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EVALUATION OF SOLID OLIVE WASTE POTENTIAL IN NORTHERN CYPRUS AS AN ENERGY SOURCE

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ABSTRACT:
Northern Cyprus is a small island, energy-importing country. The country enjoys the abundance of solar energy but the cost of solar energy technologies limit the use. Another contributor of renewable energy is biomass, obtained from agricultural residues. The fastest growing agricultural sector in the country is olive production. More than 80% of the olive yield is used for olive oil production. The residues derived for olive oil production is very suitable organic material for charcoal production. This work2. investigates the potential of produced olive oil residue in Northern Cyprus for charcoal production in order to be an alternative for imported briquetted and lump charcoal.
Key words: Northern Cyprus, renewable energy, briquetted charcoal, olive oil residue

1. INTRODUCTION:

Sustainable development, defined as "meeting current needs without destroying the ability of the future generations to meet theirs, with a balance among economic, social and environmental needs'' [1], is the most challenging topic of Northern Cyprus. Energy is one of the major concerns of sustainable development, since the environmental impacts of the fossil fuels are well recognized. Recent researches are done for a shift from fossil fuels to renewable energy sources in order to prevent fossil fuel based emission of CO_2. All non-fossil-based living organisms and organic materials that have intrinsic chemical energy content are called biomass; a form of renewable energy. Biomass sources include plant and animal residues which are classified under three general groups as woody, non-woody and animal wastes [2] and can be said as any energy produced from non-fossil biological materials.

As mentioned in abstract Northern Cyprus is a developing, energy-importing small country, which enjoys the abundance of solar energy. Beside solar energy the country has considerable amounts of agricultural residues that can contribute to energy production of country as biomass. One of the major contributors of agricultural residues is olive oil industry. The Olive oil industry is one of the fastest growing sector in Northern Cyprus and residues of olive oil production well-suits to the definition of biomass with its organic content.

In this work the amount of oil olive residue in Northern Cyprus and it's availability as an energy source is investigated and analyzed.

2. OLIVE OIL INDUSTRY:

Olive oil industry is one of the fastest growing industries especially in Mediterranean region. Spain is the main producer of olive oil and it dominates about 80% of the market[3]. Spain is followed by Italy, Greece, Turkey, Syria and Tunisia respectively [3]. The 97% of the global olive oil production is concentrated on the Mediterranean basin [4]. Beside the Mediterranean countries, countries such as Australia and United States tend to increase their olive oil production. Globally, 2,766,773 tons of olive oil is produced annually and 82.50% is produced in Europe. If associated candidate countries are counted, this percentage will rise to 89%. It should be noted that the average annual growth rate of the olive industry is 4%. As a Mediterranean island, Northern Cyprus' olive oil production rate is increasing as well. Figure 1 shows the annual olive production rate production in Northern Cyprus obtained from statistical offices [5].

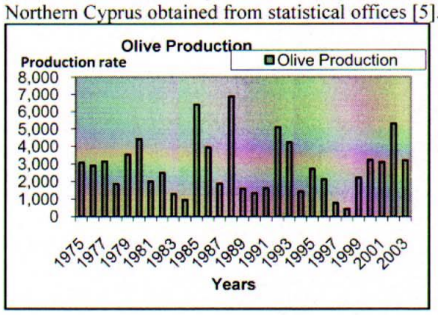

Figure 1: Olive oil production rate in Northern Cyprus between 1975-2003.

It should be stated that in Figure 1, there exists extremely low production rates for some years compared to others; it is believed that there is some miss-information for those years.

According to un-official statistics and information obtained from olive mill factory owners, it is estimated that approximately 600,000 olive trees exist in Northern Cyprus, which 100,000 of them are planted in 2009 and it is further planned to plant 100,000 more with the encouragement of the government.

Approximately 80% of olive produced in N. Cyprus is used for producing olive oil in 7 olive mills operating the country.

3. OLIVE FRUIT:

Olive fruit consists of three main parts; epicarp (skin), mesocarp (pulp) and endocarp (stone). Epicorp is the skin that covers the mesocarp, and it is covered with wax. Mesocarp is between epicarp and the stone of the fruit. Mesocarp has low sugar content with ranges 3-3.7% and high oil content of 15-30% [6]. These ranges vary with the type of fruit, cultivation, location and etc. Endocarp is the hardest part of the olive fruit, made up of lignin and encloses the seed. Average composition of olive fruit is given as 50% water, 22% oil, 19.1% sugars, 1.6% protein and 1.5% ash [7].. Figure 2 shows the cross section of olive fruit [7].

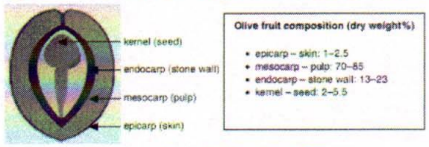

Figure 2: Cross section of olive fruit [7].

4. OLIVE MILL TECHNOLOGY:

Olive mill technologies are classified in three groups as; traditional, 2-phase decanter and 3-phase decanter systems. About thirty years ago, traditional method was the most widely used technology but in 70s, this method is replaced by continuous 2-phase or 3-phase systems due to economic reasons [8]. Traditional method extracts oil by pressing the olives where 2- and 3-phase systems have centrifugation systems to extract the oil. As shown in Figure3, the products of each system are different than others. Figure 3 shows the block diagram of 2-phase, 3-phase decanter and traditional systems. The traditional system ends up with just olive oil and vegetable water where, some other products such as pomace oil, extracted pomace are also derived from 2- and 3-phase systems.

