Effect of Moisture Content of Made Tea on the Growth of Yeast and Mould

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Introduction

Moisture content is an important factor which determines the quality of made tea. During tea processing even though the moisture content of tea is reduced to around 3% in the drying step, further gain of moisture occurs during transportation, storage and blending operations due to the hygroscopic nature of tea. The achievable level of moisture at the point of destination lies in the range of 10% to 12%. The impact of moisture on the quality of tea affect in two ways. Moisture brings about moisture related chemical changes in tea over period of time and high moisture leads to microbial growth (Dougan *et al.,* 1978). Yeast and mould are the major microorganisms found in tea which affect the quality deterioration rather than bacteria, because yeast and mould can be grown in low moisture foods comparing to bacteria. This study is to identify the effect of moisture content on yeast and mould growth of black tea and to determine the critical limit of moisture content.

Methodology

The current study was carried out at Microbiology Laboratory, Ceylon Tea Services PLC. Three black tea grades were selected for the experiment based on their particle size. Tea grades were Dust, BOP and OPA. Experiment I was conducted to determine the maximum absorbance of moisture content by black tea and carried out at 70% RH and 27 ^{0}C. Initial moisture contents of each samples were analyzed. Study was continued for five weeks and moisture content analyzed in weekly interval. Moisture content of tea was determined according to the ISO 1573.

Experiment II was conducted to determine the effect of moisture content and particle size of black tea on yeast and mould growth. *Aspergillus niger* (ATCC 8739) and *Saccharomyces spp* were used. Experiment was carried out at 55% RH and 25 ^{0}C. Initially black tea samples were oven dried to bring moisture content down to around 1% and to minimize microbial growth. Then a moisture series were prepared from 6% to 14% for each 200 g of tea grade by adding sterilized water and kept for stabilizing. Known amount of microbial inoculums were inoculated to the pre prepared three tea samples and thoroughly mixed. These samples were kept for 24 hours to stabilize. Known quantity of contaminated tea samples were inoculated into each prepared samples of all three grades and mixed thoroughly. Incubation was done at room temperature. Initial moisture content and the yeast and mould counts were analyzed in the same day. Yeast and mould counts were taken in weekly for one month duration by using the method described in Sri Lanka Standard Institution (SLS 516 part 2). The data obtained in present study was statistically analyzed with analysis of variance (ANOVA) using Minitab 16 statistical package. Pair wise comparisons were done by turkey at 5% level of significance level.

Results and Discussion

The moisture absorption pattern of Dust, BOP and OPA grades are presented in figure 1 and each point plotted on these graphs is the arithmetic mean of moisture content.

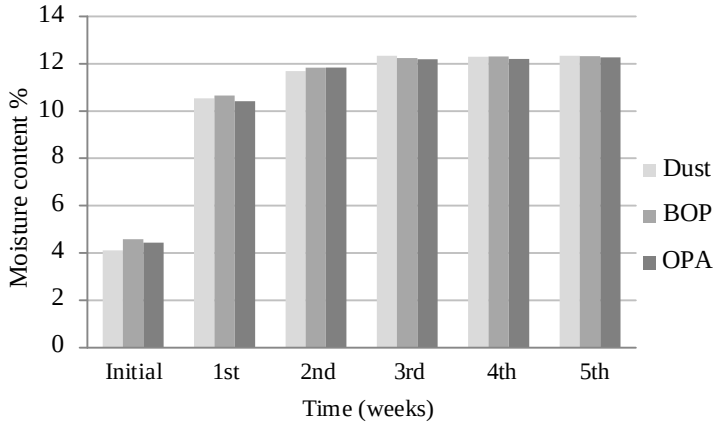

Figure 1. Comparison of moisture absorption by different tea grades

Initial moisture absorption rate was varied with the particle size of the grade. Higher initial absorption rate was reported in dust grade, while lower initial moisture absorption rate was reported in OPA grade. But maximum moisture absorption was not depended on the particle size. Moisture levels in all three grades were reached their equilibrium state after 3 weeks of storage. The equilibrium moisture content was 12.3 % at 70% RH and 27 ^{0}C. This equilibrium moisture contents are not much deviated from the values reported by Jayaratnam and Kirtisinghe (1974) and Dougan et al. (1978).

Growth difference of yeast and moulds with respect to the initial count over four weeks duration under different moisture content is mentioned is given in Table 1.

Table 1. Growth difference of yeast and moulds.

Moisture content (%)		Growth difference of yeast and moulds (cfu/g)			
		1st week	2nd week	3rd week	4th week
6.3 ± 0.1	D	0	33	0	-67
	B	100	33	0	-67
	O	0	67	0	-100
8.0 ± 0.1	D	0	67	2	-100
	B	33	33	33	-33
	O	67	100	33	33
10.0 ± 0.1	D	233	300	367	300
	B	133	267	400	267
	O	233	267	367	233
11.8 ± 0.1	D	500	2067	2400	1467
	B	433	1800	2233	1500
	O	567	1967	2433	1533
13.9 ± 0.1	D	600	2333	2600	1667
	B	600	2067	2500	1667
	O	567	2133	2600	1633

D- Dust, B-BOP and O- OPA

Table 1 shows that, similar growth pattern of yeast and mould over four weeks time observed in each of the three tea grades. All three tea grades samples were contained 11.8 % and 13.9 % moisture levels showed the highest rate of growth from the second week onwards. The yeast and mould count were low in the samples with 6.3%, 8% and 10% moisture levels.

Moisture content and storage time are significantly affect on the yeast and mould growth (p value = 0.000) while particle size is not significantly affect on the yeast and mould growth (p value = 0.190). This may be due to the water activity is independent of the particle size of tea and shelf life of tea grades greatly depends on moisture content or water activity and not on particle size (Thevathasan and Samaraweera, 1989).

Conclusions

Present study exhibited that the microbial status of made tea (yeast and moulds growth) is significantly affected by moisture content of tea and storage time, but it can be concluded that the particle size of black tea is not significantly affect on the yeast and mould growth in tea. Moisture content up to 10 % is not favorable for yeast and moulds growth in tea and moisture content above 11.8 % exhibits multiplication of yeast and moulds. In this context a very safe upper limit for moisture content in tea lies in the range of 10 %, as far as yeast and moulds proliferation concerned

References

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