GENERAL PLAN FOR THE INTEGRAL TREATMENT, MANAGEMENT AND VALORISATION OF WASTE GENERATED DURING THE PRODUCTION PROCESS OF VIRGIN OLIVE OIL

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SUMMARY: The main objective of this project is to demonstrate the environmental and economic advantages and the technical feasibility of a new system to manage the waste originated during the production of the virgin olive oil. Having the aim of achieving the maximum quantity of water recovery in the origin and the maximum use of the residue, the olive mills that normally carry out the remaining successive extractions of oil in a 2-phase system would be recommended to do so, in a 3- phase system. In this way, they will obtain an olive pomace, cake or "orujo" with a 50% of water. This system will provide them the related savings in transport and in the current drying costs in the extraction plants (which is twice, the one proposed).The alpechin would be treated in the plant where after being concentrated, it will be used for the production of solid and liquid organic fertilisers. The remaining water will be used for irrigation of the olive grove. In total, this supposes a cost of treatment of a 1/3 of the cost of the current process with the extraction plants, moreover it will be the additional advantage of the water recovery.The plan bears the construction of a demonstration plant, which incorporates a new process in 3 steps: Quick separation of solid compounds, Thermal concentration of liquid compounds and a Final treatment of the remaining water. The benefits are: total absence of solid and liquid waste, smaller costs of treatment, additional revenues in the olive mills, benefits for the "orujera" or extraction plant (olive pomace or "orujo" with a 50% of water) and energy self-supplying.

1. INTRODUCTION

The idea of carry out this project arises on one hand due to the problem created by the waste ("alpechines"- liquid olive mill waste, "alperujos" semi-liquid olive mill waste and washing water) generated by the olive mills and in general the olive sector.On the other hand, due to the necessity of expanding a technology, a performance plan and a waste management of the olive mills. The project has been developed at industrial level, starting from the research and trials in a laboratory pilot plant, continuing with a mobile plant of experimentation and demonstration, which has been used not only to carry out numerous trials and demonstrations in Spain but in Greece and Italy, also. Later on, several industrial plants have been settled in Spanish olive mills. In spite of these important activities, the management plan has not been enough expanded yet, likewise the involved

technology that will allow to solve the serious problem of this waste with the related environmental, economic and social benefits.

Currently, new technologies have been introduced in the olive oil sector and not only a production of quality is looked for but a cleaner, sustainable and environmentally friendly production. The necessity of this project arises from the importance of carrying out a good management of the waste generated during the process of virgin olive oil and from the problems created by the washing water and the alpechines. These alpechines are phytotoxic and non Biodegradable. At the present, they are accumulated in big ponds or like the "alperujos" (70% of H2O) that undergo a drying process in the extraction plants or "orujeras". These drying costs are twice the ones proposed and moreover, the water is lost as vapour in the atmosphere, with the environmental and economic problems that this generates.

This is the reason why a proposal was submitted to the European Commission in order to carry out a LIFE – Environment project. These kind of projects are essentially experimental and demonstrative projects characterised by their contribution to the reduction of the environmental impact of the economic activities; waste management, etc. The aim is to be able to apply this technology in Andalusia and in a future, in all those regions and countries in where it could be necessary.

2. DEFINITION OF A LIFE-ENVIRONMENT PROJECT AND ITS CHARACTERISTICS

It is an environmental project of innovative, experimental and demonstrative type co-financed by the European Community, in which priority is given to dissemination activities and to the obtained results.

Other goals of these projects are:

- On one hand to fill the current gap between the results of the research and development and on the other hand, to extend its application to a great scale.
- Test and assay innovative solutions for environmental problems and get specific and practical results.
- Contribute to the objectives achievement of the Environmental Community Policies, their current application, integration and their future development.
- The exploitation of the whole potential of environmental technologies for the protection of the environment, their contribution to an increase of the competitiveness and the economic growth.

3. BACKGROUND

The production of olive oil is an important economic sector in the southern European countries, especially in Spain, Italy, Greece and Portugal. However, the process of extraction of olive oil generates a non biodegradable phytotoxic waste (the "alpechin" or washing water), therefore it is an important source of pollution.

In spite of the introduction in the nineties of improved separation systems (2-phase systems), which reduced the quantity of the necessary water for the process and the generated liquid waste, the problems of toxicity of the waste and the final management continue being a problem in all these countries and especially in the olive oil producer regions, like Andalusia, Spain.

4. BACKGROUND

The main objective of this project is to demonstrate the environmental and economic advantages and the technical feasibility of a new system to manage the waste originated during the production of the virgin olive oil. The plan consists (Fig.1) in recovering the maximum water quantity in the origin. Therefore, it is recommended that olive mills carry out the remaining successive extractions of oil in a 3- phase system (olive cake with a 50% of water) with the related savings in transport and in the drying costs in the extraction plants (which is twice, the one proposed). The alpechin would be treated in the plant where after being concentrated, it will be used for the production solid and liquid of organic fertilisers and the water for the irrigation of the olive grove. In total, this supposes a cost of treatment of a 1/3 of the cost of the current process with the extraction plants, moreover, it will be the additional advantage of the water recovery. In the olive mill is generated a by-product (waste from 3-phases system, with a 50% of water) instead of a waste ("alperujo", waste from 2-phases system, with a 65-70% of water). Traditionally, the value of this waste replaced the costs of the annual olive milling.

