

REPORT

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# Application Development of *pHase*<sup>TM</sup> in Retort Products

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**Project # DEV 1340**

**Jones-Hamilton Co.**

**30354 Tracy Road  
Walbridge, Ohio  
43465-9792**

**Tel: 419-666-9838**

**Submitted by: Daina Rye  
Product Development Specialist**

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**GFTC: Creative, Confidential Solutions**

88 McGilvray Street, Guelph, Ontario, N1G 2W1, Canada

Tel.: (519) 821-1246, Fax: (519) 836-1281, E-mail: [gftc@uoguelph.ca](mailto:gftc@uoguelph.ca), Website: [www.gftc.ca](http://www.gftc.ca)

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# Application Development of *pHase*<sup>TM</sup> in Retort Products

## Report – Phase 1

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### **Project Objective**

The objectives of this project were to:

- Phase 1 - Conduct lab scale trials to develop generic formulations of a vegetable, soup and sauce with and without sodium acid sulfate (*pHase*<sup>TM</sup>) for comparison, and
  - Phase 2 - Conduct pilot scale trials of each product, retorted and acidified with *pHase* to produce samples for further testing, such as a shelf life.
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### **Rationale**

By reducing the pH of low-acid products through acidification with *pHase*<sup>TM</sup>, current retort products may require a milder heat treatment for shelf stability.

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### **Sodium Content**

The amount of sodium in both the retorted vs. the acidified version will be considered. A previous preliminary study had shown an increased salty effect when acidified with *pHase*<sup>TM</sup>. The formulations developed in this study will determine if the salt content in the retorted formulation can be reduced in the acidified formulation.

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### **Model Products Developed**

The three products chosen were:

- Sliced carrots,
  - Condensed vegetable soup, and
  - Alfredo cream sauce.
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**Formulations and Methods**

\*specification sheets of the ingredients can be found in the appendix

**Carrots**

Retorted Carrots

A standard retort formulation was used as the reference for the sliced carrots. The formulation and target fill weights are found below.

**Brine Solution**

Ingredient	%
Water	98.50
Salt	1.50
Total	100.00

**Target Fill Wts**

365 g

Ingredient	%	g batch
Brine	40.00	146.000
Carrots	60.00	219.000
Total	100.00	365.000

Processing Method:

1. Wash carrots
2. Peel carrots
3. Slice carrots 7/32"
4. Blanch carrots in water for 4 minutes at 190°F, rinse with cold water
5. Heat brine to 200°F
6. Fill jars with carrot fill weight, top with brine
7. Thermally process in retort at 250°F.
8. Cool

Note: The retort used in this study was a still retort (no agitation during cooking). The thermal process was conducted to a minimum F<sub>0</sub> value of 6.

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Acidified Carrots

The standard retort formulation and the results from the preliminary study were used as a starting guideline for the acidified carrot formulation. A target pH of 4.00 was desired. Trials involved adjusting the *pHase*<sup>TM</sup> level in the brine, removing the salt, and modifying the process.

The formulation and target fill weights for acidified carrots are found below.

**Blanching Solution**

Ingredient	%
Water	44.70
pHase	0.30
Carrots	55.00
Total	100.00

**Target Fill Wts**

365 g

Ingredient	%	g batch
Brine	40.00	146.000
Carrots	60.00	219.000
Total	100.00	365.000

**Brine**

Ingredient	%
Water	99.70
pHase	0.30
	100.00

Processing Method:

1. Wash carrots
2. Peel carrots
3. Slice carrots 7/32"
4. Add carrots/blanching solution to kettle
5. Heat to 200°F and hold for 15 minutes (stir occasionally)
6. Drain carrots from blanching solution
7. Fill acidified carrots into jars, top with heated brine (200°F) to specified fill weights
8. Lay on side (roll periodically) for 3 minutes
9. Cool in cool water bath

Final pH of acidified prototypes was 3.50-3.90 (reproducibility difficult, possibly due to minor changes in processing methods, size of carrots, variety of carrots etc.)

## Condensed Vegetable Soup

### Retorted Condensed Vegetable Soup

A generic condensed vegetable soup was developed. Two formulations were developed; one using chicken broth as a base ingredient and the other with beef broth.

