KERONE

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ISO 9001-2008 | ISO 9001-2015 | EMS 14001 | OHSAS 18001
In Association with SVCH-Technologii, Moscow (Russia)

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| | |
|---|---|
| **Customer :** | **M/s. Marico Limited** |
| **Process :** | **Batch Microwave + Convection Heat Treatment for De-Crystallization of Honey** |

## TEST REPORT No: 47/KRDC/LAB/17 Mum 31/08/2021

Date Sample reception : 30/08/2021
ID : 47/LAB/27

## SAMPLE DESCRIPTION:

Sampling : As Requested
Sample Condition : Acceptable
Quantity : 1 Kg.
Samples opening date : 30/08/2021
Product : Honey
Start Date test : 30/08/2021
End Date test : 07/09/2021

## LABORATORY EXPERIMENTAL SET UP:




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## LAB BATCH MICROWAVE+CONVECTION HEATING SYSTEM SPECIFICATIONS:

| | |
|---|---|
| **Microwave Power** | 2 KW (CW) |
| **Frequency** | 2450 MHz ± 50 |
| **Convective Power** | 3.5 KW ( airflow 350 l/min at 20°C ) |
| **Microwave Exposure Zone (Cavity)** | 1 Cubic meter |
| **Mode Stirrer** | One |
| **Thermal Monitoring System** | Single Channel Fiber Optic: Range -40 to 250°C |
| **Exhaust Power** | 1 HP |
| **Tray size (width*height*depth)** | 450*950*50 mm |

## ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:

| | |
|---|---|
| **Temperature ($^oC$)** | 26$^oC$ (±5$^oC$) |
| **Humidity (%)** | ≤70% RH |
| **Pressure (kN/m2 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 |
|---|---|---|
| CompactThermalImaging Camera |  | Model:FLIR E-30<br>Resolution: 160x 120IR<br>Thermalsensitivityof 0.10°C |
| Moisture Analyzer |  | Make: Axis Balance<br>Description:<br>Moisture range: 1%(sample 0.02/0.05g), 0.1% (Sample 0.5/5g), 0.01%(Sample>5g) |
| Thermo Hygrometer |  | Model No: HTC-2<br><br>Temperature accuracy: ±°C (1.8°F)<br>Temperature resolution: 0.1°C (0.2°F)<br>Humidity range: 10%~99% RH<br>Humidity accuracy: ±5% RH<br>Humidity resolution: 1% RH |

## SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on mixture of smooth treated honey & crystallized honey to speed up the de-crystallization rate of the mixture. For this experimental run,10% of crystallized/ coagulated honey has been added to the smooth honey sample and blend thoroughly. Later, it is spread on a microwaveable tray and placed in MW+Convection heating system with selection of suitable parameters. Observations are made after decided time period on the basis of change in Weight of the product and appearance.Set parameters like temperature and magnetron power are selected in such a way that the honey does not get caramelized.



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## ANALYTICAL RESULTS:

### TRIAL-1:

**Initial Wt. of smooth liquid honey: 300g**
**Initial Wt. of crystallized honey: 30g**
**Initial Wt. of mixture: 330g**
**Magnetron Power: 0.4 KW;**
**Temperature Limit: 45°C;**
**Fan speed: 100; Heater- 80%**

| Cycles | Cycle Time | Product Temperature | Remark |
|---|---|---|---|
| C1 | 15 sec | (30-35) °C | No visible change |
| C2 | 30 sec | (30-35) °C | Starts to de-crystallize |
| C3 | 45 sec | (41-46) °C | Continues to de-crystallize |
| C4 | 45 sec | (41-46) °C | Continues to de-crystallize |
| C5 | 1 min 30 sec | (45-51) °C | Continues to de-crystallize |
| C6 | 1 min 30 sec | (45-55) °C | Continues to de-crystallize |
| C7 | 2 min | (50-55) °C | Almost de-crystallize |
| C8 | 1 min | (53-60) °C | De-crystallized as desired |

**Total cycle time: 8 min. 25 sec**
**Final Wt. of Mixture: 302 g**

### TRIAL-2:

**Initial Wt. of smooth liquid honey: 150g**
**Initial Wt. of crystallized honey: 15g**
**Initial Wt. of mixture: 165g**
**Magnetron Power: 0.8 KW;**
**Temperature Limit: 40°C;**
**Fan speed: 100; Heater- 80%**

| Cycles | Cycle Time | Product Temperature | Remark |
|---|---|---|---|
| C1 | 2 min | (50-55) °C | Starts to de-crystallize |
| C2 | 2 min | (61-68) °C | De-crystallized as desired |



