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Olive Waste Valorization for Food Biotechnological Applications (Mini-Review)

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Olive Wastes, Types, Bioactive Ingredients, Application, Food Biotechnology .

ABSTRACT

Due to its richness in nutrients, added-value ingredients and bioactive compounds, olive agro-wastes they should not be considered as "wastes", but "raw material" pave the way for food, cosmetic, and pharmaceutical industries. In the food sector, these biowastes offer best suited ingredients for manufacturing valuable compounds such us biosurfactants, mushroom, enzymes, olive leaf tea, vinegar, polysaccharides, vitamins, antioxidants, flavor compounds, and other unique functional properties. Furthermore, olive wastes find some distinctive applications including water purification, nutritional functionality enhancement, sensory quality improvement, food additive, food shelf-life extension, active packaging and food preservation. This review summarizes all bioactive ingredients, compounds and products issued from olive wastes and discusses their valorization for food biotechnological applications.

I. INTRODUCTION

Olea europaea L. is an evergreen tree that has been cultivated for more than 7000 years. It is found throughout the world, particularly in the Mediterranean countries [1]. With currently more than ten million hectares, olive tree cultivation has spread worldwide, and large amount of biomass is generated annually from its cultivation, these pruning biowastes include leaves, thin and thick branches or wood, furthermore table olive and olive oil industries, create in a short time a high amount of biowastes include olive stones, pomace, extracted olive pomace, and olive mill waste water. All this biowastes must be adequately handled and disposed, because its accumulation can lead to harmful environmental effects due to its high organic content and phytotoxicity [2]

Conventional disposal methods include direct burning or spreading in fields, but this has economical costs and environmental concerns, as well as wasting a source of energy and chemicals. Up to now the emphasis has been focused on detoxifying these wastes prior to disposal, feeding, fertilization/composting, because they are not easy degradable by natural processes, or even used in combustion as fuel [3]. Multiple strategies for olive waste practical valorization such as combustion, secondary oil extraction and fermentation. However, the ideal aim was encouraging table olive and olive oil manufacturers to follow an eco-friendly and sustainable production chain obtaining marketable products from the generated wastes.

This review reports olive wastes sources and types, as well as summarizes all bioactive ingredients; compounds and products issued from olive wastes and discusses their valorization for food biotechnological applications.

II. OLIVE WASTE SOURCES AND TYPES

Large amount of biomass and a variety of wastes and by-products are produced annually from olive tree cultivation, table olive and olive oil production processes. These biowastes issued from pruning, leaves, olive stones and pomace, extracted olive pomace, and olive waste water (Table 1)

Table 1: olive waste sources and types

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Olive Waste Sources	**Type**	**Details**	**Chemical Composition**
Olive Orchards	Olive Tree Pruning (OTP)	-thin branches (approximately %50by weight) - thick branches or wood (approximately 25% by weight)	Cellulose, hemicellulose, lignin
	Olive Leaves (OL)	-leaves (approximately 25% by weight)	51% moisture, 26.9% carbohydrates, 3.2% oil, 7.2% crude protein, 6.9% crude fiber, 2.5% total polyphenols, and 2.4% as well as cellulose, hemicelluloses and lignin
Table Olive Industry	Olive Leaves	-	-
	Whole Olive Stones (WOS)	-	Cellulose (28.1–40.4%), hemicelluloses (18.5–32.2%) and lignin (25.3–27.2%) [4]
	Olive Waste Water	olive fruits washing, cleaning and processing waters	NA
Olive Oil Industry	Olive Leaves	-	-
	Crushed Olive Stones (COS)		
	Olive Pomace (OP)	Solids (Djefet)	water, carbohydrates, lipids, polyphenols, and a number of metals and salts with a 4.8–5.2 pH
	Extracted or Exhausted Olive Pomace (EOP)	-	NA
	Olive Mill Wastewater (OMWW)	Waste water (Zibar)	0.5 % Oil 93 % Water 6.5 % Solids
	Olive Oil Washing Wastewater (OOWWW)	-	NA