After the design and calculus for each one of the different stages, an industrial plant of demonstration will be built to transform waste ("alpechin" and "orujo") into organic fertilisers (solid and liquid ones) and in water for irrigation, which will replace part of the water shortage in these areas.

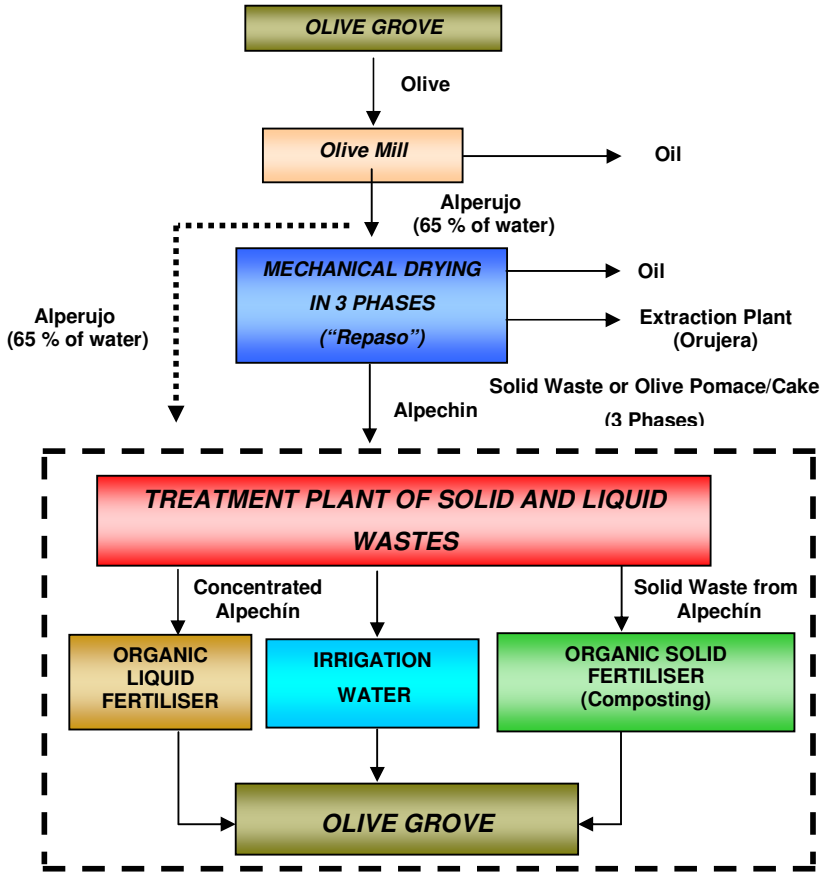

Figure 1: General Plan for Treatment.

5. TECHNICAL DESCRIPTION OF THE PROJECT

A plant for processing and treating the two main wastes generated during the olive oil production in the olive mills will be designed and built.

- Solid waste: OLIVE POMACE from 2-phases systems, (alperujo).
- Liquid waste: WASHING WATER, liquid olive mill waste, ALPECHINES.

The accumulated experience, by means of the behaviour observation of the different methods applied for the use and purification of the 2- phases waste has shown that for the treatment of the generated flows, a second extraction of the oil (centrifugation) or "repaso" is required. This will be the most effective and economic system. Previously, a separation of the pits from the pulps must have been done. Oil, alpechin and olive waste from 3-phases with a humidity of 50% and with a smaller quantity of pits will be obtained from this second centrifugation. The problems of transport and drying costs will be already solved.

The alpechin (see fig. 2) together with the washing water undergo a purification process. Then , its valorisation will take place by means of several physical, chemical and thermal processes:

- Quick separation of solid waste.
- Later evaporation-concentration process.
- Final treatment of the remaining water.

