Solar drying of olive oil by-products for the production of solid biofuels

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Three – phase process

- 2.5tn olive cake
- 0.5tn olive leaves
- 5 tn Olive mill wastewater (OMW)

Environmental problem
- High degree of organic pollution
- High content of polyphenols
- High content of solid matter

Solid Biofuels
1. Olive Pomace (POM)
2. Pomace (80%) & Leaves (20%) (PL)
3. Pomace (60%), Leaves (20%) & biomass from pruning (PLP) (20%)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>POM</th>
<th>PL</th>
<th>PLP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture (%)</td>
<td>47.3 ± 0.2</td>
<td>52.1 ± 0.2</td>
<td>44.9 ± 2.7</td>
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<tr>
<td>TOC (g/kg)</td>
<td>667 ± 6.4</td>
<td>658 ± 28</td>
<td>634 ± 2.0</td>
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Solar drying unit
Experimental procedure

✓ Materials dried in 3.0x1.5x0.20m concrete tank
✓ Aeration of the surface of the materials is effectuated by side windows
✓ Greenhouse effect provides effective usage of the solar energy
✓ POM and PL dried for 56 days
✓ PLP dried for 67 days
✓ 10cm thickness of the POM, PL and PLP
✓ Mixed manually twice a day
✓ Experiments till the moisture content → reduced to 10% (w/w).
Results

Dried for 56 days
Max moisture removal ~
highest material temperature

POM Temperature, °C and Moisture Content, % vs. Time (d)

POM Temperature
Moisture Content
Highest temperature

47.27
9.61
Results

- PL Temperature
- Moisture Content
- Highest temperature

Dried for 56 days
Max moisture removal ~ highest material temperature

Time (d)

PL Temperature, °C and Moisture Content, %

Highest temperature

52.06

8.52
Results

- PLP Temperature
- Moisture Content
- Highest temperature

Dried for 67 days
Max moisture removal ~ highest material temperature
Results

Max moisture removal ~ Min relative humidity & stable solar radiation
Conclusions

- Moisture 47% → 9.6% (POM) after 56 days
- Moisture 52% → 8.52% (PL) after 56 days
- Moisture 45% → 9.32% (PLP) after 64 days
- No correction was observed between TOC and moisture removal
- Rate of moisture was positively related to minimum relative humidity and with the highest material temperature
- Solar drying was applied as an economical and efficient further-dewatering and drying method in three different substrates thus allowing its actual use as a fuel