

Installation of Preventase Enzyme in Cerelac variants- Cerelac Honey, Cerelac Apple Cherry and Cerelac Multi Grain 5 Fruit

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The acryl amide content in the cerelac variants – cerelac apple cherry, cerelac honey and cerelac multi grain 5 fruit came out to be out of the nestle norms that is 100 ppb. For us it is very important to reduce the acryl amide content as we are concerned with the baby food. So to minimize the levels of acryl amide in cerelac baby food we discussed to minimize the AA content in the three cerelac variants- cerelac apple cherry, cerelac honey and cerelac multi grain 5 fruit. Preventase enzyme, reduces acryl amide in food by up to 90%. The enzyme converts asparagines into aspartate, a naturally occurring amino acid, thus preventing the chemical reaction that usually forms acryl amide when carbohydrate-containing foods, for example bread, cake or cereals, are being heated. So we decided to use preventase enzyme as a remedy to reduce the acryl amide in the cerelac baby food. Trials are being carried out by dosing preventase enzyme in the cerelac variants and the results came out to be positive for the two out of three variants. For apple cherry and honey it proves a good solution but for the multi grain 5 fruit it was not fruitful at first trial. So for the cerelac multi grain 5 fruit another trial for more preventase dosing has decided (from 100 ppm to 200 ppm and 400 ppm along with a close check on the other dry ingredients used in this variant and the base powder and the other factors responsible for the mechanism of the preventase enzyme such as Ph, temperature, TC, holding time. Results for the cerelac multi grain 5 fruit for the dosing 200 ppm and 400 ppm came out and results for the dry mix ingredients and base powder came out. It shows that there was more acryl amide in one of the dry mix ingredient- barley rice corn flakes. Finally it was decided to continue the dosing of the preventase enzyme as 200 ppm as it was not at all effecting. It is barley corn crunchy which is creating a problem in cerelac multi grain 5 fruit.

Keywords: Acryl Amide, Cerelac Apple Cherry, Cerelac Honey, Cerelac Multi grain 5 fruit, Temperature, pH, Preventase Enzyme, Holding Time

INTRODUCTION

Cerelac has been a leading brand in weaning foods in India. This brand was launched in 1974 and since then it has been constantly growing. Cerelac production first started in 1963 in liquid plant. The cereal plant produces infant food under the brand name of "Nestle-Cerelac". The process involves conversion of various raw materials into gentle food for the infants, 6 months onwards.

Acrylamide (or acrylic amide) is a chemical compound with the chemical formula C_3H_5NO . It is a white odorless crystalline solid, soluble in water,

ethanol, ether, and chloroform. Carbohydrate-rich products that have been subjected to heating and the "browning reaction" - when flavours, colours and textures are formed - generally contain acryl amide. So it is not that comes from outside or we put it in the product, it occurs naturally in the starch containing foods. Among the foods which develop acryl amide during cooking are coffee, chocolate, almonds, French fries, potato chips, cereal, crackers, bread, and even some fruits and vegetables. Acryl amide might cause cancer, increase the risk of heart disease, nervous disorders.

So we must put efforts to reduce or eliminate the production of acryl amide in the foods for our safety. Acryl amide cannot be eliminated from the food because it will be eliminate the maillard reaction that enhance the flavour and colour of food upon heating but we can reduce the level of acryl amide by adding some agent.

Problem Statement

In Nestle's three variants the amount of acryl amide came out to be out of limits that is not more than 100 ppb. In apple cherry, honey and multi grain 5 fruit, the value of acryl amide came out to ne more than 100 ppb. It was the major concern for a leading company like Nestle to think about the high levels of acryl amide. From Nestle R&D, Switzerland, the solution to this problem came to be preventase enzyme. So in this project, we will be using Preventase Enzyme for the reduction of acryl amide to check for the efficiency of enzyme and if positive results came out then finalizing the dose, temperature, ph, holding time for the three variants of cerelac- *cerelac apple cherry, cerelac honey and cerelac multi grain 5 fruit*.

Preventase enzyme

The Preventase enzyme is a "asparaginase enzyme preparation" from the *Aspergillus niger* micro-organism (*A. Niger*). The enzyme basically converts one of the precursors of AA, asparagines, into another naturally occurring amino acid, aspartate. As a result, asparagines is not available anymore for the chemical reaction that forms acryl amide when carbohydrate-containing foods, such as bread, biscuits, crackers, processed potato products and cereals, are being heated.. Preventase enzyme is used

to reduce the formation of AA, a suspected carcinogen, in starchy food products such as snacks and biscuits. It has proven to give reductions in the acryl amide levels of up to 90%.

