UNIVERSITI MALAYSIA PERLIS

School of Material Engineering
Presented by: Nur Firdaus Bt Mohamed Yusof
Thermogravimetric Analysis of Different Calcination Temperature of Lemon Grass Ash

Nur Firdaus Mohamed Yusof\textsuperscript{1,a}, Hakimah Osman\textsuperscript{2,b} and Rozyanty Rahman\textsuperscript{3,c}

School of Material engineering, Universiti Malaysia Perlis, Kompleks Pengajian Taman Muhibbah, 02600 Jejawi, Perlis. Malaysia.
INTRODUCTION

Lemon grass or Cymbopogon Citratus is a perennial herb widely cultivated in the tropics and subtropics countries such as Malaysia, Indonesia, Thailand, India etc.

Lemon grass is consists of crude protein (15.68%), ash (23.40% to 25.00%), crude fiber (27.72%), fat (1.25%) and carbohydrate (38.44%). Besides, proximate analysis showed that this plant consist of many important mineral such as silica, phosphorous, potassium and zinc.
Thermogravimetric analysis (TGA) is one of the major thermal analysis techniques which is used to study the thermal behaviour of carbonaceous materials. In order to predict the thermal behaviour of the materials, the rate of weight loss of the sample as a function of temperature and time is measured.

There are no extensive researches done on TGA analysis from lemon grass ash. Therefore, the results achieved through this study can be used as a guideline in order to predict the thermal behaviour of lemongrass ash.
OBJECTIVES

The purpose of this research is:

To study the TGA properties of lemon grass calcinated at various temperature.
METHODOLOGY
Lemongrass leaves were obtained from Stesen Agrotek UniMAP Perlis, Malaysia.

lemon grass are washed, resized and dried in the circulated oven according to the TAPPI Test Method, Determination of Total Solids in Biomass and Total Solids in Liquid Process Samples (T412 om-02).

The sample was treated in the muffle furnace under different temperature at 400° C, 525° C, 600° C and 700° C according to the TAPPI Test Method, Ash in wood, pulp, paper and paperboard: combustion at 525° C (T 211 om-07).

TGA analysis
RESULTS AND DISCUSSION
1) It was observed that the thermal decomposition of lemon grass ash at 0 (as control elements), 400, 525 and 600°C occurred in three stage of decomposition.

2) The thermal decomposition of lemon grass calcinated at 700°C consisted of two stage of decomposition. This is due to the removal of specific components in the sample such as water, carbonates, aluminates, silica, oxides, organic carbon and other component.
3) First weight loss of various samples was recorded between 32°C to 120°C. This is due to the removal of high amount of moisture or water in the sample and other primary volatile substance present in the sample [6].

4) The second stage within 320°C to 700°C corresponds to the burning of crystalline cellulose and lignin [7].
## RESULTS AND DISCUSSION (continue...)

Table 1. Thermal degradation data for various types of lemon grass ash.

<table>
<thead>
<tr>
<th>Types of sample</th>
<th>Temperature range (° C)</th>
<th>Weight loss (%)</th>
<th>Tmax (° C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGA calcinated at 0°C</td>
<td>32.99 -100.00</td>
<td>6.78</td>
<td>72.56</td>
</tr>
<tr>
<td></td>
<td>323.58-387.23</td>
<td>3.74</td>
<td>332.51</td>
</tr>
<tr>
<td></td>
<td>875.00-949.00</td>
<td>5.09</td>
<td>897.74</td>
</tr>
<tr>
<td>LGA calcinated at 400°C</td>
<td>50.14-103.21</td>
<td>7.32</td>
<td>75.26</td>
</tr>
<tr>
<td></td>
<td>622.14-700.00</td>
<td>2.18</td>
<td>673.57</td>
</tr>
<tr>
<td></td>
<td>752.00-1000.00</td>
<td>9.85</td>
<td>901.55</td>
</tr>
<tr>
<td>LGA calcinated at 525°C</td>
<td>56.70-82.59</td>
<td>4.48</td>
<td>75.71</td>
</tr>
<tr>
<td></td>
<td>620.23-700.01</td>
<td>2.16</td>
<td>661.31</td>
</tr>
<tr>
<td></td>
<td>900.00-965.11</td>
<td>6.27</td>
<td>930.59</td>
</tr>
<tr>
<td>LGA calcinated at 600°C</td>
<td>35.69-118.69</td>
<td>4.06</td>
<td>67.49</td>
</tr>
<tr>
<td></td>
<td>600.00-631.12</td>
<td>2.54</td>
<td>621.91</td>
</tr>
<tr>
<td></td>
<td>800.01-925.11</td>
<td>10.97</td>
<td>899.91</td>
</tr>
<tr>
<td>LGA calcinated at 700°C</td>
<td>47.11-112.56</td>
<td>1.71</td>
<td>54.26</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>757.21-984.01</td>
<td>6.97</td>
<td>917.84</td>
</tr>
</tbody>
</table>
RESULTS AND DISCUSSION (continue...)

5) As referred to table 1, the last stage in the range 750° C to 990° C is of low mass which represent the degradation of carbon on the surface of remaining solid materials or volatilization of some metal oxide present in the lemon grass sample [6].

   This is due to the incomplete combustion and SiO2 present in agricultural ash materials.

6) Besides, the highest thermal stability was recorded by lemon grass ash calcinated at 700° C.

   This can be attributed by the high amount of minerals such as silica, potassium and calcium present in the sample after combustion at high temperature [8].
CONCLUSIONS

The conclusions from the study are summarized as follows:

1) Lemon grass ash calcinated at 700° C exhibit the highest thermal stability due to the highest combustion of carboneous substance occur in the sample at high temperature

2) The thermal stability of lemon grass calcinated at 0° C is lowered due to the degradation of hemicellulose, lignin, silica oxide and other minerals which are presents in the lemon grass ash structure

3) The thermal stability of lemon grass ash is increased at higher calcination temperatures.
REFERENCES


Thank You!