Olive Mill WasteWater: From a major environmental issue to an eco-responsible valorisation.

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Context


Olive oil industry generates →
Three-phase system → OMWW


byproducts
(80% water + organics + salts,)


Mediterranean region →
Management → discharge and


30 Million tons / year
store in open-air bassin

Context

Storage problem (open air):

Rapid drying (sun heating and air flow)

Forms a crust at the interface

→ Mass transfer (water, oxygen) decrease

→ Soil asphyxiation and acidification

→ Sterile soils / river and ground water contamination

Context

OMWW

80 % of water

→ can be a water source (for irrigation, …)

Organic compounds

→ energy supply,

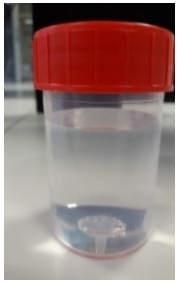
→ soil amendment,

→ fertilizer complement

Strategy

+ biomass
(sawdust, …)

drying



treatment

Water for irrigation or fertilizer solutions

Energy vector
Heat value ↗
…

Experimental section

Experimental drying tests

Operating conditions suitable with low-cost solar drying

→ Air temperature and flow rate controlled, 50°C

→ Sample thickness studied

→ Continuous mass recording,

→ Condensation of water in a condensing boiler body cooled by a cooling unit, sampling for analyses of water for reuse purpose

→ After drying → heat value of solid by-products

Experimental results

Drying tests

Impregnation of OMWW on biomass is interesting

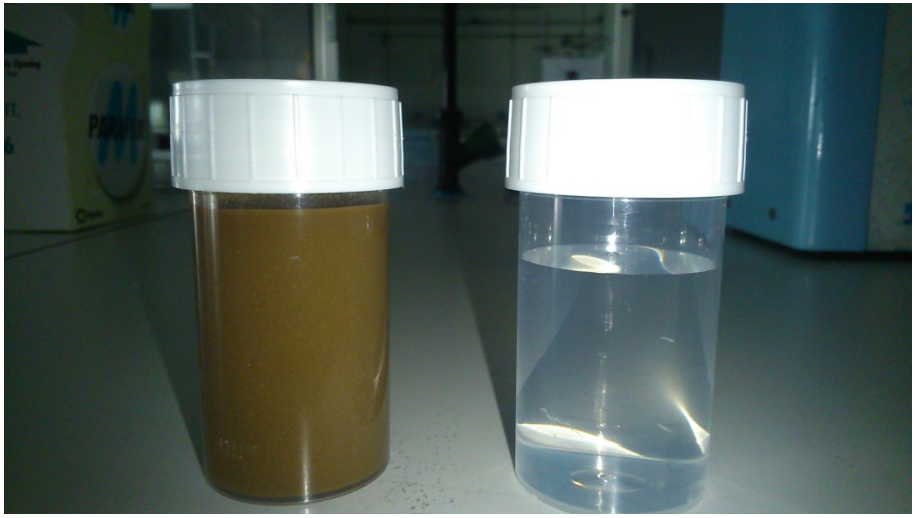
→ Quick and effective drying

→ Suitable for a solar unit

→ increase of LHV (→ 20%)

Water recovery

Effective recovery rate (~ 60 % of evaporated water)



		pH	ρ (µs/cm)	COD (g/L)
Raw OMWW		4.8	9730	100
IS		3.9	233	2.1
IWC		3.8	267	6.4
OMWW		3.5	293	8.4

Water recovery

Standards of water quality for irrigation… ex. For Tunisia

	Tunisia	Results
SM (mg/L)	< 30	~ 0
COD (mg/L)	< 90	> 2000
Faecal coliforms (MPN/100 mL)	< 2000	~ 0
Conductivity (µS/cm)	< 7000	< 300
Inorganic ions	= f (ion)	<< standards
Anions (Cl^-, SO_4^{2-},…)	= f (ion)	<< standards
pH	6.5 – 8.5	~ 3.8-3.9

→ Additional analyses (HPLC, µGC, ...) → identification of organic compounds in solution

Water recovery

Identification of chemicals in recovered waters (GC-MS)

In OMWW recovered water

- fatty acids
- tyrosol, glycerol,
- different sugars,
- ...

In waters from Impregnated biomasses (same chemicals +)

- short-chain acids
- amino-acids,
- urea,
- ...

→Biomasses supplied additional chemicals →

→Interesting nutriments for agricultural purpose

Water recovery

Additional treatment for pH → contact with crushed oyster shells and marble powder

Solutions "water from"	adsorbent	pH	COD (g/L)
OMWW		3.5	8.4
OMWW	Oyster shell	**6.6**	-
OMWW	Marble	**6.8**	2.2
Impregnated OMWW		3.9	2.1
Impregnated OMWW	Oyster shell	**6.6**	1.6
Impregnated OMWW	Marble	**6.8**	1.2

pH **ok**
COD not sufficient ↘

Water recovery

After pH correction → agricultural value

Can be used as fertilizer complement

for irrigation after dilution

Nutritive solution for hydroponic agriculture

Conclusion

Eco-frendly alternatives to OMWW discharge and natural storage are viable

→ Drying of impregnated biomasses

→ After drying, solid by-products can be densified and used as fuel or as soil improver

→ After condensation, water can be recovered and used for irrigation purpose (after pH adjustment and dilution) or fertilizer complement

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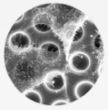

Thank you for your attention