EVALUATION OF BREWED TEA PREPARATION PROCEDURES

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OBJECTIVE

To evaluate the microbiological quality of brewed tea and its holding time using current procedure used by quick serve restaurants, and new proposed procedure, using liners.

TEST MATERIALS

- 3M™ Petrifilm™ E.coli/Coliform Count Plates
- Plate Count Agar (PCA)
- Butterfield's Phosphate Buffer
- Four in-use tea urns – collected from one quick serve restaurant

TEST PROCEDURE

1. Following the cleaning procedures in quick serve restaurants (Wash/Rinse/ Sanitize), tea urns were cleaned and sanitized by Ecolab representative. Microbiological swabs were collected from the urns before and after cleaning.
2. Two urns were used to brew unsweet tea (with and without a liner), and two urns were used to brew sweet tea (with and without a liner).
3. Brewed tea samples were dispensed and collected at six time points: 0 hours (h), 4h, 8h, 12h, 16h and 24h.
4. Concurrently, the brewed tea was dispensed from the urns into ½ gallon containers and was stored in a refrigerator at 35 – 40°F. Samples were tested at six time points: 0h, 4h, 8h, 12h, 16h and 24h.
5. All tea samples were collected in duplicate. Results were reported as an average of each replicate. Log10 values of the counts were used for graphs.

MICROBIOLOGICAL ANALYSIS

Swabs were diluted with phosphate buffer and vortexed to mix the samples. Tea samples were tested without dilution. Samples were spiral-plated and incubated at 35±1°C for approximately 48 hours, and the results were recorded. Samples were also plated in 3M™ Petrifilm™ E.coli/Coliform Count Plates and incubated for 24 hours at 35±1°C for coliform enumeration.

TEST RESULTS

Before and After Urn Cleaning Swabs Result

Urn#	Site	Total Bacterial Count (cfu/swab)		Coliform Count (cfu/swab)	
		Before	After	Before	After
Urn #1 will be used for Unsweet tea without Liner	Interior of Urn & Opening to Nozzle	200	100	10	<10
	Interior of Nozzle	<10*	<10	<10	<10
Urn #2 will be used for Unsweet tea with Liner	Interior of Urn & Opening to Nozzle	160,000	400	>2,500**	30
	Interior of Nozzle	200	100	<10	30
Urn #3 will be used for Sweet tea without Liner	Interior of Urn & Opening to Nozzle	79,000	200	>2,500	30
	Interior of Nozzle	<10	<10	<10	<10
Urn #4 will be used for Sweet tea with Liner	Interior of Urn & Opening to Nozzle	130,000	<10	<10	<10
	Interior of Nozzle	3,000	<10	<10	<10

* <10 is the minimum detectable limit for Total Bacterial Count and Coliform

** >2,500 is the maximum detectable limit for Total Bacterial Count and Coliform

Brewed Tea Samples Result

Urn #	Tea Type	Liner	Time	Temperature	Total Bacterial Count (cfu/ml)			Coliform Count (cfu/ml)		
					Sample 1	Sample 2	Average	Sample 1	Sample 2	Average
1	Unsweet	No	0 h	Ambient	200	200	200	1	6	4
		No	0 h	35 - 40 °F	180	200	190	<1	<1	<1
2		Yes	0 h	Ambient	<1*	<1	<1	<1	<1	<1
		Yes	0 h	35 - 40 °F	<1	<1	<1	<1	<1	<1
3	Sweet	No	0 h	Ambient	1,000	180	590	<1	3	3
		No	0 h	35 - 40 °F	20	20	20	3	2	3
4		Yes	0 h	Ambient	<1	<1	<1	<1	<1	<1
		Yes	0 h	35 - 40 °F	<1	<1	<1	<1	<1	<1
1	Unsweet	No	4 h	Ambient	740	400	570	>250**	22	136
		No	4 h	35 - 40 °F	140	40	90	<1	<1	<1
2		Yes	4 h	Ambient	<1	<1	<1	<1	<1	<1
		Yes	4 h	35 - 40 °F	<1	<1	<1	<1	<1	<1
3	Sweet	No	4 h	Ambient	8,100	1,300	4,700	>250	>250	>250
		No	4 h	35 - 40 °F	100	20	60	5	6	6
4		Yes	4 h	Ambient	<1	<1	<1	<1	<1	<1
		Yes	4 h	35 - 40 °F	<1	<1	<1	<1	<1	<1
1	Unsweet	No	8 h	Ambient	2,200	7,200	4,700	>250	>250	>250
		No	8 h	35 - 40 °F	180	100	140	<1	<1	<1
2		Yes	8 h	Ambient	<1	<1	<1	<1	<1	<1
		Yes	8 h	35 - 40 °F	<1	<1	<1	<1	<1	<1
3	Sweet	No	8 h	Ambient	31,000	6,500	18,750	>250	>250	>250
		No	8 h	35 - 40 °F	180	60	120	6	4	5
4		Yes	8 h	Ambient	<1	<1	<1	<1	<1	<1
		Yes	8 h	35 - 40 °F	<1	<1	<1	<1	<1	<1
1	Unsweet	No	12 h	Ambient	16,000	7,200	11,600	>250	>250	>250
		No	12 h	35 - 40 °F	40	<1	40	<1	<1	<1
2		Yes	12 h	Ambient	<1	<1	<1	<1	<1	<1
		Yes	12 h	35 - 40 °F	<1	<1	<1	<1	<1	<1
3	Sweet	No	12 h	Ambient	56,000	37,000	46,500	>250	>250	>250
		No	12 h	35 - 40 °F	100	140	120	9	2	6
4		Yes	12 h	Ambient	<1	<1	<1	<1	<1	<1
		Yes	12 h	35 - 40 °F	<1	<1	<1	<1	<1	<1
1	Unsweet	No	16 h	Ambient	53,000	19,000	36,000	>250	>250	>250
		No	16 h	35 - 40 °F	60	80	70	<1	<1	<1
2		Yes	16 h	Ambient	<1	<1	<1	<1	<1	<1
		Yes	16 h	35 - 40 °F	<1	<1	<1	<1	<1	<1
3	Sweet	No	16 h	Ambient	98,000	170,000	134,000	>250	>250	>250
		No	16 h	35 - 40 °F	180	80	130	3	2	3
4		Yes	16 h	Ambient	<1	<1	<1	<1	<1	<1
		Yes	16 h	35 - 40 °F	<1	<1	<1	<1	<1	<1
1	Unsweet	No	24 h	Ambient	140,000	140,000	140,000	>250	>250	>250
		No	24 h	35 - 40 °F	80	20	50	<1	<1	<1
2		Yes	24 h	Ambient	680	100	390	<1	<1	<1
		Yes	24 h	35 - 40 °F	180	200	190	<1	<1	<1
3	Sweet	No	24 h	Ambient	120,000	82,000	101,000	>250	>250	>250
		No	24 h	35 - 40 °F	100	120	110	4	6	5
4		Yes	24 h	Ambient	1,800	460	1,130	<1	<1	<1
		Yes	24 h	35 - 40 °F	100	60	80	<1	<1	<1

