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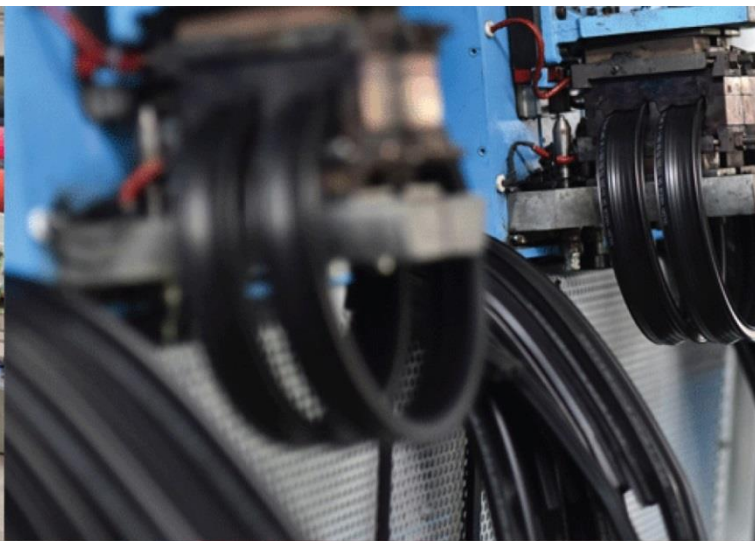
A.M.P.E.R.E (EUROPE)

In Association With



ELECTRO MAGNETIC innovative technologies

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



**Batch Microwave+Convection Heat Treatment  
for Drying & Sterilization/Disinfection of Fecal  
Sludge**

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



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|            |   |
|------------|---|
| Customer : | Laboratory Experimental Analysis  |
| Process :  | Batch Microwave+Convection Heat Treatment for Drying & Sterilization/Disinfection of Fecal Sludge |

**TEST REPORT No: 47/KRDC/LAB/17 Mum 29/12/2018**

Date Sample reception : 29/12/2018  
ID : 47/LAB/76

**SAMPLE DESCRIPTION:**

Sampling : As Requested  
Sample Condition : Acceptable  
Quantity : 1 kg  
Sampling date : 09/01/2019  
Product : Fecal Sludge  
Requirement : Final product must have moisture content between 15 to 20%  
Start Date test : 09/01/2019  
End Date test : 09/01/2019

**LABORATORY EXPERIMENTAL SET UP:**



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#### LAB BATCH MICROWAVE+CONVECTION HEATING SYSTEM SPECIFICATIONS:

|                                  |   |
|----------------------------------|---|
| Microwave Power                  | 2 kW(CW)  |
| Frequency                        | 2450 MHz $\pm$ 50                                 |
| Convective Power                 | 3.5 kW (air flow 350 l/min at 20°C)               |
| Microwave Exposure Zone (cavity) | 1 cubic meter                                     |
| Mode Stirrer                     | One   |
| Thermal Monitoring System        | Single Channel Fiber Optic:<br>Range -40 to 250°C |
| Exhaust Power                    | 1HP   |
| Tray Size                        | 450x950x50 mm                                     |




#### ENVIRONMENT-LABORATORY AMBIENT CONDITIONS:

|                                     |                     |
|-------------------------------------|---------------------|
| Temperature (degree C)              | 28.1°C ( $\pm$ 5°C) |
| Humidity (%)                        | $\leq$ 63% 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



## EQUIPMENTS USED:

| Name of Equipment              | Picture of Equipment  | Specifications   |
|--------------------------------|---|--|
| Compact Thermal Imaging Camera |    | Model: FLIR E-30<br>Resolution: 160x 120<br>IR Thermal sensitivity of 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>Temperature accuracy: $\pm^{\circ}\text{C}$ (1.8°F)<br>Temperature resolution: 0.1°C (0.2°F)<br><br>Humidity range: 10%~99% RH<br>Humidity accuracy: $\pm 5\%$ RH<br>Humidity resolution: 1% RH |

## SAMPLE PREPARATION AND METHOD/PROCEDURE:

The experiment has been performed on fecal sludge without adding any additive to speed up the drying rate and sterilization treatment. For this experimental run, particular quantity of sample has been taken in microwave transparent tray with uniform thickness of 5 mm and this material loaded tray has been placed in heating system with different setting parameters. The observations are made on the basis of LOD and moisture content.



