

# Sanitation of Juice Facilities for Presumptive *Alicyclobacillus* (TAB)

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## Introduction to TAB

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# TAB = Thermo-Acidophilic Bacteria

(a.k.a. **ATB**, Acido-Thermophilic Bacteria, or **STARS**, Sporeforming Thermo-Acidophilic Rod-Shaped bacteria)

Isolation of TAB from beverages is “presumptive” for *Alicyclobacillus*.

Further testing needed to confirm identification of *Alicyclobacillus*.



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**TAB = Thermo-Acidophilic Bacteria**

**Thermophile = "heat loving"**

**Acidophile = "acid loving"**

**Prefers growing in warm, acid conditions.**



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## Nine recognized species and subspecies of *Alicyclobacillus*

### Optimal Growth Conditions

	pH	Temp. °C
<i>A. acidocaldarius</i> subsp. <i>acidocaldarius</i>	3.0 - 4.0	60 - 65
<i>A. acidocaldarius</i> subsp. <i>rittmannii</i>	4.0	63
<i>A. acidiphilus</i>	3.0	50
<i>A. acidoterrestris</i>	3.5 - 4.0	45 - 50
<i>A. cycloheptanicus</i>	3.5 - 4.0	45 - 50
<i>A. herbarius</i>	4.5 - 5.0	55 - 60
<i>A. hesperidum</i>	3.5 - 4.5	50
<i>A. pomorum</i>	4.0 - 4.5	45 - 50
<i>A. sendaiensis</i>	5.5	55
<i>A. vulcanalis</i>	4.0	55

50°C = 122°F



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# Juice – Beverage Spoilage by TAB

**Primary effect:**

**Strong antiseptic/medicinal off-aroma**



**Secondary effect:**

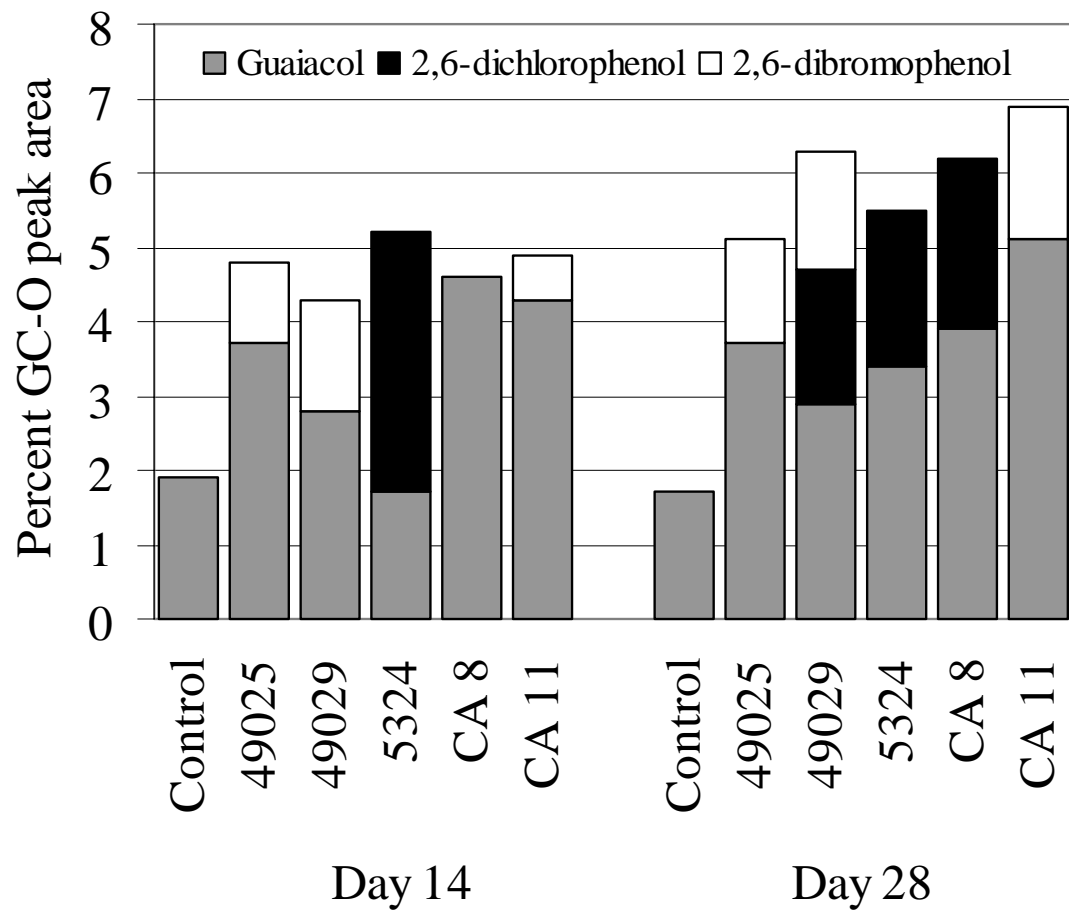
**Slight haze in clear liquids**

**Key point:**

**No production of CO<sub>2</sub>**



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Off-flavor production in orange juice inoculated with 5 strains of TAB and incubated at 45°C.



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# Key points regarding control of TAB

**Pasteurization will not eliminate TAB**

**Evaporation will not eliminate TAB**

**Growth does not occur at refrigerated temps**



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**Preventing contamination is the only control option at this time.**

**Thorough cleaning/sanitation regimes**

**Stringent SSOPs and cGMPs**

**Attention to condensate water**

**Sampling of processing environment**



# Sanitation

Little published research on sanitizer effectiveness against TAB

In plant spore reductions from 500 ppm hypochlorite or 1200 ppm acidified sodium chlorite were less than 90%. Hydrogen peroxide and peracetic not very effective. (Orr and Beuchat, *J. Food Prot.*, 63, 1117, 2000)

Only current alternative is stringent sanitation controls.

# Three sanitation points for control efforts:

**Facility / equipment hygiene**

**Fruit quality and cleanliness**

**Water quality, esp. condensate**



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# Additional control issue:

## Ineffective laboratory recovery protocols

Recovery media, incubation conditions, heat shock, etc.

Improved recovery efficiencies are likely in the future.



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# Recent phone survey:

Five processing facilities

Queried on TAB control measures



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# Recent phone survey:

## General observations

Only one facility chemically treats condensate water (just prior to pulp washer).

One facility does not store condensate water. Uses condensate within the day of production.

One facility uses condensate only for general cleaning prior to the brushwasher.

One facility has not changed handling of condensate water.



# Recent phone survey:

## General observations

Evaporator clean-up occurs no less than once per day at any facility. No facility uses chemical sanitizer although one occasionally finishes cleaning with 170 F without vacuum for 15 min.

Continuous sanitizer sprays on belts is common.

No facility has 100% control of TAB even with extra precautions.

One facility noticed better control at a second location where there is greater emphasis on brushwashing.



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