* <1 is the minimum detectable limit for Total Bacterial Count and Coliform
** >250 is the maximum detectable limit for Total Bacterial Count and Coliform

CONCLUSIONS

1. Samples of brewed tea (sweet & unsweet) collected from urns without liners showed bacterial growth in the initial samples (0h), with the count increase throughout the 24 hours of test (Chart 1).

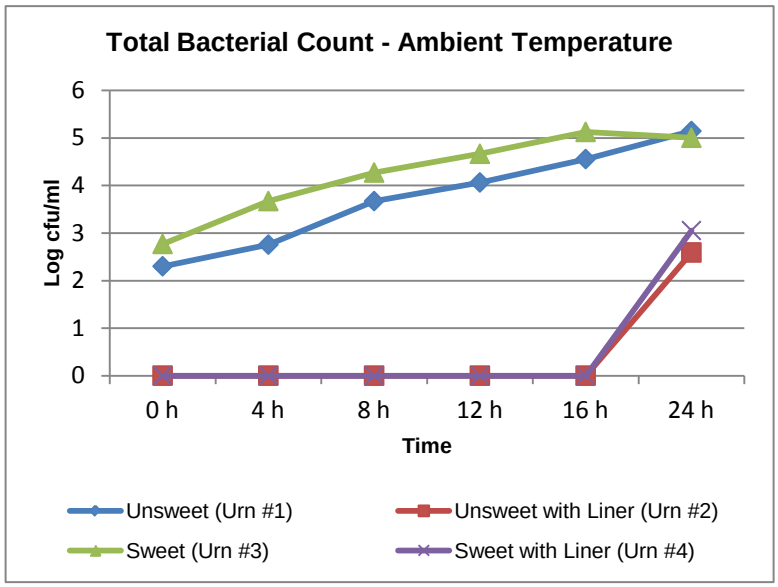
2. Samples of brewed tea (sweet & unsweet) collected from urns with liners showed no growth in total bacterial count for up to 16 hours, and showed bacterial growth after 24 hours of holding. There was no growth in coliform count for up to 24 hours of the test (Chart 1).

3. Refrigerated samples of brewed tea (sweet & unsweet) collected from urns without liners showed initial bacterial presence with no increase in the bacterial count within the 24 hours of the test. Only sweet tea showed growth in coliform count (Chart 2).

4. Refrigerated samples of brewed tea (sweet & unsweet) collected from urns with liners showed no growth in total bacterial count for up to 16 hours, and showed bacterial growth after 24 hours of the tea holding. There was no growth in coliform count for up to 24 hours (Chart 2).

Disclaimer: The test was done in control conditions to avoid contamination of the interior of liners during installation. Also, introduction of contamination was minimized when adding and mixing sugar.

Chart 1



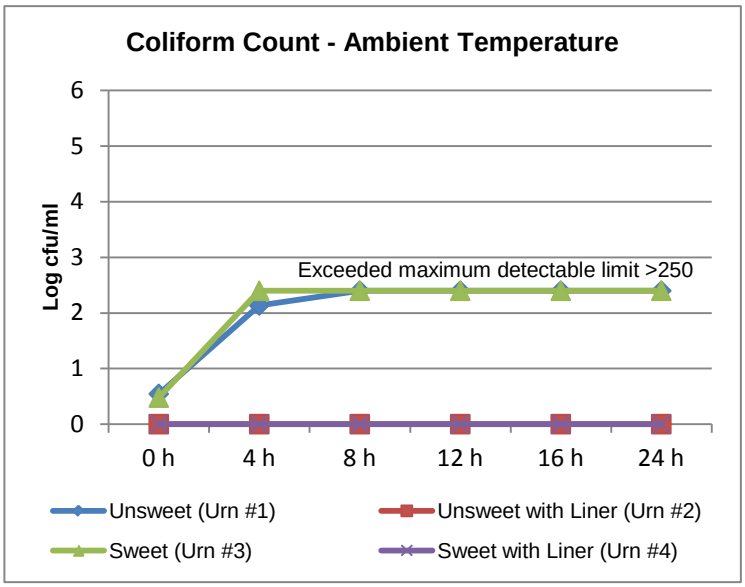


Chart 2