The formulations are found below:

#### ***Vegetable Soup A (Chicken)***

<b>Ingredient</b>	<b>%</b>
Water	52.90
Salt	1.50
Modified Starch <sup>1</sup>	1.00
Can-Fil Starch <sup>2</sup>	2.00
Tomato Paste	9.20
Chicken Broth <sup>3</sup>	2.33
Diced carrots	10.00
Diced potatoes	10.00
Peas	4.30
Pasta	1.40
High Fructose Corn Syrup	4.50
Celery Concentrate <sup>4</sup>	0.10
Yeast Extract <sup>5</sup>	0.37
Garlic Powder	0.20
Onion Powder	0.20
Total	100.00

#### ***Vegetable Soup B (Beef)***

<b>Ingredient</b>	<b>%</b>
Water	52.98
Salt	1.75
Modified Starch <sup>1</sup>	1.00
Can-Fil Starch <sup>2</sup>	2.00
Tomato Paste	9.20
Beef Broth <sup>6</sup>	2.00
Diced carrots	10.00
Diced potatoes	10.00
Peas	4.30
Pasta	1.40
High Fructose Corn Syrup	4.50
Celery Concentrate <sup>4</sup>	0.10
Yeast Extract <sup>5</sup>	0.37
Garlic Powder	0.20
Onion Powder	0.20
Total	100.00

<sup>1</sup>Modified Starch, Novation 3300, *Nacan*

<sup>2</sup>Can-Fil Starch, *Nacan*

<sup>3</sup>Chicken Broth, 3422 powdered, *IDF*

<sup>4</sup>Celery Concentrate, *Diana Vegetal*

<sup>5</sup>Yeast Extract, standard light 800220, *Givaudan*

<sup>6</sup>Beef Broth

#### Processing Method:

1. Slurry water and tomato paste
2. Add starch and mix well
3. Add all remaining ingredients
4. Heat to 185°F and fill into jars
5. Thermally process in retort at 250°F
6. Cool

### Acidified Condensed Vegetable Soup

The standard retort formulation and the results from the preliminary study were used as a starting guideline for the acidified soup formulation. A target pH of 4.00 was desired. Trials involved adjusting the *pHase*<sup>TM</sup> and salt levels and modifying the process.

The formulations are found below:

#### ***Vegetable Soup A (Chicken)***

<b>Ingredient</b>	<b>%</b>
Water	53.88
Salt	0.50
Modified Starch <sup>1</sup>	2.50
Can-Fil Starch <sup>2</sup>	0.00
Tomato Paste	9.20
Chicken Broth <sup>3</sup>	2.33
Carrots	10.00
Potatoes	10.00
Peas	4.30
Pasta	1.40
High Fructose Corn Syrup	4.50
Celery Concentrate <sup>4</sup>	0.10
Yeast Extract <sup>5</sup>	0.37
Garlic Powder	0.20
Onion Powder	0.20
<i>pHase</i>	0.52
Total	100.00

#### ***Vegetable Soup B (Beef)***

<b>Ingredient</b>	<b>%</b>
Water	54.04
Salt	0.75
Modified Starch <sup>1</sup>	2.50
Can-Fil Starch <sup>2</sup>	0.00
Tomato Paste	9.20
Beef Broth <sup>6</sup>	2.00
Carrots	10.00
Potatoes	10.00
Peas	4.30
Pasta	1.40
High Fructose Corn Syrup	4.50
Celery Concentrate <sup>4</sup>	0.10
Yeast Extract <sup>5</sup>	0.37
Garlic Powder	0.20
Onion Powder	0.20
<i>pHase</i>	0.44
Total	100.00

<sup>1</sup>Modified Starch, Novation 3300, *Nacan*

<sup>2</sup>Can-Fil Starch, *Nacan*

<sup>3</sup>Chicken Broth, 3422 powdered, *IDF*

<sup>4</sup>Celery Concentrate, *Diana Vegetal*

<sup>5</sup>Yeast Extract, standard light 800220, *Givaudan*

<sup>6</sup>Beef Broth, powdered beef extract 5431, *IDF*

#### **Processing Method:**

1. Slurry water and tomato paste
2. Add starch and mix well
3. Add all remaining ingredients, including *pHase*<sup>TM</sup>
4. Heat to 200°F and hold for 20 minutes
5. Fill acidified soup into jars
6. Lay on side (roll periodically) for 3 minutes
7. Cool in cool water bath

Final pH of acidified prototypes 4.20-4.22.

