

# Development of Ready to Serve Iced Tea Drink from Tea Wastage Generated During the Black Tea Manufacturing Process in Sri Lanka.

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**Abstract.** - Study it was attempted to identify the possibility of developing a Ready to Serve (RTS) iced tea from the tea wastage generated in down country black tea manufacturing process in Sri Lanka. Around 8.8% GDP of Sri Lankan economy depends on tea manufacturing (Central Bank Report 2014,2015). According to the Central Bank annual reports shows that more than 6-8% of the tealeaves were lost as wastage during the process of manufacturing black tea in Sri Lanka.

Even though these waste tea were throw away without any valuable usage, this research clearly shown how this wastage can be turn in to a valuable and marketable product. Sri Lankan tea market can reduce the cost they lost as tea wastage by implementing this methodology in industrial scale.

The main objective of this study was to develop a RTS type Iced tea drink from the wastage generated in between the down country black tea manufacturing process. Moreover to identifying the proper stage to collect the refused tea and analyzing its behavior and accessibility to developed a food product. Identification of the better formulation, nutritional value of the developed product and analyze the stability of the product were other objectives of this study.

Essential Ingredients were identified through Literature review and market reference study in Sri Lankan market and two factorial studies were carried out to identification of the raw material proportions in an initial stage. Thereafter series of sensory evaluation were carried out in order to seven point hedonic scale with the participation of 35 panelists. Collected data were analyzed using Minitab 14 statistical software. Kruskal-Wallis test Method was applied within 5% significance level, and pair-wise test also done. Finally microbiology and proximate analysis were carried out complying with the AOAC standards. Stability of the product was determined through microbiologically and sensory evaluation for four weeks of time period.

There were series of sensory evaluation and finally four samples were selected among them numbered as 478, 642, 703, and 854. Within them sample No. 854 was significantly different from 703 and it has the highest average rank value. Also there were no significant differences between samples 478,642, and 703. And 854 were identified as the most preferable sample and carried out further analysis for each attribute for the sample with different formulations of citric acid. There were 12 newly prepared samples for each attribute and 742 was the most preferable sample for each attribute studied as appearance, strangeness, odour, taste, colour and overall acceptability among them.

The final product consists with 0.52% of Total solids, 0.78% of ash, 96.67% moisture and free of protein, fat and fibre and the average pH value was constant in 5.8. And there wasn't any significance difference in pH value or sensory evaluation for four weeks of time period.

The developed product can be recommended for the Ceylon black tea industry to increase profit while protects the environment through redacting solid waste generation. And best raw material collection point was identified as at the colour-sorter. Aseptic packaging and triple laminated packaging methods recommended to use for the packaging process.

**Key-words:** *Refused tea, Iced tea, Black tea, wastage*

## 1. Introduction

In Sri Lanka tea is the number one exporting cultivation that contribute to 2% of the GDP thus it is been cultivated in large number of lands. According to the statistics 14 districts cultivate tea out of 25 districts in Sri Lanka. Among them Nuwara Eliya is the district with highest number of tea cultivated land while Gampaha is the district with least number of tea cultivated lands. [1]

In black tea processing there is a considerable wastage being generated throughout the manufacturing process. Yet this wastage has some potential to generate some drinkable or edible component to reduce environmental pollution while increasing the profit.

Almost 4- 6% of Sri Lankan tea lost as wastage. [2]

This is a huge amount when it comes to national level. Thus it is a very important thing if that wastage can be reduced by developing a product by using them as a main ingredient.

Tea market is one of the main factors that Sri Lankan economy depends on. 8.8% GDP of Sri Lankan economy depend on tea. [3]

By taking all these things in to consideration I conducted this research to develop an iced tea RTS that can be manufactured via the left over that generated throughout the tea manufacturing process.

Black tea is the most famous type among those thousands of different tea types and now the trend is been towards green tea due to the health benefits that said to be found in green tea. Iced tea is kind of a new concept that tries out by many consumers. [4]

Iced tea is a form of cold tea. It's not just tea served in a glass with ice cubes. This is a different kind of a product where lots of food science theories and science and technological facts comes in to play. In iced tea industry there can be seen lots of cultural and other differences and lots of different types of flavours being added to enhance the taste and aroma of the product. [5]

In steeped tea, polyphenols are largely responsible for astringency. The term polyphenol simply refers to a categorization of compounds composed of many phenolic groups, hence the name poly-phenol. These compounds are plant metabolites produced as a defense against insects and other animals and are the most abundant compounds in tea comprising as much as 30-40% of both freshly plucked tea leaves and solids in tea liquor.