Preventase can be used as a food processing aid to reduce the formation of acryl amide, a suspected carcinogen, in starchy food products. It has reduced the level of acryl amide in a wide variety of foods without changing the finished product attributes.

Preventase dosage levels

It is simple to dose, does not impact the process and does not change finished product attributes like taste, color and texture. The effectiveness of preventase enzyme, like all enzymes is dependent on:

- Raw Materials
- Moisture content
- Contact time- Should not be less than 10 min.
- Temperature- Should not be less than 30° C.
- Total concentration of soup should not be less than 50%.

The dosing of the preventase enzyme is decided to be 100 ppm (1.5 kg/batch)

Improvement of the problem

Preventase enzyme has proven to give reductions in the acryl amide levels of up to 90%.It has reduced the level of acryl amide in a wide variety of foods without changing the finished product attributes. So for the

cerelac variants preventase enzyme addition got started. Enzyme solution for addition in soup was made by dissolving 1.5 kg enzyme in 1000 lt. water.

New set up for enzyme dosing was installed in soup section near soup vat and papenmier mixer. 2 enzyme tanks are installed with capacity of 100 litres each. Automatic distribution of enzyme in papenmier was set with screw pump with flow rate of 17 litre / hour (1.25 litre / hour). Temperature of enzyme was maintained at 20- 25 °C by means of refrigeration system

Control of the problem

After addition of Preventase, Samples were taken for AA test. The results were as follows according to table 1. Results for the samples of the variants – cerelac apple cherry and cerelac honey came out to be positive. Acrylamide levels came under the norms for these two. So dose of preventase enzyme for cerelac apple cherry and cerelac honey got fixed to **100 ppm**. But there is a problem in cerelac multi grain five fruit. The results for this shows that acrylamide is still high in this case. So this needs a further improvement.

Quality Parameter	Nestle Norm	Result
Acrylamide		
CMG5F	Max 100 ppb	114 & 109 ppb
CAC	Max 100 ppb	< 100 ppb
CH	Max 100 ppb	<100 PPb

Table 1: results for 100 ppm dosage on cerelac variants.

Further improvement

As the acrylamide content for the cerelac multi grain 5 fruit come out to be out of norms. It is further suggested that as there are more juice content in this variant so may be due to this reason the acrylamide content are coming out to be more.

So by considering this the dosage of the preventase enzyme got revised from **100 ppm to 200 ppm**. The trial for the revised dosage for preventase enzyme on multi grain 5 fruit carried out. The results for AA for multi grain 5 fruit for 200 ppm are as follows according to table 2. The result for AA in multigrain 5 fruit came out to even more than earlier as present in 100 ppb dosing of preventase(114 and 109 ppb respectively) .

Quality Parameter	Nestle Norm	Result
Acrylamide	Max 100 ppb	140 ppb
Acrylamide	Max 100 ppb	158 ppb

Table 2: results for acrylamide in cerelac multi grain 5 fruit for 200 ppm dosage.

Analysis

Results for 200 ppm for this variant came out to high in AA. They are even high as compare to 100 ppm. The reason for this unexpected level of AA could be as follows:

1. High concentration of juices in CMG5F
2. Several Dry mix ingredients as:
 - Apple dice
 - Cherry crunchy

- Strawberry crunchy
- Apricot crunchy
- Barley rice corn flakes
- 3. Soup temperature
- 4. Batch resting time
- 5. Soup pH
- 6. Total Concentration of Soup

Improvement Trial

The next trail for the cereleac multi grain five fruit has been decided by considering the following points.

- Record AA in base powder
- Record AA in finished powder
- Record AA in dry ingredients(flakes and crunchies)
- Check on the parameters (Ph, temp. of soup vat, holding time of enzyme, tc of soup)

Also the trial to be done is planned for four days in which the first two days the dosing of enzyme will be 200 ppm and the last two days the dosing of enzyme will be 400 ppm.

Data Collection

Data as per requirement was collected at different sampling point. Samples of analysis also collected and sent to QA lab for analysis.

