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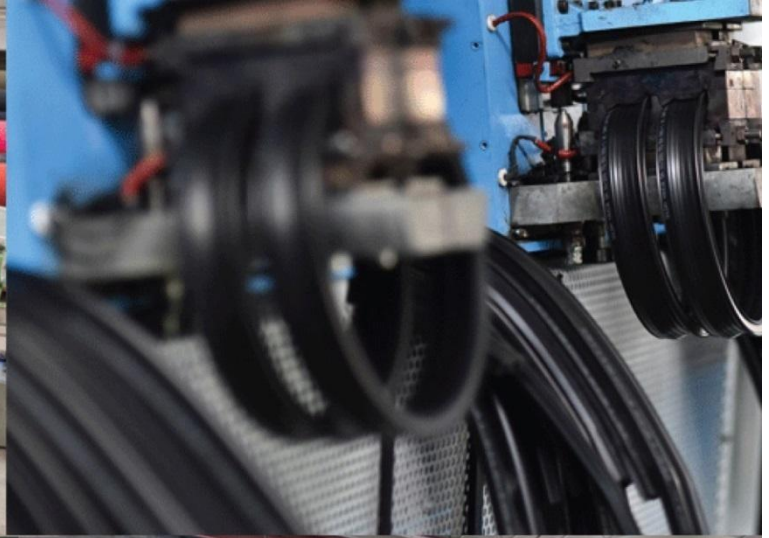
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ELECTRO MAGNETIC innovative technologies

Kerone Research & Development Centre (KRDC),  
B/47, Addl. MIDC. Anand Nagar, Ambernath (East), Thane- 421 506, India  
Tel- +91-251-2620542/43/44/45/46, Email-info@kerone.com, www.kerone.com



**Batch Convection Heat Treatment for  
Melting of Distilled Fatty Acid in Soaps**



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Customer :	M/s. HINDUSTAN UNILEVER LIMITED
Process :	Batch Convection Heat Treatment for Melting of Distilled Fatty Acid (DFA) in Soaps

**TEST REPORT No: 47/KRDC/LAB/64 Mum 13/11/2021**

Date Sample reception : 13/11/2021

ID : 47/LAB/64

**SAMPLE DESCRIPTION:**

Sampling : As Requested

Sample Condition : Acceptable

Quantity : 1 Drum (200lts)

Samples opening date : 13/11/2021

Requirement : Melting of DFA in soap {Melting point- above 60 °C}

Product : Toilet soap

Start Date test : 13/11/2021

End Date test : 15/11/2021

**LABORATORY EXPERIMENTAL SETUP:**



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### LAB BATCH CONVECTION HEATING SYSTEM SPECIFICATIONS:

Inner Heating Chamber (width*depth*height)	3000*3000*2000 mm
Outer Heating Chamber (width*depth*height)	3600*3300*2400 mm
Type of Heaters	Electric Tubular Heaters
Total Heater Power	48 KW (24KWx2)
Forced Air Circulation	3 HP (2 Nos.)
Temperature Sensor range	0°C - 250°C

### ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:




Temperature (°C)	30°C (±5°C)
Humidity (%)	≤74% RH
Pressure (kN/m <sup>2</sup> or kPa)	Not recorded

**Note for recommendation:** Environmental conditions have a direct impact on test results. Accuracy and consistency of test data are affected by the laboratory conditions



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## EQUIPMENTS USED:

Name of Equipment	Picture of Equipment	Specifications
Compact Thermal Imaging Camera		Model: FLIR E-30 Resolution: 160x 120 IR Thermal sensitivity of 0.10°C
Moisture Analyzer		Make: Axis Balance Description: Moisture range: 1%(sample 0.02/0.05g), 0.1% (Sample 0.5/5g), 0.01%(Sample>5g)
Thermo Hygrometer		Model No: HTC-2 Temperature accuracy: $\pm 1^{\circ}\text{C}$ ( $1.8^{\circ}\text{F}$ ) Temperature resolution: 0.1°C (0.2°F) Humidity range: 10%~99% RH Humidity accuracy: $\pm 5\% \text{RH}$ Humidity resolution: 1%RH
K-type Thermometer		Model: TM902C Thermometer range: -50°C to 1300°C Resolution: 0.1°C, 1°C

