Olive Processing Waste Management: Summary

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Waste Management Method	Advantages OMWW=Olive Mill Waste Water 2POMW=Two-Phase Olive Mill Waste	Disadvantages OMWW=Olive Mill Waste Water 2POMW=Two-Phase Olive Mill Waste
Fertilizer/ Soil Conditioner	0MWW: Provides economical irrigation water, helps soil aggregation, enhances microbial activity of soil, reduces costs and groundwater contamination compared to conventional fertilizers, and improves soil water capacity. 2POMW: Improves soil fertility when composted with other wastes, improves surface soil oxygenation, increases stability of aggregates, improves hydraulic retention of the soil, and creates a greater bio-availability of micro-elements for vegetal nutrition.	OMWW: Has phytotoxic effects when used directly on soil. 2POMW: Requires expensive pretreatment, varies in effectiveness depending on soil properties, has mineral salts and organic compounds detrimental to soil fertility, needs to be detoxified prior to use to break up toxic phenolic compounds.
Herbicide/ Pesticide	Olive Juice: Reduces the ability of Bactrocera oleae to reproduce. OMWW: Reduces the ability of Bactrocera oleae to reproduce, protects against olive knot disease tomato plant diseases, repels bugs, prevents suckers, effective alternative to chemical weed control.	OMWW: Causes leaf and fruit abscission and is toxic on HEP2 human cells.
Animal Feed/ Human Consumption	Olive Cake: Is economical for egg and meat producers by reducing feed costs. OMWW: Helps reduce the inhibition of phenolic compounds, promoting digestibility (Dalmolive method). 2POMW: Is suitable for human consumption using some processes.	Olive Cake and OMWW: Have low nutritional value when untreated, cause antidigestive problems, and are not economical due to high energy needs. 2POMW: Produces low levels of protein and is high in cost.
Recovery of Residual Oil	Olive Cake: Creates high quality oil with little refining needed and can produce a residual oil that is additive free. 2POMW: Creates a free residual pulp for animal feed or fertilizer, and a portion that can be used for fuel	Olive Cake: Not suitable for human consumption. 2POMW: High moisture content demanding large amounts of energy, difficult to dry due to sugars, requires a costly purification step to reduce polycyclic aromatic hydrocarbons
Recovery of Pectins	2POMW: Proves to have the ability to act as a gelling pectic material	
Recovery of Antioxidants	OMWW and 2POMW: Contain large quantities of complex water-soluble compounds with strong antioxidant properties potentially decreasing the chances	OMWW and 2POMW: High cost b/c of the use of solvents and the generation of wastes, squalene

	of some pathologic processes, such as atherosclerosis and cancer, have both antimicrobial and antifungal abilities, can be used to make skin cosmetics, can be converted to ethanol through a hydrothermal treatment, extracted agents are effective in fighting yeasts produced during dandruff formation, can be used for the extraction of flavonoid pigments used as food colorants, can be used therapeutically for some cancers and protect skin against UV exposure, proves to have antiviral, antifungal, antibacterial, antioxidant, and anti-inflammatory properties, can be used to treat acne and hyperseborrhea	produced from olive oil wastes uses a nickel-catalyst and solvents, making it a non-environmentally friendly method of extraction
Recovery of Enzymes	OMWW: Can be used to extract an enzymatic concentrate, which improves olive oil yield and quality when recycled into the mechanical olive oil extraction process, proves to work as a growth medium for the production of extracellular laccase and manganese peroxidase, can produce industrial quantities of edible biomass and enzymes, peroxidases, and phenol oxidases.	
Production of Alcohols	OMWW: Contains sugars that can be converted into alcohol used in foods, fuels and cosmetics, can produce Butanol using solventogenic Clostridium spp., allowing a large reduction of COD value 2POMW and Olive Cake: Can be used to extract Mannitol	OMWW: Alcohol fermentation by yeasts was not an economical use of b/c of low alcohol concentration in the fermentation broth and the toxicity of the substrate
Production of Biosurfactants	OMWW: Can act as a raw material for the production of Biosurfactants	Yields of are low, making it not economically viable
Production of Biopolymers	OMWW: Can be used in the production of xanthan, which acts as a thickener in food, cosmetics, pharmaceuticals, paper, paint, textiles, adhesives, and tertiary oil recovery, eco-friendly and inexpensive technique, proves to be an inexpensive source of carbon in the production of homo- and copolymers of polyhydroxyalkanoates used in bio-plastics, Olive cake: High in lignin, cellulose, and hemicellulose which can be converted into polyurethane and phenolic resins	
Production of Activated Carbons	Olive Stones: Are an economically feasible source for activated carbon production OMWW: can be used to treat contaminated water and absorb herbicides with an absorption capacity higher than commercial activated carbons, Activated carbons can be used as absorbents for COD and phenols in OMWW	
Gasification	Olive Cake and 2POMW: Treatment of wastes proves to be an environmentally friendly way to produce energy, can be used as a source of energy for the mill itself, olive cake can be used to fire pottery kilns and as an energy source for the brick industry	Olive Cake and 2POMW: Large capital investments and qualified personnel are required

Briquetting	OMWW and Olive Stones: Represent a low cost method of turning olive oil waste into fuel blocks, paper wastes can be added to improve shatter index Olive Stones: Smokeless briquettes can be made in combination with coal, proving to be environmentally friendly	OMWW and Olive Stones: Solid olive wastes have low compression strength and shattering index, requiring an additional binding agent, emissions are not eco-friendly.
Co-combustion	2POMW and Olive Cake: Have high caloric values which can be compared to wood or soft coal, olive residues and coal act as compatible co-combustion materials having a similar density, heat release, and general burning characteristics, reducing emissions and improving efficiency, Olive Cake: Co-combusted with lignite coal proves to be a cleaner form of energy, and requires similar equipment to that of coal	Olive cake: Can not be burnt without the aid of another form of energy in some cases 2POMW: Causes problems in a fluidized bed combustor for energy production because of the high moisture and alkaline, exhaust gases from the production require treatment, increasing costs
Bio-gas	OMWW: Can be used in anaerobic biogas production to produce methane that is a cheap and easily produced substitute for natural gas and medium caloric gases, is a successful substrate for biohydrogen production process, being both renewable and pollution-free. Olive Cake: Proves to be a suitable alternative fuel when using a slurry and anaerobic digesters	OMWW: Anaerobic degradation to obtain methane proves to be an unsuccessful method due to the toxicity of the waste and the high investment needed for production
Liquid Fuels	Olive Oil: Methyl ester from used olive oil is capable of being transformed into a usable fuel by an alkali-catalyzed transesterification process	
Miscellaneous Uses of Olive Oil Waste	OMWW: Treated or untreated can be used to replace water in various parts of olive oil production, can be used to make soaps, can be used to produce B12, has been a successful growth medium for the production of plant growth hormones, pollutants can be removed and used as a wood glue, can be used as a substitute for water in brick production, can be used as a lightweight material in concrete and cements Olive Fruit: Can be used to produce a deodorant affective in deodorizing the malodor components of tobacco odors Olive cake: Can be used as a drilling fluid additive in oil wells, being both environmentally and economically friendly,	

Table summarizes waste management methods described in Niaounakis, M., and Halvadakis, C.P., *Olive Processing Waste Management, Volume 5, Second Edition: Literature Review and Patent Survey, 2nd Edition (Waste Management)*, 2006.