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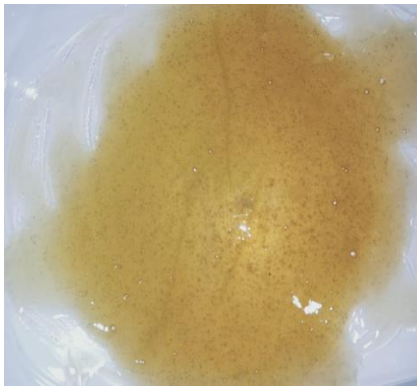
**Total cycle time: 4 mins**

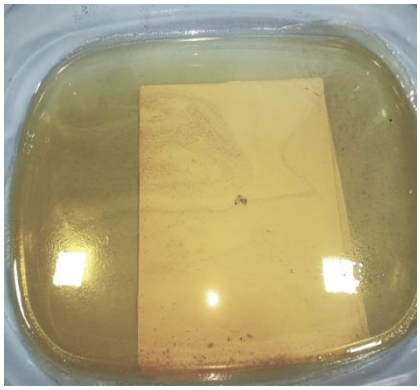
**Final Wt. of Mixture: 148 g**

## BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:

a) Liquid Honey



b) Crystallized honey



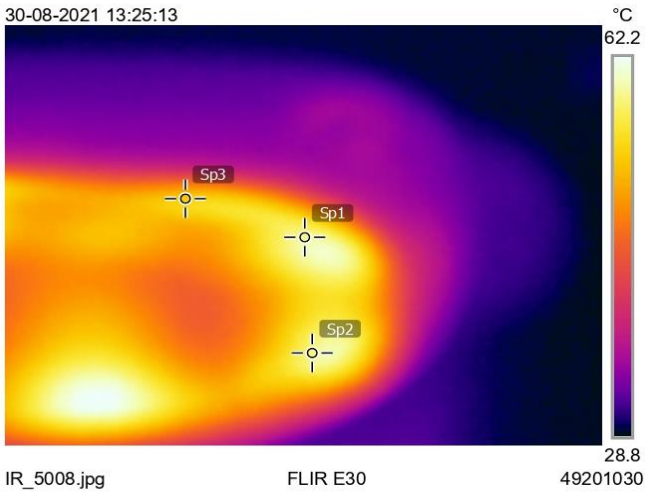
c) De-crystallized honey

## THERMAL ANALYSIS REPORTS:

### During Trial -1:

| Measurements | |
|---|---|
| Sp1 | 59.5 °C |
| Sp2 | 59.1 °C |
| Sp3 | 54.3 °C |

| Parameters | |
|---|---|
| Emissivity | 0.95 |
| Refl. temp. | 20 °C |



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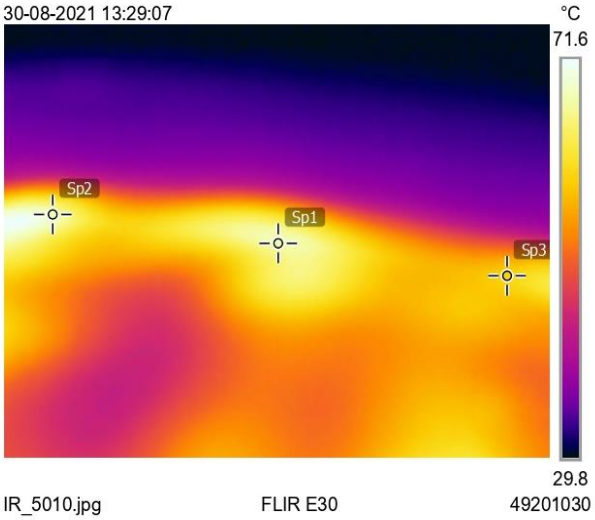
**During Trial -2:**

| Measurements | |
|---|---|
| Sp1 | 67.9 °C |
| Sp2 | 68.7 °C |
| Sp3 | 60.4 °C |

| Parameters | |
|---|---|
| Emissivity | 0.95 |
| Refl. temp. | 20 °C |




## TRIAL-3:

**Initial Wt. of mixture: 60g (Sample-A)**
**Magnetron Power: 0.5 KW;**
**Temperature Limit: 45°C;**
**Fan speed: 100**

| Cycles | Cycle Time | Convection Heater | Product Temperature | Remark |
|---|---|---|---|---|
| C1 | 2 min | 100% | (65-75) °C | Starts to de-crystallize (B3) |
| C2 | 2 min | 70% | (80-90) °C | De-crystallized as desired (C3) |

