermented millet samples were analysed organoleptically with 12 well-trained panellists to select the best millet type for beer recipe optimization.

Then the optimum ratio of malt to selected millet (pearl millet) was to find. In order to replace the rice component with pearl millet & to determine the most suitable pearl millet inclusion as the adjunct, a series of malt and pearl millet combinations were selected ranging from 25% to 40%. Based on the results of the experiment during brewing, fermentation and end product testing the optimum combination could be selected. For

that, three different strong beer samples were prepared by changing the pearl millet, malt and water amount of the original recipe. The amount of Extract was calculated according to the IBD (Institute of Brewing & Distillation) method. The pearl millet usage starting from 30% and gradually increased by 35% and finally up to 40%. Then beer samples were organoleptically analysed by the well trained sensory panel. The Triangular test and deceptive test were done to identify the differences and organoleptic assessment.

Pearl millet was recorded real degree of fermentation as 79.9% and good result on overall acceptability in the sensory evaluation of fermented millet samples while finger millet gets 78.2%. Out of the three recipe developed with pearl millet all gave significantly similar chemical analysis results, but sensory evaluation shows significantly different result among those three. The sample with 70% malt and 30 % millet gave the best sensory results and 65% malt and 35% millet recipe was also recorded very good overall results while. 60% malt and 40% millet deviated significantly from the standard characteristics. Triangular test which was conducted for three samples Have shown positive results for both 70% malt and 30% millet and 65% malt and 35% millet recipes, by considering cost factor 65% malt and 35% millet recipe was selected for further scale up trails.