There are an estimated 30,000 polyphenolic compounds in tea, flavonoids are arguably the most important group of polyphenols in tea and are the source of the many health claims surrounding tea, and specifically tea antioxidants

Polyphenol oxidase and peroxidase are the most important enzymes in tea leaves. They are responsible for the enzymatic browning of tea leaves that takes place when the cell walls in the leaves are broken and the polyphenols are exposed to oxygen – otherwise known as oxidation. These enzymes may be denatured or deactivated using heat so that

browning cannot occur; this is one of the first steps in green tea production and is why finished green tea leaves remain green. The enzymes may also be denatured by simply depriving them of moisture for a time which is what happens during the long withering period in white tea production.

## 2. Objectives

### General Objective

To develop a RTS Iced tea from the tea wastage generated in between the down country black tea manufacturing process.

### Specific Objectives

To determine the best raw material collecting point to develop the product from the normal down country black tea manufacturing process.

To determine the best procedure/formula to manufacture/develop the product.

To analyze the nutritional value of the developed product.

To conduct series of sensory analysis to identify the best composition/formulation of raw materials for the product development and to identify the organoleptic acceptability of the final product.

To analyze the shelf life and stability of the product

## 3. Methodology

There were three main steps in the methodology:

Identification of raw materials.

Selecting best product formulation among prepared samples.

Statistical analysis

Refused black tea has been identified as the main ingredient for the product and there were three main samples collecting points such as colour sorter, Miton sifter and also at the Fiber mat. These samples were individually analyzed to find out the proper collecting point. Samples were collected from Batuwanjala Tea Factory (Pvt) Ltd, Neluwa, Sri Lanka. Market references and literature surveys were used to collect some information about ongoing products.

Samples were prepared with different formulations and sensory analyzing used to determine the best sample product to develop the final product, by using a trained sensory panel. Sensory analysis was carried out in order to the six point hedonic scale and double blind single centered sensory method, finally collected data were analyzed using Minitab statistical software (Kruskal-Wallis test). Moreover proximate analysis tests were carried out complying with the AOAC methods and microbiology tests were done in order to Sri Lankan Standard Institution standard test methods.

#### 4. Results and Discussion

There were four pre prepared samples with different formulations named as 478,642,703 and 854 were hosted to the sensory evaluation test 01. Formulations were design in order to the two factorial method. According to the following graphical representation sample number 854 has the highest average rank value.

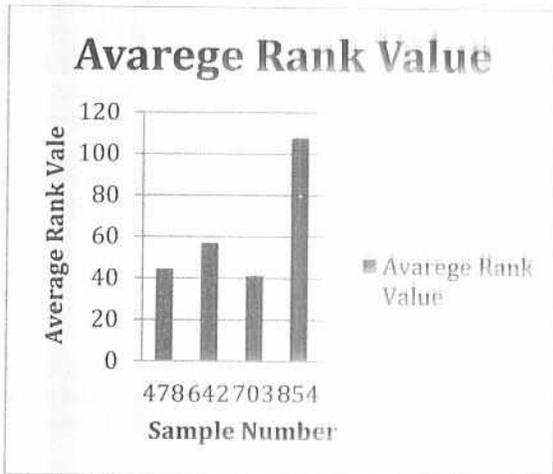


Figure 4.1 - Average rank values of the sensory evaluation-01

According to the above graph 845 has the highest average rank value. Also 642, 478 and 703 sample have rest values respectively. Selected sample (854) tend to further analysis.

Three samples were prepared using the above selected formula with different proportions of sweetener. The average rank values graphically represented in figure 4.2.

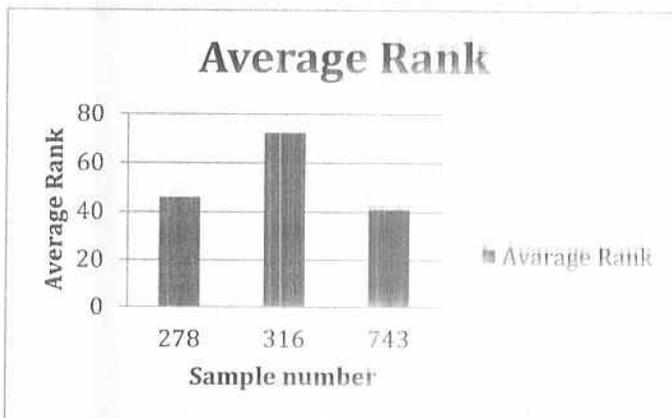


Figure 4.2 - Average rank values of the sensory evaluation-02

In order to the statistical evaluation results  $H_{\text{stat}}$  (24.54) value is greater than  $H_{\text{table}}$  value ( $H= 5.99$ ) (Appendix I), since there was a significant difference among samples (278,316,743). According to paired wise comparison between samples using average rank values and the mean separation value, preferable sugar level of sample 316 was