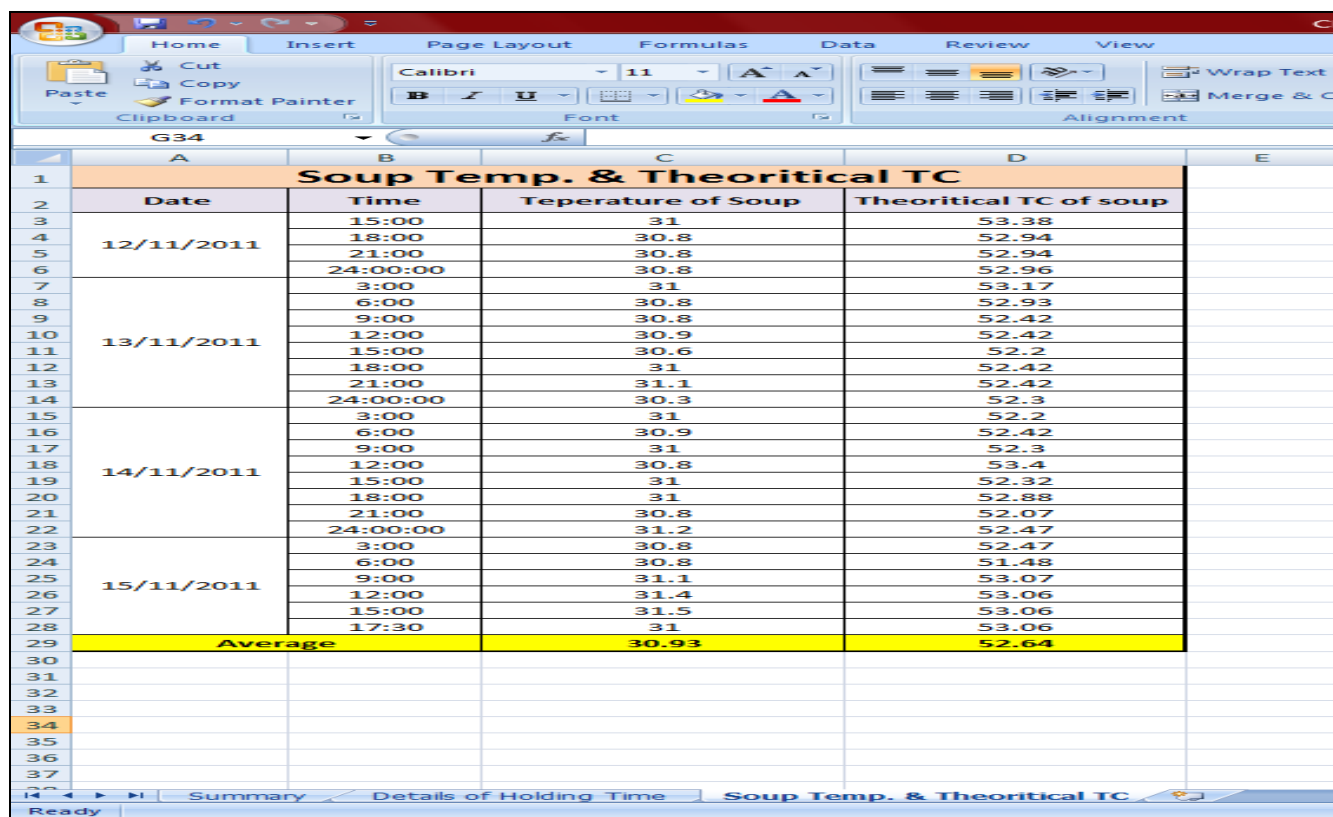
Summary of Sampling and Data Collection for CMGSF									
Date	12/11/2011 to 15/11/2011	Done and Prepared By	Prabhdeep Kaur / Trisha Soni						
S.No	Component	Sampling Date	Sampling Time	Batch no./ Lot no.	AA	TSS	pH	Temperature	Avg Holding Time (Min)
Dry mix Ingredients									
6	Apricot crunchies	9:30	71059011	Lab	x	x	x	x	x
7	BRC flakes 1	9:30	80C-11125	Lab	x	x	x	x	x
8	BRC flakes 2	9:30	N68C 027511	Lab	x	x	x	x	x
9	Strawberry crunchies	9:30	71066011	Lab	x	x	x	x	x
10	Chermi crunchies	9:30	51123006	Lab	x	x	x	x	x
11	Apple Dices	9:30	825178R	Lab	x	x	x	x	x
Blend									
13	Lot 1	9:30	0451679228	Lab	x	x	x	x	x
14	Lot 2	9:30	0451685141	Lab	x	x	x	x	x
15	Lot 3	9:30	0451685551	Lab	x	x	x	x	x
Soup sample with 200ppm enzyme dosing and 4 Roller drier were in operation									
17	Sample 1	12/11/2011	15:55	10	x	34.36	5.11	30.8	10.09
18	Sample 2	16:30	16	x	32.74	5.11	31		
19	Sample 3	17:00	20	x	33.67	5.07	31.1		
Soup sample with 200ppm enzyme dosing and 3 Roller drier were in operation									
21	Sample 4	13/11/2011	13:00	64	x	33.44	5.02	31.4	15.52
22	Sample 5	13:30	68	x	34.63	5.03	31.5		
23	Sample 6	14:00	76	x	34.11	5.03	31.4		
Soup sample with 400ppm enzyme dosing and 3 Roller drier were in operation									
25	Sample 7	14/11/2011	9:00	22	x	35.18	5.04	30.5	15.65
26	Sample 8	12:00	45	x	35.25	5.13	30.8		
27	Sample 9	14:00	65	x	32.87	5.13	31.3		
Soup sample with 400ppm enzyme dosing and 4 Roller drier were in operation									
29	Sample 10	15/11/2011	10:00	42	x	31.98	5.15	31.1	10.16
30	Sample 11	12:00	59	x	32.16	5.09	31.4		
31	Sample 12	15:30	87	x	32.42	5.07	31.5		
Base Powder with 200ppm Enzyme dosing and 4 Roller drier were in operation									
33	Sample 1	12/11/2011	14:55		Lab	x	x	x	x
34	Sample 2	15:55			Lab	x	x	x	x
35	Sample 3	16:00			Lab	x	x	x	x
Base Powder with 200ppm Enzyme dosing and 3 Roller drier were in operation									
37	Sample 4	13/11/2011	13:00		Lab	x	x	x	x
38	Sample 5	13:30			Lab	x	x	x	x
39	Sample 6	14:00			Lab	x	x	x	x
Base Powder with 400ppm Enzyme dosing and 3 Roller drier were in operation									
41	Sample 7	14/11/2011	9:00		Lab	x	x	x	x
42	Sample 8	12:00			Lab	x	x	x	x
43	Sample 9	14:00			Lab	x	x	x	x
Base Powder with 400ppm Enzyme dosing and 4 Roller drier were in operation									
45	Sample 10	15/11/2011	9:00		Lab	x	x	x	x
46	Sample 11	11:45			Lab	x	x	x	x
47	Sample 12	16:00			Lab	x	x	x	x
49						33.586	5.0817	31.15	12.855

