

# SEGMENT INSIGHTS

## PRODUCT INCUBATION ACCELERATION

PRODUCT INCUBATION ACCELERATION - ABOVE AMBIENT TEMPERATURES

### OVERVIEW

Running above ambient reactions on Conjure™ and Propel™ has shown acceleration of segments exiting the reactor at a rate faster than that targeted. To better understand the acceleration, experiments were conducted at various incubation rates and temperatures and the data summarized in this Segment Insight.

Actual above ambient actual incubation rates were compared too the actual rate at 22 °C.

- Incubation Rates: 5, 15 and 30 minutes
- Temperatures: 22, 100 and 200 °C
- Transport Solvent: Denatured Alcohol
- Reagent: Food Coloring in Denatured Alcohol.
- Reactor Volume: 1,910 µL
- Segment Spacing: 1,200 µL
- UV Set Point: 0.90 V
- UV Reset: 1.10 V

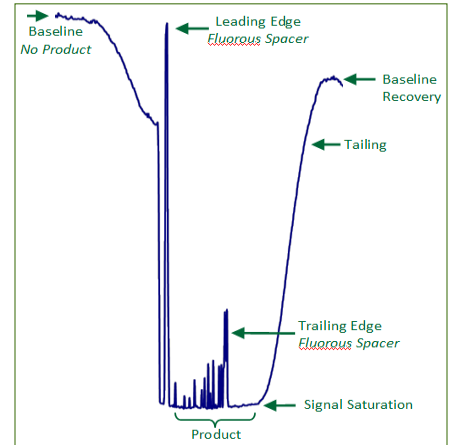
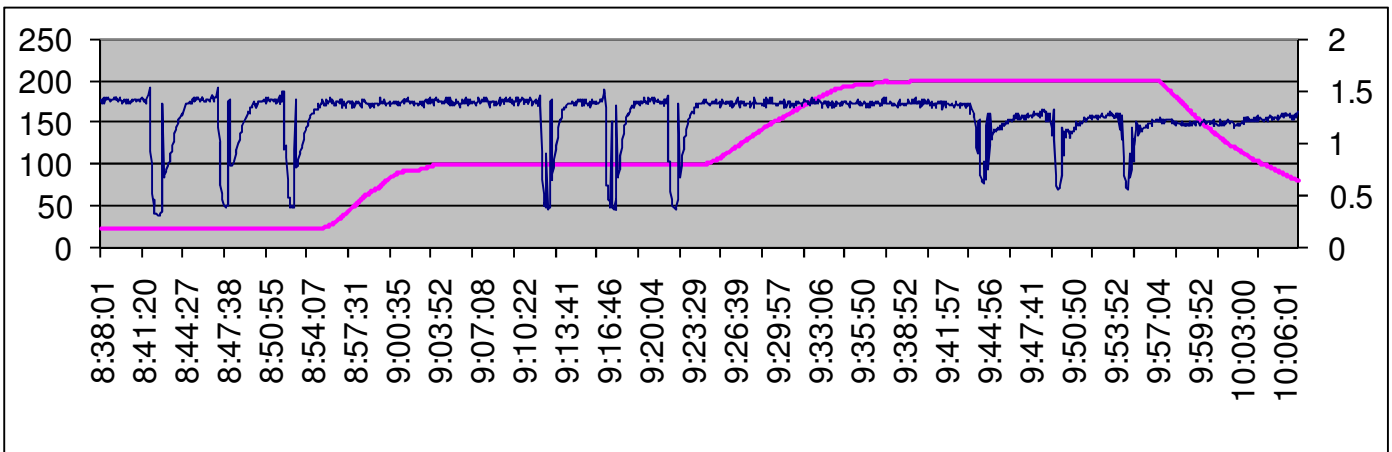