## ANALYTICAL RESULTS:

Microwave Power: a) Initially 1.5 kW for 1 hour

b) After 1 hour 2 kW

Setting Temperature: a) Initially 120°C for 1 hour

b) After 1 hour 150°C

Initial Moisture Content: 76%

Initial Weight: 442 grams

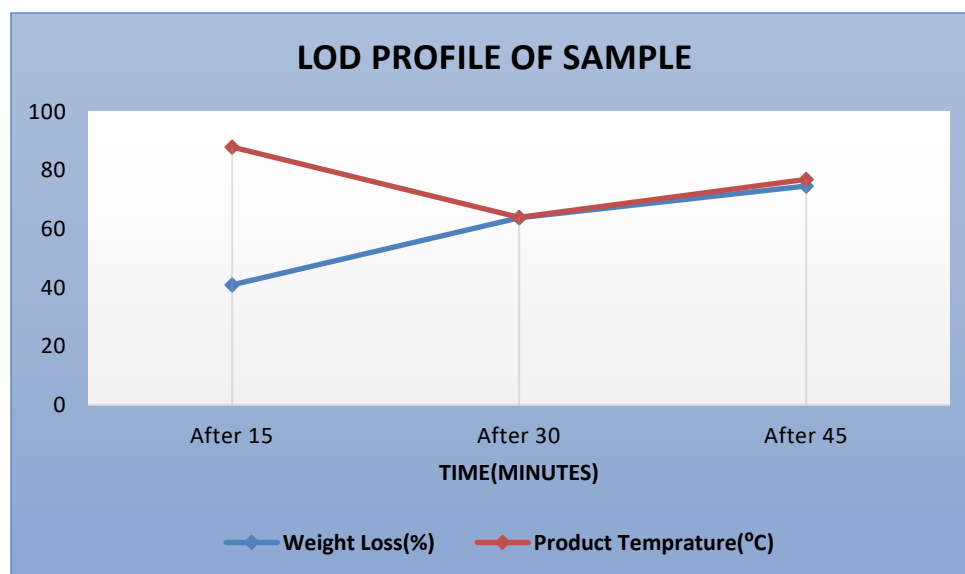
| Sr. No. | Time (minutes) | Weight noted (grams) | Total weight loss (%) | Moisture Content (%) | Temperature on sample(°C) | Remarks, if any                |
|---------|----------------|----------------------|-----------------------|----------------------|---------------------------|--------------------------------|
| 1.      | After 15       | 261                  | 40.95                 | 69                   | 88                        | Drying rate started            |
| 2.      | After 30       | 160                  | 63.8                  | 56                   | 64                        | Drying phase continue          |
| 3.      | After 45       | 112                  | 74.7                  | 25                   | 77                        | Variant of Drying rate         |
| 4.      | After 47       | 107                  | 75.8                  | 6.3                  | 64                        | Less than Required Drying rate |

Sample weight after drying: 107 grams

Total weight loss on drying: 75.8%

Final Moisture Content: 6.3%

## GRAPHICAL REPRESENTATION OF DRYING PARAMETERS:



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## THERMAL IMAGE BEFORE AND AFTER HEAT TREATMENT:

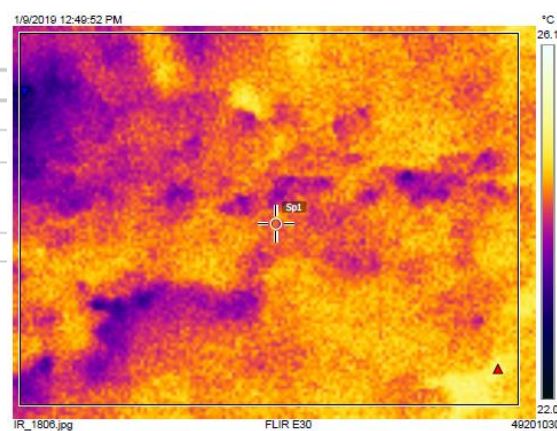
### 1. Before Heat Treatment:

#### Measurements

|     |         |         |
|-----|---------|---------|
| Bx1 | Max     | 25.3 °C |
|     | Min     | 22.8 °C |
|     | Average | 24.3 °C |
| Sp1 |         | 24.3 °C |