**Total cycle time: 4 mins**
**Final Wt. of Mixture: 59 g**

## THERMAL ANALYSIS REPORTS:



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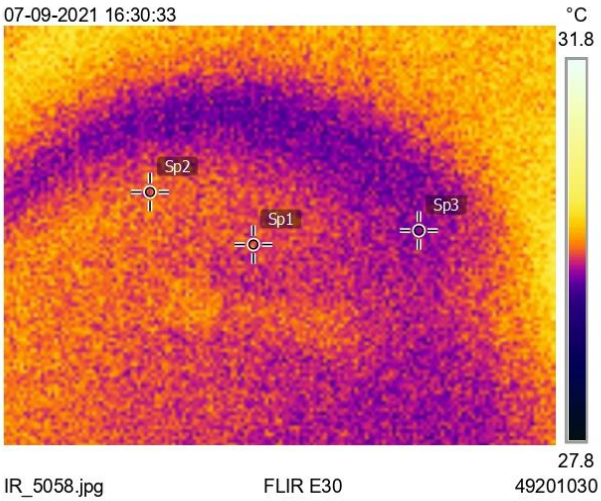
**Before treatment:**

| Measurements | |
|---|---|
| Sp1 | 30.0 °C |
| Sp2 | 29.7 °C |
| Sp3 | 29.6 °C |

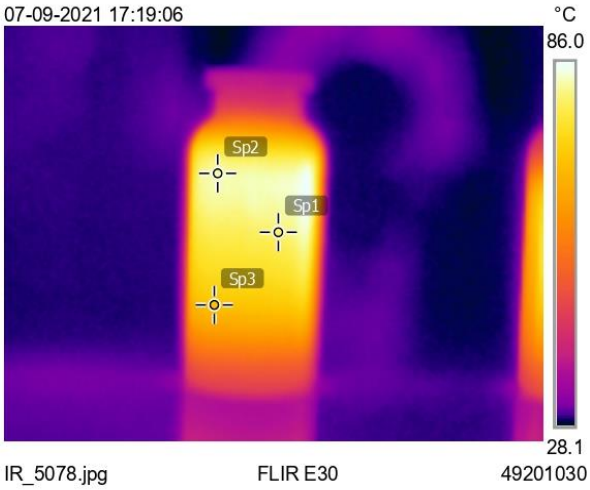
| Parameters | |
|---|---|
| Emissivity | 0.95 |
| Refl. temp. | 20 °C |




**During cycle -2:**

| Measurements | |
|---|---|
| Sp1 | 81.1 °C |
| Sp2 | 83.4 °C |
| Sp3 | 72.3 °C |

| Parameters | |
|---|---|
| Emissivity | 0.95 |
| Refl. temp. | 20 °C |



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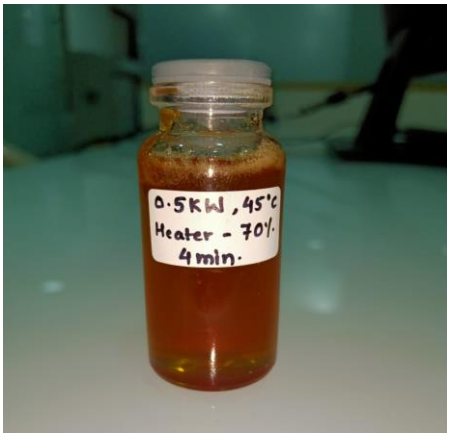
**BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:**

a) **Crystallized honey**




b) **De-crystallized honey**

## TRIAL-4:

**Initial Wt. of mixture: 60g (Sample-A)**
**Magnetron Power: 0.3 KW;**
**Temperature Limit :30°C;**
**Fan speed: 100**

| Cycles | Cycle Time | Convection Heater | Product Temperature | Remark |
|---|---|---|---|---|
| C1 | 2 min | 100% | (45-55) °C | Starts to de-crystallize (B4) |
| C2 | 2 min | 70% | (75-80) °C | De-crystallized as desired(C4) |