Details of Holding Time:

Details of Resting Time of Batch			
1	Date	12/11/2011 to 15/11/2011	Prepared By Prabhdeep / Trisha
2	Product	CMG5F	Avg Batch Size 275.54 Kg
3	Batch with 200ppm enzyme dosing and 4 roller drier were in operation		
4	Location	Activity	Total Time (min)
5	Papenmeir mixer	Intake	2.20
6		Mixing	0.66
7		Holding	1.91
8	Discharge Pipe	Discharge	0.80
9	Soup Tank	Holding at minimum level 25% (1;2 batch)	6.288
10		Holding at maximum level 35% (2;2 batch)	12.34
11	Duplex Filter and Pipeline till DSI 1		
12	me available for preventase enzyme to act at minimum level 10.09		
13	me available for preventase enzyme to act maximum level 16.15		
14	Batch with 200ppm enzyme dosing and 3 roller drier were in operation		
15	Location	Activity	Total Time (min)
16	Papenmeir mixer	Intake	2.28
17		Mixing	0.51
18		Holding	5.39
19	Discharge Pipe	Discharge	0.54
20	Soup Tank	Holding at minimum level 25% (1;2 batch)	8.58
21		Holding at maximum level 35% (2;2 batch)	17.3
22	Duplex Filter and Pipeline till DSI 1		
23	me available for preventase enzyme to act at minimum level 15.52		
24	me available for preventase enzyme to act maximum level 24.24		
25	Batch with 400ppm enzyme dosing and 3 roller drier were in operation		
26	Location	Activity	Total Time (min)
27	Papenmeir mixer	Intake	2.23
28		Mixing	0.55
29		Holding	5.09
30	Discharge Pipe	Discharge	0.66
31	Soup Tank	Holding at minimum level 25% (1;2 batch)	8.89
32		Holding at maximum level 35% (2;2 batch)	17.06
33	Duplex Filter and Pipeline till DSI 1		
34	me available for preventase enzyme to act at minimum level 15.65		
35	me available for preventase enzyme to act maximum level 23.82		
36	Batch with 400ppm enzyme dosing and 4 roller drier were in operation		
37	Location	Activity	Total Time (min)
38	Papenmeir mixer	Intake	2.15
39		Mixing	0.59
40		Holding	2
41	Discharge Pipe	Discharge	0.83
42	Soup Tank	Holding at minimum level 25% (1;2 batch)	6.228
43		Holding at maximum level 35% (2;2 batch)	12.3
44	Duplex Filter and Pipeline till DSI 1		
45	me available for preventase enzyme to act at minimum level 10.16		
46	me available for preventase enzyme to act maximum level 16.23		
47			
48	Working Recipe		
49	Ingredients	Dosing /Batch (Kg) Enzyme 200 ppm	Dosing /Batch (Kg) Enzyme 400 ppm
50	Water	10	10
51	Wheat flour	30	30
52	Sugar	31.04	31.04
53	Corn Oil	10.18	10.18
54	MSK	12.48	12.48
55	Orange Concentrate	17.37	17.37
56	Preventase Enzyme	2.99	5.96
57	Total	274.06	277.03
58			
59			