significantly different from sample 743. Also there were no significant differences between samples 278, and 743. According to the AR values, the most preferred formulation preferable sugar level was 316.

Series of sensory analysis were carried out to find out the better formula for each attribute such as colour, Taste, Odour, Strongness, appearance and Overall acceptability. Sensory evaluations were planned for twelve samples labeled as 103, 113, 123, 133, 143, 153, 163, 173, 742, 193, 203 and 213. When considering all the sensory attributes, 742 obtained the highest preference among them. Results have been illustrated by descriptive chart (web diagram) in figure 3.3 as follows.

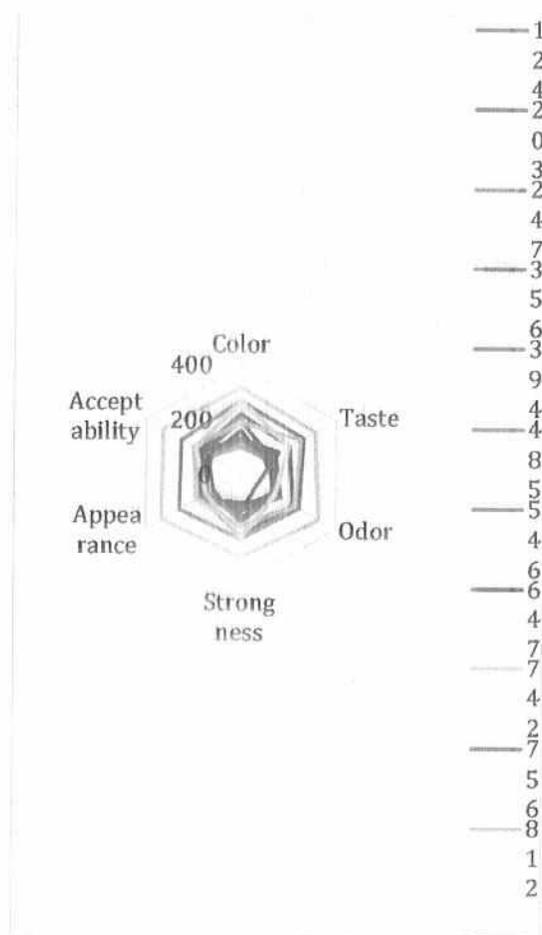


Figure 4.3 – sensory evaluation summery for each attribute.

Proximate analysis results were as follows,

Table 4.1. Proximate analysis results for the final product.

Nutrition	Result	Test Method
Moisture	96.67%	Oven drying method
Protein	-	AOAC method 960.52
Fat	-	-
Crude Fibre	-	AOAC method 978.10
Total Solids	0.52%	-
Ash	0.78%	AOAC method 94546

Final product was consists with the pH value of 5.8 and it was measured for four weeks of time period and there was no significant change within the above time period. Final products stabilized with 2.4% of sweetener and 1%of sodium benzoate.

## 5. Conclusion And Recommendations

### Conclusion:

The development of the Ready To Serve iced tea product from product wastage from down county black tea manufacturing process was successful in laboratory scale in terms of sensory acceptability and microbial safety. Final product had a good stability and shown a quality parameter stability during the four weeks observing time.

Proximate analysis results of the final product show that it contains 0.52% of total solid, 0.78% ash and 0% protein and crude fiber. And the final product shows a 5.8pH.

### Recommendations:

Conducting a market survey is a very helpful thing to understand the target market and it'll helpful to make fine-tuning of the product. That will help to add new flavors to the product according to customer preference.

Industrial level product development method has to determine for large scale production.

To understand the feasibility of manufacturing this product as a marketable product feasibility study is very important. Since shelf life determination was done using the lab scale developed product, it's important to conduct a shelf life determination process for industrial level product.

Comparative study with market available similar product to evaluate the quality of the product with similar products available in the market.

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