SUSTAINABLE OLIVE OIL PRODUCTION

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ECO-ORGANIC Ltd
World wide olive oil production

84% Europe
8.5% Africa
5.5% Asia
2% America
European Olive Oil Production

Spain: 42%
Italy: 20%
Greece: 18%
Other countries: 20%
Greek situation

- The olives and olive oil are inextricable part of Greek culture
- In Greece there are 150,000,000 olive trees cultivated in 765,000 hectare
- The yearly production of each tree rises up to 300 kg of olives
- The 1/3 of Greek farmers are working on cultivation of olives
- Olives and olive oil production in Greece rise up 1,750,000 tn and 400,000 tn respectively
Situation in Greece

INSTALLATIONS

- 2,633 olive oil mills
  - 2,152 centrifugal systems (mostly 3-phases)
  - 481 traditional (pressure squeezing)
- 35-40 pomace processing plants
Situation in Greece

Olive oil production per region
Environmental impact from olive oil production

- 359 kg Emissions
- Olives 1000 kg
- Water 1479 kg
- Olive oil production
- 212 kg Olive oil
- 238 kg Solid wastes
- 1670 kg Wastewater
## Characteristics of OMWW

<table>
<thead>
<tr>
<th>parameter</th>
<th>OMWW</th>
<th>ENQL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 pH</td>
<td>4.50</td>
<td>6-9</td>
</tr>
<tr>
<td>2 BOD₅, g/l</td>
<td>68.71</td>
<td>0.04</td>
</tr>
<tr>
<td>3 COD, g/l</td>
<td>158.18</td>
<td>1</td>
</tr>
<tr>
<td>4 Phenolic compounds, g/l</td>
<td>17.15</td>
<td>0</td>
</tr>
<tr>
<td>5 Conductivity, mmhos/cm</td>
<td>18.00</td>
<td>3</td>
</tr>
</tbody>
</table>
Evaporation ponds

- This is the common used method of OMW treatment in Greece
- There are about 400 installations in Greece
An OMWW evaporation pond
METHODS OF OMW TREATMENT

case studies in Greece

Physical methods
- Evaporation ponds (lagooning)

Biological methods
- Anaerobic digestion
- Use of OMW for irrigation of olive groves
- Co-composting of OMW with OSWR
- Detoxification by Nitrogen fixation (Bio-wheel method)

Physicochemical methods
- Membranes technology combined with evaporation and wet oxidation (EHO method)
- Phenolic compounds removal using ion exchange technology

Combined Chemical and biological methods
- Fenton oxidation following by co-composting with pomace
Proper characteristics for any success treatment method

- To be technical effective
- To be integrated
- To be feasible
- To meet all Environmental limits
Basic concept of the innovation

Olive tree cultivation → 1000 kg Olives → Olive oil production (Olive mill) → 200 kg olive oil

Solid wastes:
- 186.14 kg Carbon
- 1.39 kg Nitrogen
- 0.48 kg Phosphorous
- 3.13 kg Potassium
- 0.46 kg Calcium

Wastewaters:

Return back to the tree all the elements that it needs for grow up

CO-COMPOSTING HUMIFICATION
Influent OMW

FeSO₄ 7H₂O

H₂O₂ 60%

SIMPLE FLOW DIAGRAMME OF THE METHOD
Advantages of the method

- It is an integrated method for OMWW management
- There are no emissions.
- The method could be feasible if the soil conditioner that is produced will take a good price in the market
- It is simple to install and to operate from the owners of Olive mills
Commercial Product
Cultivation of grapes

Grape for wine making

0% and 10% mixture of Humo Olea with conventional soil

Comparison after two months cultivation
Καλλιέργεια εσπεριδοειδών
Installations for Humo Olea production

Humo Olea Production units
Chania, Crete
Detoxification unit
1st stage of cocomposting of oxidized OMW with pomace, Chania, Crete
2d stage of co-composting Chania, Crete
Katástari, Zakinthos
Koutsouras, Creta
HUMO OLEA COST PRODUCTION

LIMITED FERTILITY COST
EURO/tn

110 Euro/tn  Installation for a single olive mill

Grapes, Sugar Beets, Potatoes, Vegetables, Olive Trees, Apple Tree, Cotton, Peach, Citrus, Barli, Tomatoes, Wheat, Corn, Sunflower
INTEGRATED SOLUTION

INTEGRATED UTILIZATION OF OLIVE OIL PRODUCTION WASTES
Market limitation

Humoco Lea Cost Production

- 110 Euro/tn: Installation for a single olive mill
- 80 Euro/tn: Centralized Installation for ten olive mills
- 50 Euro/tn: Waste oil extraction
- 35 Euro/tn: Bioenergy production

Crop Types:
- Grapes
- Sugar Beets
- Potatoes
- Vegetables
- Olive Trees
- Apple Tree
- Blossom
- Peach
- Citrus
- Barli
- Tomatoes
- Wheat
- Corn
- Sunflower
Productivity limitation

MAXIMUM PRODUCTION CAPACITY FOR HUMO OLEA tn/year

<table>
<thead>
<tr>
<th>Crop</th>
<th>Consumption (tn/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRAPE</td>
<td>1000000</td>
</tr>
<tr>
<td>SUGAR BEETS</td>
<td>2000000</td>
</tr>
<tr>
<td>POTATOES</td>
<td>3000000</td>
</tr>
<tr>
<td>VEGETABLES</td>
<td>4000000</td>
</tr>
<tr>
<td>OLIVE TREES</td>
<td>5000000</td>
</tr>
<tr>
<td>APPLE TREE</td>
<td>1000000</td>
</tr>
<tr>
<td>COCONUT</td>
<td>800000</td>
</tr>
<tr>
<td>PEACH</td>
<td>700000</td>
</tr>
<tr>
<td>CITRUS</td>
<td>600000</td>
</tr>
<tr>
<td>BARLEY</td>
<td>500000</td>
</tr>
<tr>
<td>TOMATOES</td>
<td>4000000</td>
</tr>
<tr>
<td>WHEAT</td>
<td>3000000</td>
</tr>
<tr>
<td>CORN</td>
<td>2000000</td>
</tr>
<tr>
<td>SUGARBEET</td>
<td>1000000</td>
</tr>
<tr>
<td>SUNFLOWER</td>
<td>1000000</td>
</tr>
</tbody>
</table>
Accumulative needs for all biological cultivations

![Bar chart showing the accumulative needs for different biological cultivations. The x-axis represents different crops (Grapes, Sugar Beets, Potatoes, Vegetables, Olive Trees, Apple Tree, Cotton, Peach, Citrus, Barli, Tomatoes, Wheat, Corn, Sunflower) and the y-axis represents consumption in tons (tn). The chart shows varying consumption levels for each crop, with Sunflower having the highest consumption.]
Thank you