Figure 1 - UV Segment Trace

### RESULTS: 5 MINUTE INCUBATION AT 22, 100 AND 200 °C



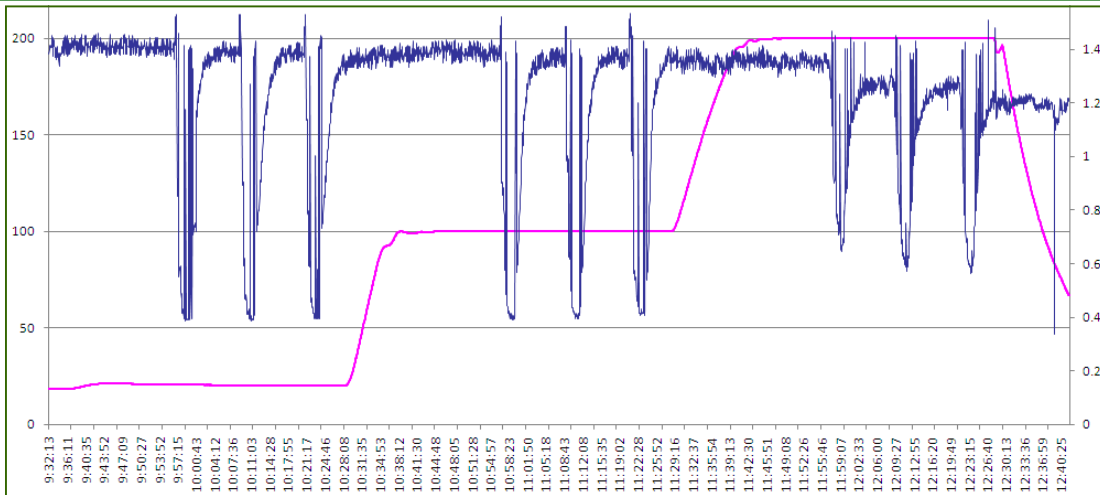
#### Observations

- 100 °C incubation accelerated by 8.6 %
- 200 °C incubation accelerated by 24.1 %
- Baseline voltage at 200 °C reduced from nominal 1.40 V to 1.20 V along with decrease in overall segment signal to 0.60 volts. May have been due to degradation of denatured alcohol and food coloring at elevated temperature.
- Baseline returned to 1.40 V once system cooled to ambient temperature.

Exp #	Temperature (°C)	Target (Minutes)	Actual (Minutes)	Acceleration as Compared to Ambient		
				(Minutes)	(%)	(%)
1	22	5.0	5.2			
2			5.2			
3			5.3			
4	100	5.0	4.9	-0.31	-6.0%	-8.6%
5			4.8	-0.47	-9.0%	
6			4.7	-0.57	-10.9%	
7	200	5.0	4.0	-1.26	-24.2%	-24.1%
8			4.0	-1.27	-24.4%	
9			4.0	-1.25	-23.9%	