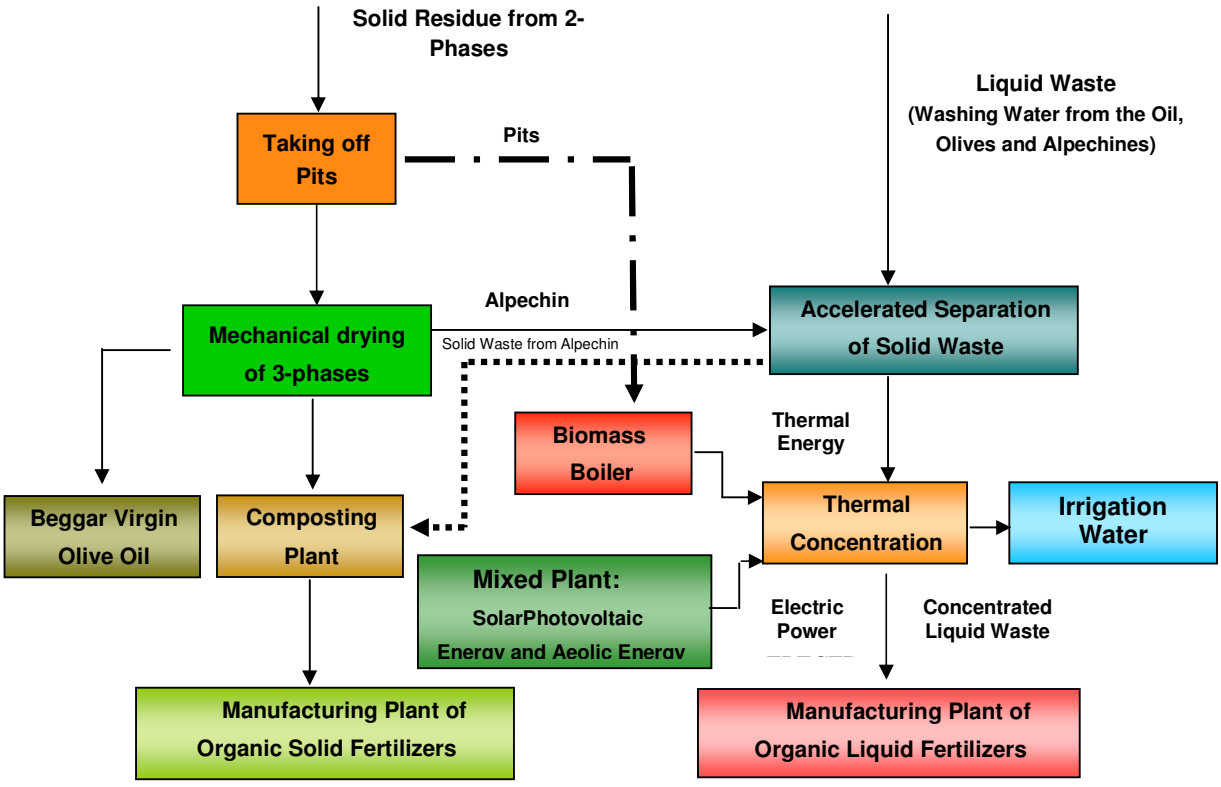

Figure 2: Diagram of the Treatment of the Process.

This plant could be also used for the treatment of liquid waste coming from industries of the seasoning of olives, since they contain a big quantity of brine and soda. The system used in the evaporation-concentration stage is similar to the one used in the plants for taking off salt from the sea water.

The thermal concentration of waste is carried out in two exchangers:

- One fed by thermal energy, which comes from a boiler that burns the obtained pits of 2-phases olive pomace or solid waste.
- The other one, fed by electric power given by a combined power station of photovoltaic solar energy and aeolic energy.

The plant shows two fundamental characteristics:

1. Total absence of waste (solid and liquid waste).
   - The concentrated liquid waste is used for the production of liquid organic fertilisers.
   - The solid residue, with an appropriate humidity after the drying process (extraction or "repaso" in three phases) and an appropriate composting process will be used to obtain solid organic fertilisers.
   - The only waste that remains is the water, which can be poured into public beds or to be used as watering water.
2. Smaller treatment costs
   - The treatment costs for each litre of water are a 1/3 of the current cost of the process in the extraction plants (summing transport and energy costs), with the additional advantage of the water recovery.
3. Additional incomes for the olive mills
   - In the olive mill, a by-product is generated (olive cake or solid waste from three phases, 50% water) instead of a residue (alperujo, solid waste from 2 phases, 65% of water). Traditionally, the value of this waste replaced the annual costs of the olive milling.
4. Energy self-supplying.

5.1 Characteristics of the Treatment Plant and Waste Use

The Plant of Treatment and Valorisation of waste will have enough capacity to treat:

- 2.500 m3/year..... Liquid residue (washing water of the oil and olives).
- 1.000 tm..... Solid residue (Alperujo, Solid waste or Olive cake from 2 Phases).

In this plant, the valorisation of the waste is made as it is mentioned next:

- Production of ORGANIC SOLID FERTILISER by means of a composting process.
- Production of MIXED FERTILISER (organic and inorganic), LIQUID FERTILISER of two types, for the soil and the leaves and to be used to make three treatments a year of the olive grove.
- Biomass obtaining (the olive pit has a heating power of 4.000 kcal/kg).

6. PARTICIPANTS

- Fundación CARTIF.
- Tratamiento Integral de Alpechines Baena (TRAINALBA S.L.).
- ENERMAN S.A.
- Excelentísimo Ayuntamiento de Baena.
- Diputación Provincial de Córdoba.

7. BENEFICIARIES (REGIONS AND COUNTRIES)

Andalucía, España, Italia, Grecia, etc.

8. OTHER DATA

- Total budget: 4.524.561,00 €.
- Contribution of LIFE: 2.065.585,00 €.
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