

## **Orange Juice Comparison Study: The Effects of a Combination of Turbulence and Gas on Thermal (Heat) Pasteurized and Non-pasteurized (Fresh Squeezed) Orange Juice**

This study was conducted to determine the physical effects the combination of turbulence with a gas would exhibit on thermal (heat) pasteurized and non-pasteurized (fresh squeezed) orange juice.

### Materials;

7 gal., Tropicana “No Pulp” orange juice – thermal pasteurized  
7 gal., Florida Natural “No Pulp” orange juice – thermal pasteurized  
7 gal., Wegmans “fresh squeezed” orange juice – non-pasteurized  
7 gal., Jennings Citrus “fresh squeezed” orange juice – non-pasteurized  
9 gal., Stainless Steel tank with cover  
Twin, spiral, 530 rpm mixers  
Carbon Dioxide @ 2psia, with inoculation tube  
Nitrogen @ 2psia, with inoculation tube

### Methods;

8 trials were conducted.

#### Trial 1;

7 gal., Tropicana “No Pulp” orange juice (thermal pasteurized) was slowly poured into the 9 gal. tank. The cover was closed except for a view/test plug. A continuous flow of carbon dioxide was introduced through a tube into the juice at 2 psia. The twin spiral mixers were activated in the juice at 530 rpm producing a Reynolds number greater than 2200. The observations were recorded.

#### Trial 2;

7 gal., Florida Natural “No Pulp” orange juice (thermal pasteurized) was slowly poured into the 9 gal. tank. The cover was closed except for a view/test plug. A continuous flow of carbon dioxide was introduced through a tube into the juice at 2 psia. The twin spiral mixers were activated in the juice at 530 rpm producing a Reynolds number greater than 2200. The observations were recorded.

#### Trial 3;

7 gal., Wegmans “fresh squeezed” orange juice (non-pasteurized) was slowly poured into the 9 gal. tank. The cover was closed except for a view/test plug. A continuous flow of carbon dioxide was introduced through a tube into the juice at 2 psia. The twin spiral mixers were activated in the juice at 530 rpm producing a Reynolds number greater than 2200. The observations were recorded.

#### Trial 4;

7 gal., Jennings Citrus “fresh squeezed” orange juice (non-pasteurized) was slowly poured into the 9 gal. tank. The cover was closed except for a view/test plug. A continuous flow of carbon dioxide was introduced through a tube into the juice at 2 psia. The twin spiral mixers were activated in the juice at 530 rpm producing a Reynolds number greater than 2200. The observations were recorded.

#### Trials 5, 6, 7, & 8;

Trials 5 through 8 were conducted the same as Trials 1 through 4 except nitrogen was used instead of carbon dioxide.

**Results;**

1. When mixed with a turbulence resulting in a Reynolds number greater than 2200 and simultaneously inoculated with either carbon dioxide or nitrogen at 2 psia, both the Tropicana and Florida Natural “No Pulp” thermal (heat) pasteurized orange juice exhibited uncontrollable, violent foaming within one minute (photos 1 & 2). The reaction continued to increase uncontrollably until mixing and gas inoculation were stopped.



Photo 1



Photo 2

2. When mixed with a turbulence resulting in a Reynolds number greater than 2200 and simultaneously inoculated with either carbon dioxide or nitrogen at 2 psia, both the Wegmans and Jennings Citrus “fresh squeezed” non-pasteurized orange juice exhibited very little or no foaming within a 60 minute period (photos 3 & 4 - NOTE: orange juice inside view/test hole next to plug).



Photo 3

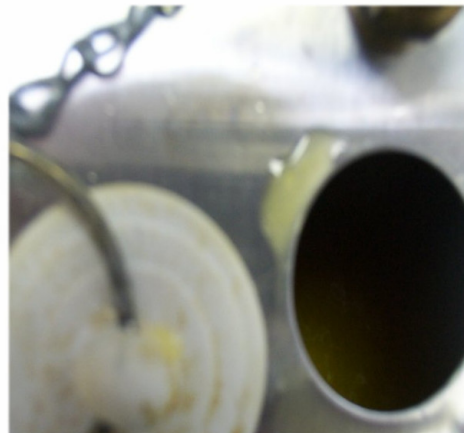


Photo 4

**Conclusion:**

Speculation is the heat required for thermal pasteurization is sufficient enough to eliminate most or all the enzymes in orange juice. Reduction of the enzymes alters the physical construction of the orange juice radical, resulting in the instability and possible gelation of the juice. This phenomenon requires additional simulation and human clinical trial studies to determine the consequences of the reaction due to heat pasteurization.