Figures 2 - Experiment #1: 5 Minute Incubation

**RESULTS: 15 MINUTE INCUBATION AT 22, 100 AND 200 °C**

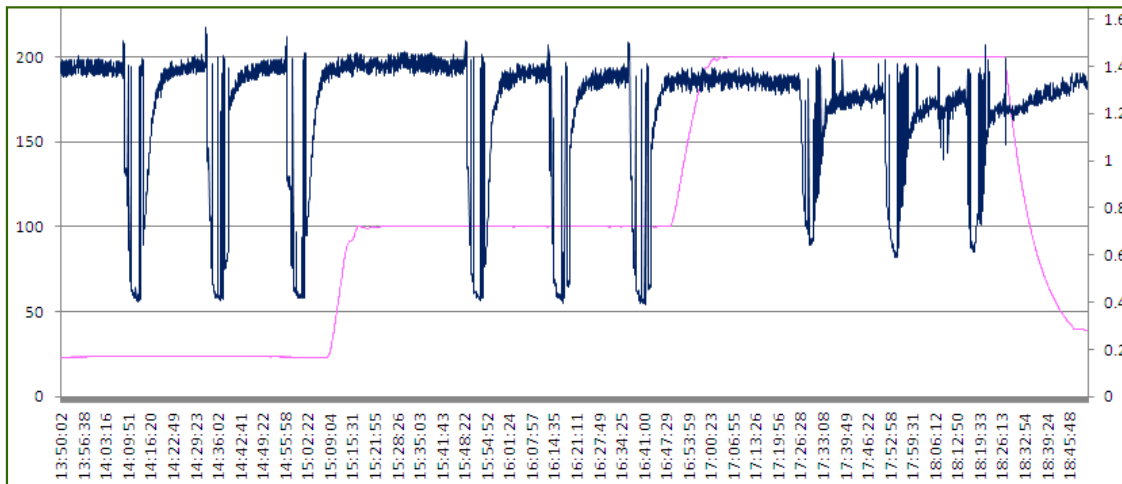


Observations

- 100 °C incubation accelerated by 8.6 %
- 200 °C incubation accelerated by 25.2 %

Exp #	Temperature (°C)	Target	Actual	Acceleration as Compared to Ambient		
		(Minutes)	(Minutes)	(Minutes)	(%)	(%)
1	20	15.0	16.2			
2			16.5			
3			16.3			
4	100	15.0	14.9	-1.46	-9.0%	
5			15.1	-1.24	-7.6%	<b>-8.1%</b>
6			15.1	-1.28	-7.8%	
7	200	15.0	12.6	-3.77	-23.1%	
8			11.8	-4.53	-27.7%	<b>-25.2%</b>
9			12.3	-4.07	-24.9%	

