

Technologies for the utilization of olive husk in the energy industry

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Olive husk is one of the main residues of olive oil production procedures in terms of the utilization of the two- as well as the three-phase technologies [IMP03]. According to its properties, olive husk is a very good example of what we may call biomass. Biomass is all the matter that can be derived directly or indirectly from plant photosynthesis [IFRF 00]. It is a renewable energy that could replace the use of some fossil fuels, such as coal. Wood residues in terms of pellets are at the time being the most important biomass resource in Europe regarding space heating; agricultural residues are important as well [OFI07]. Olive husk is considered to be a typical form of agricultural residue of the Mediterranean region, since more than 90% of olive trees worldwide are located around the Mediterranean basin [FAO05].

When olive husk is burnt, an energy resource that would otherwise have gone to waste or been dumped in a landfill can be utilized. Table 1 gives an overview of composition properties of olive husk, according to several studies. The great variations in moisture content, ash and chemical composition give rise to large variations in combustion behavior and pollutant emissions from combustion systems.

This information introduces us to the essence of the problem, which is the careful consideration in the design and operation of the furnaces and boilers in addition to the implementation of proper cleaning systems when olive husk is to be utilized. Also it states the main hurdle in studies concerning olive husk and thus the fact that the properties of the fuel are much different.

Biomass residues from olive oil production

According to the FAO stats for the year 2005 [FAO05], countries which are located in the Mediterranean basin are the producers of more than 95% of the total world olive oil production. The largest olive oil producers are European; Spain is by far the most important olive oil producer, as Spanish olive oil represents about half of the European production. Italy and Greece are also important producers, and to a lesser extent France, Cyprus, and Malta. It is also very important to notice that olive oil production has an increasing rate within European countries of about 50% over the last decade [TDC05].

A very important aspect of olive oil production is the environmental impacts of this process. Based on the existing applied techniques for olive oil production, more than 12 million tons of water are used in order for olive oil to be extract-

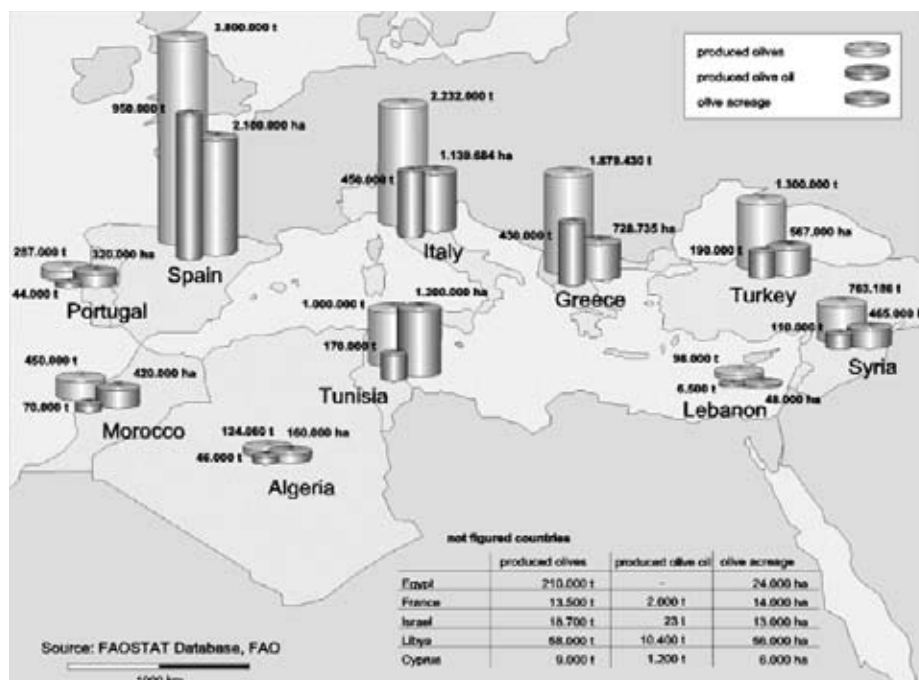


Figure 1: Olives and olive oil production in the Mediterranean area [FAO05]

ed. At the same time a production of about 8 to 10 million tons of sludge occurs [IMP03]. Three different processes are used today for olive oil production:

- The traditional process (olive presses);
- The 3-phase decanter process;
- The 2-phase decanter process (ecological process).

The latter two methods, although based on similar principles, differ significantly in the amount and the composition of the different by-product fractions.

Olive husk exploitation for energy production

The simplest way to exploit olive husk for energy production is to directly combust it. The most important techniques for biomass and thus olive husk combustion are [IFRF00]:

- Small scale (wood stoves, tiled stoves, underfeed stokers);
- Large scale (moving grates, vibrating grates, bubbling and circulating fluidized beds, pulverized combustors, etc.).

Small olive husk burning boilers are frequently used for space heating and cooling purposes. Today in Cyprus there are approximately 125 small (<96kW) and 20 large boilers (>96kW) [Ven07] burning olive husk. The largest of all is installed in the Monastery of Machairas and has a power of 850 kW. This type of boilers gives off its heat to radiators in exactly the same way as an oil-fired boiler. These boilers are mainly automatic, since they are equipped with a silo containing olive husk. A screw feeder feeds the fuel simultaneously with the output demand of the dwelling. A typical example of olive husk boilers is the "Mile P boiler" constructed and manufactured