III. Olive Waste Food Biotechnological Applications

summarized in (**Table 2**)

Table 2: Olive Wastes Food Biotechnological Applications

Product/service	Product Type/Microorganism or Treatment	Olive Waste Type	Ref.
Water Purification	High-surface area active carbon (AC). was employed to reversibly adsorb chromate ions from water	Solid Olive Waste	[5]
	Activated carbon from olive stones activated by KOH facilitated the adsorption of metal ions.	Olive Stones	[6]
Functional Beverages	Bioactive phenolic extract in beverage	OMW	[7]
Tea	Olive tree leaf Tea	Olive Tree Leaf	[8]
Vinegar	Saccharomyces cerevisiae	Olive Oil Mill Wastewaters	[9]
Antioxydants	Hydroxytyrosol, oleuropein, syringaldehyde and tyrosol	Olive Tree Pruning.	[10]
	Hydroxytyrosol, Caffeic acid, OleoeuropeinVerbascosideLuteoin-7-O-glucoside	Olive Leaves	[11-12]
	Tyrosol ,Apigenin ,Oleuropein , Squalene	Olive Pomace	[13-14]
Mushrooms	*Pleurotus eryngii*	Olive Mill Solid Waste (OMSW)	[15]
	Pleurotus ostreatus	Solid Olive Mill Wastes (SOMW)	[16]
	Hericium americanum	Olive Press Cake (OPC)	[17]
	Hericium erinaceus	Olive Mill Wastewater + Olive Crop Residues	[18]
	Agrocybe cylindracea, Inonotus andersonii, Pleurotus ostreatus and Trametes versicolor	(OMWW)	[19]
Polysaccharides	fungal glucans/ Selected Basidiomycetes	Olive Mill Waste Water (OMWW)	[20]
	β-glucan β (1→3), β (1→6) / *Botryosphaeria rhodina* mycelium growth	(Undiluted OMWW)	[21]
	Pectins	Olive Pomace (Alperujo)	[22]
	Pullulan / *Aureobasidium pullulans*	OMW	[23]
	Xanthan / *Xanthomonas campestris*	Olive Mill Waste Water (OMWW)	[24]
	Xylan and β-glucan (lentinan) / *Lentinula edodes* mycelium growth	OMWW	[25]
Monosaccharides	glucose, galactose, arabinose, rhamnose, and galacturonic acid		[26]
	Gluco- and xylooligosaccharides / autohydrolysis	Olive Tree Pruning	[27]
Sugar Alcohol or Polyol	Mannitol	Alpechin, Olive Twig, Leaves or Alperujo.	[28]
	Xylitol /*Candida tropicalis*	Olive-Pruning Debris	[29]
	Arabitol		
Bioplastic: Poly-3-(Hydroxybutyrate-Co-Hydroxyvalerate) (PHBHV)	*Haloferax mediterranei*	(OMWW)	[30]
	Azotobacter chroococcum		[31]
Enzymes	α-amylase / SSF: *Aspergillus oryzae*	OOC	[32]
	Lipase and protease / *Candida utilis*	Olive Cake	[33]
Soluble Fiber and Protein	AlcalaseTM protein extraction	Olive Pomace	[34]
Flavor Compounds	D-limonene / *Rhizopus oryzae* and *Candida tropicalis*	Olive Mill Waste (OMW)	[35]
Organic Acids	Citric acid /*Yarrowia lipolytica*	(OMWW)	[36]
	Acetic acid		
Vitamins	vitamin E	Alperujo Extract	[37]
	Vitamins A and K, carotenoids	Olive Mill Wastewater	[38]
	Vitamin B12 / *Propionibacterium shermanii*, on predigested OMWW with *Aspergillus niger*	OMWW (Alpechin)	[39]

II. Conclusion

Both olive trees cultivation and olive oil and table olive production generate enormous quantities of very rich solid, liquid wastes need more and more exploitation and valorization to marketable by-product with health promoting properties is a promising field in olive oil and food biotechnology sectors.

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