Figures 3 - Experiment #2: 15 Minute Incubation

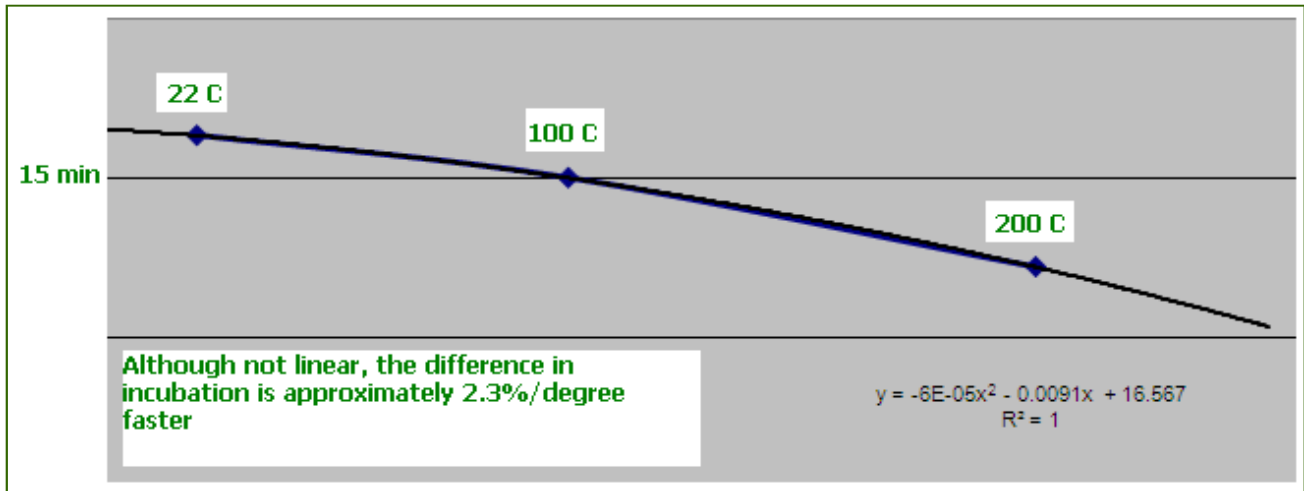


Observations

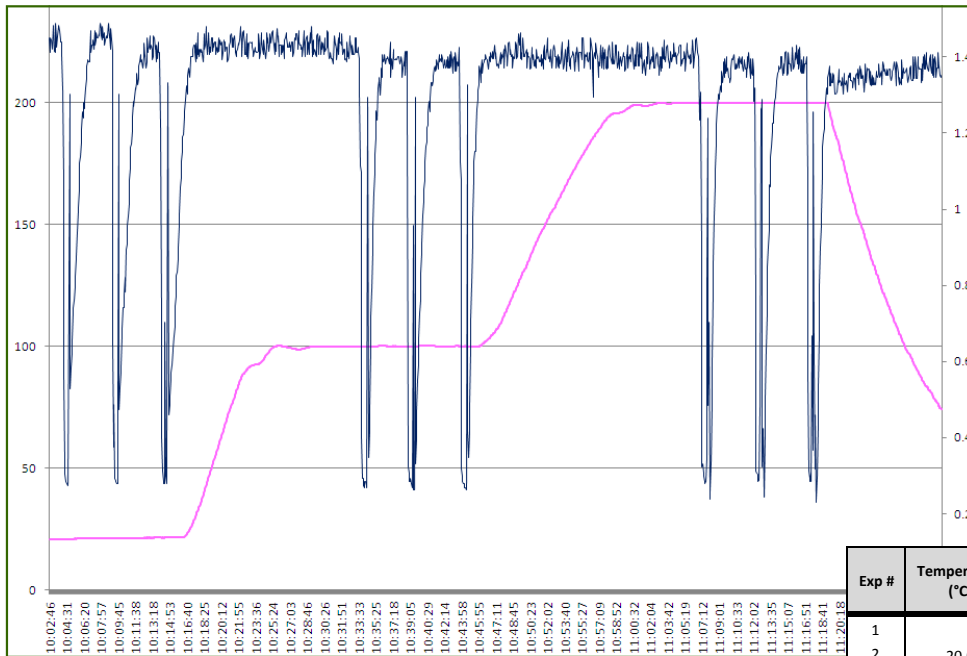
- 100 °C incubation accelerated by 7.9 %
- 200 °C incubation accelerated by 27.8 %
- UV Signal at 200 °C fully recovered to baseline reading at 22 °C.

Exp #	Temperature (°C)	Target	Actual	Acceleration as Compared to Ambient		
		(Minutes)	(Minutes)	(Minutes)	(%)	(%)
1	20	30.0	29.4			
2			29.3			
3			29.5			
4	100	30.0	26.9	-2.47	-8.4%	
5			27.1	-2.28	-7.8%	<b>-7.9%</b>
6			27.1	-2.24	-7.6%	
7	200	30.0	20.7	-8.72	-29.7%	
8			21.4	-8.01	-27.3%	<b>-27.8%</b>
9			21.6	-7.77	-26.5%	

Figure 4 - Experiment #3: 30 Minute Incubation



Figures 5 - Acceleration Curve at 15 minute incubation



Exp #	Temperature (°C)	Target	Actual	Acceleration as Compared to Ambient		
		(Minutes)	(Minutes)	(Minutes)	(%)	(%)
1	20.0		5.5			
2			5.4			
3			5.5			
4	100.0	5.0	5.3	-0.2	-3.7%	-4.1%
5			5.2	-0.3	-5.5%	
6			5.3	-0.2	-3.1%	
7			4.7	-0.8	-15.7%	
8	200.0		4.7	-0.8	-16.2%	-15.2%
9			4.8	-0.7	-13.8%	

Figures 6 - Water: Acceleration Curve at 5 minute incubation

Final Observations

- The acceleration is purely based upon the temperature and not incubation time
- The acceleration is not linear as shown in Figure 5, one could estimate acceleration at approximately 2.3% per °C. Note that this experiment was conducted using Denatured Alcohol, other solvents may have different acceleration curves based upon their vapor pressure properties. Such as water
- The water Acceleration Curve indicates that it has approximately 50% of the acceleration of Denatured Alcohol and therefore other solvents depending upon their physical properties may have differing accelerations, Figure 6.