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### **SAMPLE PREPARATION AND METHOD/PROCEDURE:**

The experiment has been performed on drum filled with toilet Soap containing Distilled Fatty Acid (DFA) to speed up its melting rate. For this experimental run, below procedures are to be followed:

- Complete drum is placed in Chamber of Batch Convection Heater.
- It is ensured that all the outer surfaces of the drum are clean & dried properly.
- Also, there is no open flame or live wire in vicinity of the drum heating chamber.
- Damper vent is kept open.
- There is a provision for Isolation switch in case of emergency.
- Then, the product is left for heating in chamber with suitable parameters set on the control panel.
- All the observations & indications are noted at regular intervals of time.

### **ANALYTICAL RESULTS:**

**Initial Product temperature- 24.9°C**

**Setting Temperature: (80-100)°C**

**Time taken to reach 80°C- 20 min**

**Time taken to reach 90°C- 25 min**

**Time taken to reach 100°C- 30 min**

**Individual Cycle Time: 1-2 Hr**



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Cycle. No	Cycle Time (Hours)	Convection Set Temp. ( °C)		Drum Temp. ( Avg. in °C)	Product Temp. ( Avg. in °C)	Remarks, if any
		ZONE-1	ZONE-2			
C1	After 1 Hr	80°C	80°C	65.2°C	58.4°C	10% melt
C2	After 2 Hr	90°C	90°C	86.3°C	70.6°C	40% melt
C3	After 4 Hr	100°C	100°C	95.3°C	84.4°C	75% melt

#### BEFORE & AFTER PICTURES OF TREATED SPECIMEN SAMPLE:



a) INITIAL -0% MELT



b) Cycle 1-10% melt



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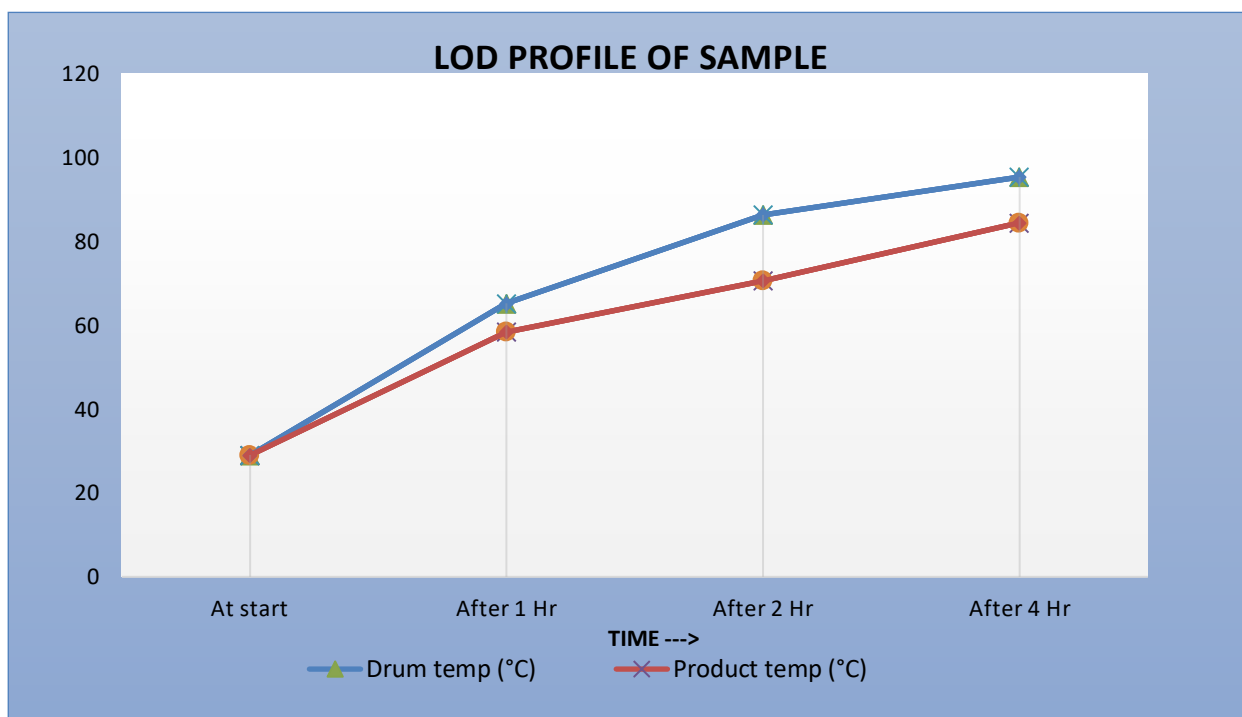