Details of Total concentration and Temperature:

TC Calculation		
	Quantity	% TS
1		
2		
3	Water	109.1 0
4	Maida	92.8 80.736
5	Sugar	30.7 30.7
6	Enzyme	0.5 0
7	MSK	12.2 11.834
8	Rework	0 0
9	Corn oil	10.2 10.2
10	Carrot powder	0 0
11	Moong dal	0 0
12	Apple conc	0 0
13	Orange Conc	17.5 11.375
14	Honey	0 0
15	T.paste	0 0
16	Total	273 144.845
17		
18	% TC of the Soup	53.06
19		
20		



Soup Temp. & Theoretical TC				
Date	Time	Temperature of Soup	Theoretical TC of soup	
12/11/2011	15:00	31	53.38	
	18:00	30.8	52.94	
	21:00	30.8	52.94	
	24:00:00	30.8	52.96	
13/11/2011	3:00	31	53.17	
	6:00	30.8	52.93	
	9:00	30.8	52.42	
	12:00	30.9	52.42	
14/11/2011	15:00	30.6	52.2	
	18:00	31	52.42	
	21:00	31.1	52.42	
	24:00:00	30.3	52.3	
15/11/2011	3:00	31	52.2	
	6:00	30.9	52.42	
	9:00	31	52.3	
	12:00	30.8	53.4	
Average	17:30	31	53.06	
		30.93	52.64	

Summary of Data Collection of CMG5F				
Enzyme Dosing	Measure			
	TSS (°Brix)	pH	Temperature °C	Avg Holding Time (Min)
200 ppm with 4 Roller Date-12/11/2011	32.74 - 34.36	5.04 - 5.11	30.8 - 31.1	10.09
200 ppm with 3 Rollers Date-13/11/2011	33.44 - 34.63	5.02 - 5.03	31.4 - 31.5	15.52
400 ppm with 3 Rollers Date-14/11/2011	32.87 - 35.85	5.04 - 5.13	30.5 - 31.3	15.65
400 ppm with 4 Rollers Date-15/11/2011	31.98 - 32.42	5.07 - 5.15	31.1 - 31.5	10.16
Average	33.57	5.08	31.15	

Summary of Data Collection

Sr No	Product	Date Of Maf	Material code	Vendor name	Batch code	Parameters	Norms	Results (ppb)
1	Apple Dices	12.11.2011	43088683	Capuzzo	B25178R	Acrylamide	No norm	<30
2	Barley Corn Rice Flakes	12.11.2011	43087970	KCI Food	BRC-1125	Acrylamide	No norm	463
3	Appricot Crunchies	12.11.2011	43089679	Diana Naturals	71059011	Acrylamide	No norm	<30
4	Barley Corn Rice Flakes	12.11.2011	43087970	Kayem Food	NSBC027511	Acrylamide	No norm	723
5	Cherry Crunchies	12.11.2011	41083500	Diana Naturals	51122006	Acrylamide	No norm	<30
6	Strawberry Crunchies	12.11.2011	41082709	Diana Naturals	71066011	Acrylamide	No norm	<30
7	CMG5F Base Powder (200 ppm Preventase)	12.11.2011	50020453	Moga	Batch-1	Acrylamide	Max. 100 ppb	<30
8	CMG5F Base Powder (200 ppm Preventase)	13.11.2011	50020453	Moga	Batch-2	Acrylamide	Max. 100 ppb	<30
9	CMG5F Base Powder (400 ppm Preventase)	14.11.2011	50020453	Moga	Batch-3	Acrylamide	Max. 100 ppb	<30
10	CMG5F Base Powder (400 ppm Preventase)	15.11.2011	50020453	Moga	Batch-4	Acrylamide	Max. 100 ppb	<30

Conclusion

The BCRF batches shown higher results from both the suppliers (Kayem Foods & KCL Foods). In Cerelac Base powder sample the results are within norm for Preventase usage even at @ 200 ppm. Results of finished products are awaited till then CMG5F will run with 200 ppm of preventase dosing and appropriate action for BCRF will be taken by Head office.

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