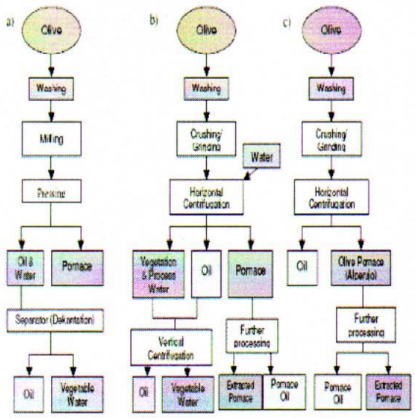

Figure 3: Block diagram of olive mill systems (a) Traditional System (b) 2-phase decanter system (c) 3-phase decanter system [7].

It is approximated that 200 kg and 210 kg olive oil will be extracted from 2- and 3- phase systems respectively if 1000 kg olives are milled [8]. At the first glance, 3- phase systems seems more efficient but if other by products are considered, especially vegetable water (olive mill waste water) then the advantages of 2- phase systems will be understood much more better. However, usage rate of both systems differ from one country to another, even in main producers of olive oil. In Spain 2-phase systems are the most widely used systems where in Italy 3-phase and traditional systems are most widely used.3-phase systems are more common in Greece [8]. In Northern Cyprus, there is only one traditional system and all other six systems are 3-phase decanter systems.

5. RESIDUES OF OLIVE OIL PRODUCTION:

Amount and the type of the generated residues depend on system used. It is stated that, if 1000 kg olive is processed in two phase system, approximately 800 kg wet olive cake and 0.2 m^3 olive mill waste water is produced but if same amount of olive is processed in three-phase system, approximately 550 kg olive cake and 1-1.6 m^3 olive mill waste water is produced [8]. Beside the solid residues; liquid residue "Olive Mill Waste Water" (OMWW) is produced as well. The water content of the olive cake changes due to employed mill technology and generally ranges 25-60% of total weight of the olive cake.

6. CHARCOAL PRODUCTION FROM SOLID OLIVE OIL RESIDUES:

In order to find out the charcoal yield from the olive oil residues and olive tree branches; olive oil residues and olive tree branches were carbonized. These materials were carbonized an aerobically in a closed cylinder having a vent pipe placed in a furnace. Starch was used as a binder and grinded charcoal was blended with starch paste made of 5 percent of starch and hot water. The blend was compressed into cylindrical shaped briquettes by a hand press. The produced, olive oil residue and olive branch charcoal briquettes were dried in the furnace at about 100 °C and the coal was binded as starch set by loosing water. Charcoal Produced charcoal briquettes are burned for the determination of their ash content. Obtained results are shown in Table 1.

Table 1: The char yield (wt%), charcoal density(kg/m^3) and the ash content of, olive oil residue charcoal briquettes, olive branch, imported lump charcoal and imported briquetted charcoal.

	Char yield (wt%)	Charcoal density (kg/m^3)	Ash content (wt%)
Olive oil residue	36.4	404	14.3
Olive branch	36.3	350	4.9
Imported Lump charcoal	-	401	5.5
Imported briquetted charcoal	-	550	21.4

According to the results presented in Table 1 the char yield, charcoal density and the ash content of the briquetted charcoal produced by olive oil residues are 36,4%, 404 (kg/m^3) and 14.3% respectively. The char yield, charcoal density and the ash content of the briquetted charcoal produced by olive oil branches are 36.3%, 350 (kg/m^3) and 4.1% respectively. Densities and ash contents of the imported charcoal (briquetted and lumped) are also presented in Table 1.

Table 1 shows that charcoal produced from both olive oil residues and olive tree branches have comparable charcoal density with the imported lump and imported briquetted charcoal. The ash content of olive branch is less than both of the imported charcoals but the olive oil residue have higher ash content than imported lump charcoal which is still less than imported briquetted charcoal.

7. CONCLUSION:

The energy demand of developing countries in world is increasing due to their population growth and comfort-based issues. The well-understood environmental impacts of fossil fuels, encourages all states to use renewable energy sources in order to meet their energy needs. As a developing island state, Northern Cyprus has enjoying the abundance of solar energy but the cost of solar technologies is a limitation for the utilization of solar energy. Besides solar, biomass is another form of renewable energy which is available in the island. Especially the contribution of olive mill factories is considerably huge to total biomass production. The results obtained in previous sections show that, the produced charcoal from olive oil residues have suitable content to produce charcoal and produced charcoals are competitive with the imported charcoal.

References:

[1] Sims R.E.H., "Renewable Energy; a response to climate change", Solar Energy, 76(2004), pp 9-17

[2]Mirza U. K., Nasir A., Tariq M. "An Overview of biomass utilization in Pakistan", Renewable and Sustainable Energy Reviews 12 (2008), p. 1988-1996

[3] A.Roing,M.L. Cayuela, M. A. Sanchez- Monedero, "An overview on olive mill wastes and their valorization method", Waste Management, 2006(26),p.960-969.

(4) Avraamides M. and Fatta D. " Resource consumption and emissions from olive oil production: a life cycle inventory case study in Cyprus" , Journal of Cleaner Production, 2008(16), p. 809-821

[5]http://www.kktob.org/75-03%20tab/uzum_uzumsu_meyve.htm

[6] Menegaki A., "Valuation for renewable energy: A comparative review", Renewable & Sustainable Energy Review, 12 (2008),pp2422-2437

[7]MORE;"Market of olive residues for energy", Regional Energy Agency of Central Macadonia, Intelligent Energy,Europe

[8]Alburquerque J. A. Conzalves J., Garcia D."Agrochemical characterization of "alperujo", a solid by-product of the 2-phase centrifugation method for olive oil extraction", Bioresource Technology 92(2), 195-200