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Microbiological Standards for Reusable Plastic Containers within Produce Grower Facilities

Aim

To assess the microbiological standard of reusable plastic containers (RPC's) used in different fresh produce packing stations.

Summary

The sanitary status of delivered reusable plastic containers was assessed at different grower operations. The tests performed were visual inspection, ATP readings, Total Aerobic Counts, Enterobacteriaceae and *E coli*/coliform counts. Visual assessment was made with respect to damage, un-removed labels and general cleanliness. ATP readings provide an estimate on the viable cells present on a surface that is primarily a result of microbial contamination but can also include plant residues. The Total Aerobic Count (TAC) provides a more accurate assessment of the microbial load with *E coli*/Coliform count and Enterobacteriaceae as indicators if potential fecal contamination (i.e. presence of pathogens). The standards set were those expected of a cleaned surface of a food contact surface within the food industry with a 20% failure rate being deemed as acceptable.

There was significant variation on the sanitary status of RPC's at different growers although it should be noted that the trays were sampled as delivered thereby ruling out contamination at the packing facility. Collectively, 64% of RPC's failed in terms of ATP readings with 56% of trays having higher TVC expected of a cleaned surface. Visual inspection of RPC's revealed a proportion that were damaged or had labels affixed from previous use. Yet, 92% of RPC's did not exceed the levels of Enterobacteriaceae with no coliforms being recovered on any of the trays tested. From the results it can be concluded that although there was no evidence of a food safety issue it is recommended that the decontamination method for RPC's be reviewed to prevent carriage and transfer of human pathogens.

Methods

Five fresh produce packing operations located within Ontario and Quebec were visited in the course of the study. At each location 10 randomly selected RPC's were sampled using ATP and microbiological sampling, in addition to visual inspection. ATP swabs were taken from approximately 10cm^2 areas of the container base and one side. Sponge samples were taken from the entire inside surface of the tray as outlined in SOP (Annex A). The sponge samples were returned to the laboratory and submerged in 30 ml saline then stomached for 30s. A dilution series was prepared in saline then plated on Total Aerobic Count, *E. coli*/Coliform and

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Enterobacteriaceae petri films. The TAC was incubated at 34°C for 48h with the other petri films being incubated at 37°C for 24h. The colonies were enumerated and converted into log values. There is no specific criteria set for the microbiological standards for RPC's and as a consequence those based on food contact surfaces were used to designate pass or fails. Specifically, for ATP testing a fail was designated at >3 log RLU, for TAC the limit was 4 log cfu/tray, Enterobacteriaceae or coliforms >3 log cfu and presence of *E coli*.

Results

Table 1: ATP readings from RPC sampled at different fresh produce packing operations.

		Log RLU				
Location/ Grower	**Number Units Tested**	**Min**	**Max**	**Median**	**% Pass**	**% Fail**
Grower A	10	2.64	3.81	3.23	10	90
Grower B	10	1.77	2.52	2.15	90	10
Grower C	10	2.44	3.56	3.15	10	90
Total	30				36%	64%

Table 2: Total aerobic counts of RPC's sampled at different fresh produce packing operations.

		TAC log cfu/tray				
Location/ Grower	**Total Units Tested**	**Min**	**Max**	**Median**	**% Pass**	**% Fail**
Grower A	10	2.08	5.26	3.18	60	40
Grower B	10	2.18	4.43	2.78	90	10
Grower C	10	2.97	3.86	3.86	80	20
Grower D	10	5.32	6.20	5.68	0	100
Grower E	10	5.52	7.03	6.39	0	100
Total	50				44%	56%

Fail designated as > 4 log cfu/tray

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Table 3: Enterobacteriaceae counts of RPC's sampled at different fresh produce packing operations.

		Enterobacteriaceae cfu/tray				
Location/ Grower	**Total Units Tested**	**Min**	**Max**	**Median**	**% Pass**	**% Fail**
Grower A	10	<1.48	1.78	1.48	100	0
Grower B	10	<1.48	3.60	1.48	90	10
Grower C	10	<1.48	3.52	2.32	90	10
Grower D	10	<1.48	3.58	2.69	90	10
Grower E	10	<1.48	3.53	2.41	90	10
Total	50				92%	8%

Fail designated as > 3 log cfu/tray

Table 4: Coliform counts of RPC's sampled at different fresh produce packing operations.

		Coliforms cfu/Tray				
Location/ Grower	**Total Units Tested**	**Min**	**Max**	**Median**	**% Pass**	**% Fail**
Grower A	10	<1.48	<1.48	<1.48	100	0
Grower B	10	<1.48	2.48	1.48	100	0
Grower C	10	<1.48	2.18	1.48	100	0
Grower D	10	<1.48	2.95	1.48	100	0
Grower E	10	<1.48	2.73	1.48	100	0
Total	50				100%	0%

Fail > 3 log cfu/tray
No *E coli* was recovered from any trays tested

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Discussion

The sampling provided an indication on the sanitary quality of RPC's used in different packing operations. The ATP readings provided a general assessment of the sanitary status of the containers. It should be noted that ATP derived from microbial and plant sources would contribute to the final RLU readings. An arbitrary figure of 20% failures was deemed acceptable for cleaned RPC's that had not been used post-cleaning (i.e. as delivered to the packer). On this basis Grower B had an unacceptable failure rate with the other growers deemed acceptable. No ATP readings were taken for Growers D and E due to logistical reasons.

The TAC levels encountered within containers varied between Grower operations. Both facilities within Growers D and E had unacceptable levels of failures along with Grower C and Grower A. The TAC provided an assessment on the microbial loading with the results suggesting that either the container decontamination step was insufficient or post-process decontamination had occurred.

Enterobacteriaceae and coliform counts are reflective of potential contamination from fecal sources. Although both indicators were recovered sporadically the overall failure rate was acceptable. It is unlikely that the Enterobacteriaceae and coliforms were from fecal sources given that no E coli was recovered in any of the samples tested. Furthermore, coliforms and Enterobacteriaceae are commonly associated with plant material that again would indicate that those RPC testing positive were either insufficiently washed or subject to post-process contamination.

From visual inspection of the RPC's it was evident that several had labels from previous use that would indicate that the washing/decontamination process had not been performed or was insufficient. In addition, there was physical damage to a proportion of the trays that could represent niches for contamination to accumulate and become inaccessible to sanitizing agents.

Conclusions

From taking the results as a collective, it was evident that the sanitary status of the containers was dependent on the batch tested to the different growers. Given that there was minimal contact of the containers with the workers it can be concluded that the RPC were insufficiently cleaned prior to delivery to the Growers. Although there was no indication of a food safety threat (i.e. presence of pathogens) it would be recommended that the RPC decontamination process should be reviewed to enhance efficacy.

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