#### Parameters

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



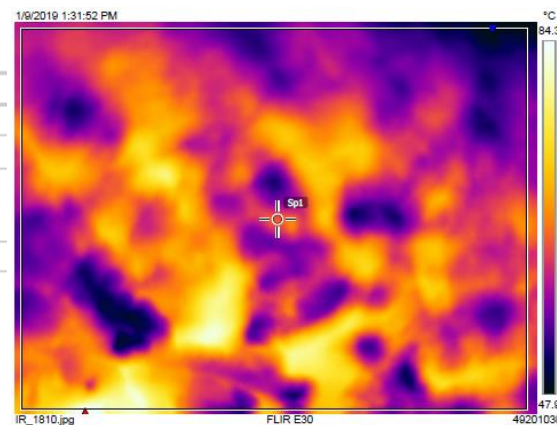
### 2. After Heat Treatment:

#### Measurements

|     |         |         |
|-----|---------|---------|
| Bx1 | Max     | 84.1 °C |
|     | Min     | 48.0 °C |
|     | Average | 63.4 °C |
| Sp1 |         | 64.4 °C |

#### Parameters

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



## BEFORE AND AFTER PICTURES OF TREATED SPECIMEN SAMPLE:



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**MOISTURE ANALYSIS REPORTS:**

| Drying started  | Drying started  | Drying started  | Drying started  | Drying started  |
|---|---|---|---|---|
| Date : 9-01-2019<br>Time : 13:00:00<br>Model: A00200<br>Serial number : 138 | Date : 9-01-2019<br>Time : 13:30:45<br>Model: A00200<br>Serial number : 138 | Date : 9-01-2019<br>Time : 14:00:00<br>Model: A00200<br>Serial number : 138 | Date : 9-01-2019<br>Time : 14:30:44<br>Model: A00200<br>Serial number : 138 | Date : 9-01-2019<br>Time : 14:46:13<br>Model: A00200<br>Serial number : 138 |
| Drying parameters   | Drying parameters   | Drying parameters   | Drying parameters   | Drying parameters   |
| Product : Test  | Product : Test  | Product : Test  | Product : Test  | Product : Test  |
| Drying temperature : 105.0 °C   | Drying temperature : 105.0 °C   | Drying temperature : 105.0 °C   | Drying temperature : 105.0 °C   | Drying temperature : 105.0 °C   |
| Drying profile : standard   | Drying profile : standard   | Drying profile : standard   | Drying profile : standard   | Drying profile : standard   |
| Mode : Short mode   | Mode : Short mode   | Mode : Short mode   | Mode : Short mode   | Mode : Short mode   |
| Calculation : ((a0-a)/a0)*100%  | Calculation : ((a0-a)/a0)*100%  | Calculation : ((a0-a)/a0)*100%  | Calculation : ((a0-a)/a0)*100%  | Calculation : ((a0-a)/a0)*100%  |
| Finished : 3 samples  | Finished : 3 samples  | Finished : 3 samples  | Finished : 3 samples  | Finished : 3 samples  |
| Initial weight : 0.478 g  | Initial weight : 0.349 g  | Initial weight : 0.478 g  | Initial weight : 0.431 g  | Initial weight : 0.483 g  |
| Final weight : 0.363 g  | Final weight : 0.109 g  | Final weight : 0.219 g  | Final weight : 0.333 g  | Final weight : 0.640 g  |
| Drying time : 00:15:40s   | Drying time : 00:08:40s   | Drying time : 00:09:00s   | Drying time : 00:04:00s   | Drying time : 00:02:40s   |
| Sampling interval : 30 sec  | Sampling interval : 30 sec  | Sampling interval : 30 sec  | Sampling interval : 30 sec  | Sampling interval : 30 sec  |
| Moisture : 74.0 %   | Moisture : 69 %   | Moisture : 56 %   | Moisture : 25 %   | Moisture : 4.3 %  |
| NOTE Initial  | NOTE After 15 minutes   | NOTE After 30 minutes   | NOTE After 45 minutes   | NOTE Final (After 47 minutes)   |
| The analysis performed by: KKomal   | The analysis performed by: KKomal   | The analysis performed by: KKomal   | The analysis performed by: KKomal   | The analysis performed by: KKomal   |

**OBSRVATIONS:**

The Drying behavior of fecal sludge has been investigated under the microwave+convection heating system. The drying rate is found to be increasing with respect to increasing drying time. It has been found that the moisture content on the dry basis (%) decreases with respect to increase drying time. As per physical investigation, it has been observed that there is complete drying with less than required moisture content without burning effect.

*KKomal*

Miss. Komal Bhoite  
Tested By

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