## Alfredo Cream Sauce

### Retorted Alfredo Cream Sauce

A generic Alfredo cream sauce was developed.  
The retorted formulation is found below:

Ingredient	%
Water	46.53
Salt	1.30
Modified Starch <sup>1</sup>	2.15
Butter Buds 32x <sup>2</sup>	1.30
Parmesan Buds-Ex <sup>3</sup>	1.07
Parmesan Flavor <sup>4</sup>	0.08
Xanthan gum	0.10
Sugar	1.15
Onion Powder	0.20
White Pepper	0.02
Garlic Powder	0.10
Cream 35% fat	46.00
Total	100.00

<sup>1</sup>Modified Starch, Frigex W, *Nacan*

<sup>2</sup>Butter Buds 32x, *Dealers Ingredients Inc.*

<sup>3</sup>Parmesan Buds Ex, *Dealers Ingredients Inc.*

<sup>4</sup>Parmesan Flavor, N&A powder #4801, *Ealong*

#### Processing Method:

1. Slurry water and starch
  2. Dry mix dry ingredients with xanthan gum
  3. Add dry mix and cream
  4. Mix well
  5. Fill sauce into jars
  6. Thermally process in retort at 250°F
  7. Cool
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## Acidified Alfredo Cream Sauce

The standard retort formulation and the results from the preliminary study were used as a starting guideline for the acidified cream sauce formulation. A target pH of 4.00 was desired. Trials involved adjusting the *pHase*<sup>TM</sup> and salt levels, and modifying the process.

The acidified formulation is found below:

<b>Ingredient</b>	<b>%</b>
Water	45.92
Salt	0.75
Modified Starch <sup>1</sup>	3.00
Butter Buds 32x <sup>2</sup>	1.30
Parmesan Buds-Ex <sup>3</sup>	1.07
Parmesan Flavor <sup>4</sup>	0.08
Xanthan gum	0.10
Sugar	1.15
Onion Powder	0.20
White Pepper	0.02
Garlic Powder	0.10
Cream 35% fat	46.00
pHase	0.36
<b>Total</b>	<b>100.00</b>

<sup>1</sup>Modified Starch, Frigex W, *Nacan*

<sup>2</sup>Butter Buds 32x, *Dealers Ingredients Inc.*

<sup>3</sup>Parmesan Buds Ex, *Dealers Ingredients Inc.*

<sup>4</sup>Parmesan Flavor, N&A powder #4801, *Ealong*

### Processing Method:

1. Slurry water and starch
2. Dry mix dry ingredients (except phase) with xanthan gum
3. Add dry mix and cream, mix well
4. Slowly add in *pHase*<sup>TM</sup> while mixing
5. Heat to 200°F and hold for 20 minutes
6. Fill acidified sauce into jars
7. Lay on side (roll periodically) for 3 minutes
8. Cool in cool water bath

Final pH of acidified prototype 4.05

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**Sodium  
Content  
Reduction**

The following chart demonstrates the approximate sodium contents and the % reduction of the acidified versus the retorted prototypes.

Note: the sodium content was determined by calculation based on ingredient specifications and formulation levels.

<b>Product</b>	<b>% sodium</b>	<b>% reduction</b>
Retorted Carrots	0.236	75
Acidified Carrots	0.060	
Retorted Vegetable Soup A	0.648	45
Acidified Vegetable Soup A	0.359	
Retorted Vegetable Soup B	0.793	39
Acidified Vegetable Soup B	0.488	
Retorted Alfredo Cream Sauce	0.620	23
Acidified Alfredo Cream Sauce	0.475	

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**Sensory Results Carrots**

The acidified carrots were firmer in texture (similar to fresh carrots), brighter orange in colour and had a fresher, raw carrot flavor. Some bitterness was noted, possibly due to the enhancement of the raw flavor character or *pHase*<sup>TM</sup>. A mild acidity can also be detected.

**Vegetable Soup**

The acidified soups resulted in vegetables with firmer texture, the sauce was more red and the flavor had less cooked notes, was more tangy and there was some bitterness detected. The flavor of the soup with the beef broth was preferred over the soup with the chicken broth (less tangy and less bitter\*).

\*a lower level of *pHase*<sup>TM</sup> was required for the soup with the beef broth due to both the lower percent broth in the formulation and the chicken broth seemed to have a higher buffering capacity than the beef broth.

**Alfredo Cream Sauce**

The acidified sauce had a more creamy white appearance, fresh cheese flavor with more robust parmesan cheese flavor, less cooked flavor, and a tangy aftertaste. The flavor profile is less balanced than retort product. The texture was also smoother.

**Conclusion**

Sodium acid sulfate (*pHase*<sup>TM</sup>) was effective in reducing the pH of traditional retort products to enable the products to use a hot-fill process. The resulting products were quite different in texture, appearance and flavor. In general, the acidified products had improved texture (more firm) and appearance (color). The flavor profiles of the acidified products were distinct, and further formulation modification may be required to balance the acidity and bitterness.

The sodium content, determined by calculation, was decreased in all three products acidified with *pHase*<sup>TM</sup> as compared to the retort formulations.

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## Appendix