**Total cycle time: 4 mins**
**Final Wt. of Mixture: 59 g**



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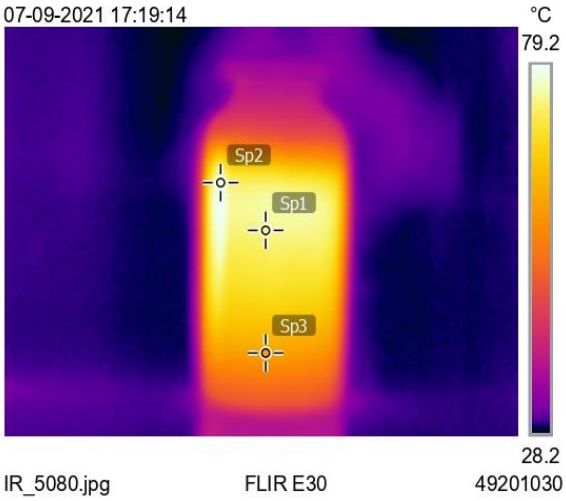
## THERMAL ANALYSIS REPORTS :

### During cycle -2:

| Measurements | |
|---|---|
| Sp1 | 74.9 °C |
| Sp2 | 78.5 °C |
| Sp3 | 62.0 °C |

| Parameters | |
|---|---|
| Emissivity | 0.95 |
| Refl. temp. | 20 °C |




## BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:

a) Crystallized honey


b) De-crystallized honey



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## TRIAL-5:

**Initial Wt. of mixture: 60g (Sample-A)**

**Magnetron Power: 0.3 KW;**

**Temperature Limit: 30$^{o}$C;**

**Fan speed: 100**

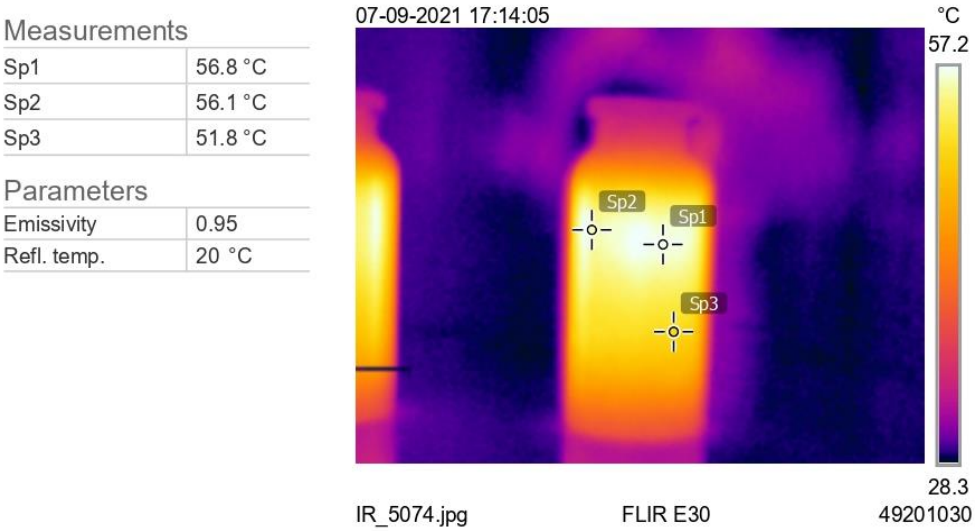
| Cycles | Cycle Time | Convection Heater | Product Temperature | Remark |
|---|---|---|---|---|
| C1 | 1 min | 50% | (40-50) °C | Starts to de-crystallize (B4) |
| C2 | 1 min | 50% | (55-60) °C | De-crystallized as desired(C4) |

**Total cycle time: 2 mins**

**Final Wt. of Mixture: 59 g**

## THERMAL ANALYSIS REPORTS:

### During cycle -2:



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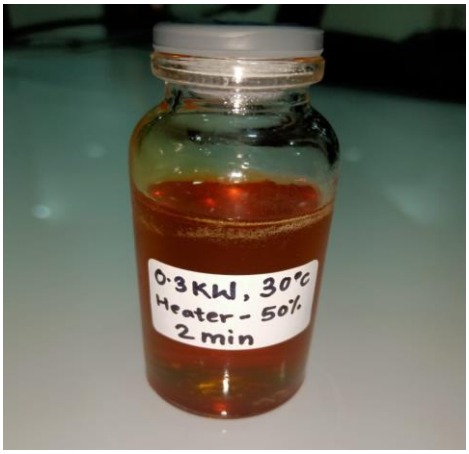
**BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:**

**a) Crystallized honey**




**b) De-crystallized honey**

**OBSERVATION:**

**The de-crystallization of coagulated honey has been investigated under the Microwave+Convection heating system. The de-crystallization rate is found to be increasing with respect to increase in time & temperature. It has been found that the product's weight decreases to some extent as the moisture content in it tries to escape in the form of bubble. As per physical investigation, it has been observed that product is completely liquefied/de-crystallized. Also, texture and colour of honey is retained.**

**Ms. Komal Ingle**
**(Tested By )**



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