c) Cycle 2 - 40% MELT



d) Cycle 3 - 75% MELT

#### GRAPHICAL REPRESENTATION OF DRYING PARAMETERS:



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## THERMAL ANALYSIS REPORTS :

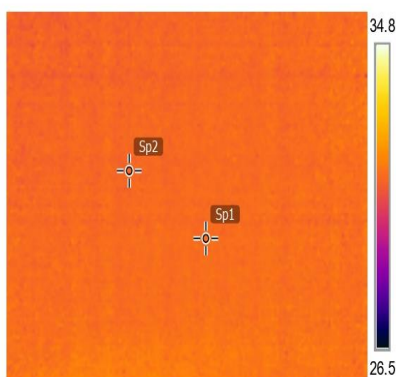
### BEFORE TREATMENT:

#### Measurements

Sp1	31.3 °C
Sp2	31.1 °C

#### Parameters

Emissivity	0.95
Refl. temp.	20 °C



**DRUM TEMPERATURE**



**PRODUCT TEMPERATURE**

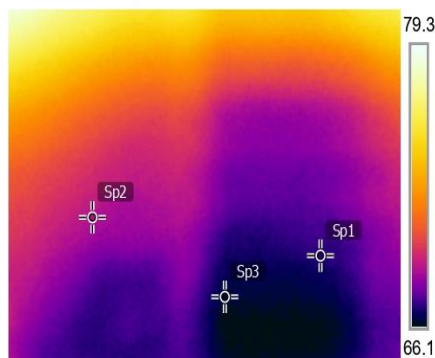
### AFTER 1 HOUR:

#### Measurements

Sp1	67.1 °C
Sp2	68.9 °C
Sp3	66.4 °C

#### Parameters

Emissivity	0.95
Refl. temp.	20 °C



**DRUM TEMPERATURE**



**PRODUCT TEMPERATURE**

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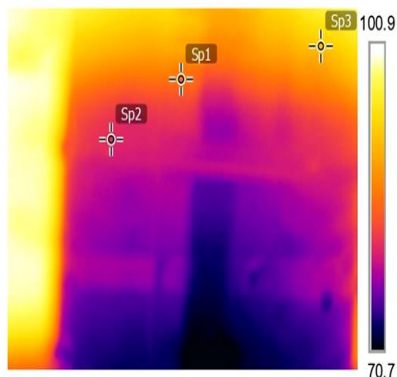
### AFTER 2 HOUR:

#### Measurements

Sp1	86.3 °C
Sp2	81.5 °C
Sp3	92.2 °C

#### Parameters

Emissivity	0.95
Refl. temp.	20 °C



**DRUM TEMPERATURE**



**PRODUCT TEMPERATURE**

### AFTER 4 HOUR:

#### Measurements

Sp1	89.7 °C
Sp2	99.2 °C
Sp3	101.0 °C

#### Parameters

Emissivity	0.95
Refl. temp.	20 °C



**DRUM TEMPERATURE**



**PRODUCT TEMPERATURE**

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## OBSERVATIONS:

The heating behavior of Distilled Fatty Acid (DFA) in soap has been investigated under the convection heating system. The gradual heating of drum and thus increase in melting rate of DFA with respect to increase in heating time & Convection temperature can be seen. As per physical investigation, it has been observed, that the DFA melts as desired. A continuous cycle of 4 hours at 100°C can also ensure complete melting of DFA.

A handwritten signature in blue ink that reads "Komal".

**Ms. Komal Ingle**  
**Tested By**