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Biogas Production From Agro-Food Wastes In The Abruzzo Region (Italy)

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ABSTRACT: *The most abundant agro-food wastes in Abruzzo Region (Italy) are those derived either from olive oil production, e.g., olive pomace (OP) and olive mill wastewaters (OW), or from wine production, e.g., waste waters (WW) and wineries' solid waste (WS). All of these wastes have high organic matter Chemical Oxygen Demand (COD) mean value of 0.12 kg/kg for OW,0.80 for OP, 0.07 for WW and 0.44 for WS.*
We started from the results obtained from the last work on the wineries wastes (liquid and solids). We estimated about 3.361.105 Nm3 of methane produced per year in Abruzzo Region by wineries wastes and 155.553.736 Nm3 by olive mill wastes. This energy can be used by the enterprises as for thermic applications or as electric consumption to save energy costs.
Keywords: *Renewable Energy, agricultural waste, biogas, olive mill wastes, wineries wastes*

INTRODUCTION

Agricultural activities, waste management, and use of energy from fossil fuels, all contribute to global warming and climate change. Against this background it is necessary to strengthen waste management activities in the context of climate change, promoting alternative energy derived from natural sources. Biogas technology, also known as anaerobic digestion (AD) technology, can be considered a competitive process for reducing the rate of climate change and global warming managing biodegradable waste streams to produce renewable energy in a sustainable way.

1) Wineries wastes

Nowadays, the winery industry treats millions of tons of grapes and produces millions of cubic meters of effluents that, if not treated, cause environmental pollution. The treatment of waste waters from wineries are usually done by aerobic systems, which involves high energy costs because of the needs of oxygen required by this system. Moreover, during the treatment process, an excess of sludge is generated, which must be managed and this leads to extra costs. It has been developped an innovative anaerobic treatment plant, using high performance reactor able to treats medium sized wineries effluents, since actually anaerobic digestion only is profitable in wineries of big size. The development of such plant presents some advantages over aerobic processes: it will help to decrease the energy and operation cost, and also to reduce the production of excess sludge. It has been also investigated the possibility to treat also wineries' solid waste to enhance methane production and also to work all year with the plant. This solid wastes were identified, characterized and it has been estimated yield in methane by laboratory experience.

2) Olive mill wastes

Italy is the second world olive oil's producer; the two most abundant wastes generated from this agro-industry are a semi-solid effluent, olive pomace (OP) and a liquid one, olive mill wast water (OW). Several authors [1] reported the feasibility to produce biogas from these wastes.

DESCRIPTION OF THE VALIDATED MODEL FOR WINERIES

In Table 1 is reported the average composition of WW and WS for the Abruzzo Region (Italy) where are worked about 500,000,000 kg grape/year.

TABLE 1: WINERIES WASTES CHARACTERISTICS

	WW [2]	WS
COD (kg/kg)	0.007	0.44
Quantity (kg/year)	160,000,000	85,950,000

Anaerobic biodegradability experiments carried out by WW and WS have been carried out at 37 ºC. In Table 2 are reported the average methane yields obtained for WW and WS.

TABLE 2: AVERAGE METHANE YIELDS BY WW AND BY WS

	WW	WS
Nl CH_4/kg COD removed	330	114.4
Anaerobic biodegradability (% COD removed)	90	70

APPLICATION OF THE VALIDATED MODEL TO OLIVE MILL WASTES

Italy with about 1,350,000,000 kg/year of pressed olive, is the second world olive oil's producer. If we apply the same experimental model obtained in wineries sector for olive mill sector, it's possible estimate what reported in Table 3 and Table 4.

TABLE 3: OLIVE MILL WASTES CHARACTERISTICS

	OW [2]	OP
COD (kg/kg)	0.12 [3]	0.8 [4]
Quantity (kg/year)	20,250,000	67,500,000

In Table 4 are reported the average methane yields for OW and OP.

TABLE 4: AVERAGE METHANE YIELDS BY OW AND BY OP

	WW	WS
Nl CH_4/kg COD removed	270	114.4
Anaerobic biodegradability (% COD removed)	90	70

Polyphenolic compounds present in OW are originally synthesized by the olive plants as a defence against pathogens. Due to their high solubility in water, during the extraction process they pass into OW. These components inhibit anaerobic digestion (AD) so, before the AD process it's necessary to remove them.
With the data reported it's possibile to calculate the methane potentially produced by these wastes (Table 5).

TABLE 5: CALCULATED METHANE AND ENERGY YIELDS BY WINERIES AND OLIVE MILL WASTES

	Wineries	Olive mill
CH4 (m3/year)	3.361.105	4.914.810
MJ/year	106.378.987	155.553.736

Every year wineries can produce about 3,360,000 cubic meter of methane from wastes by AD treatment; olive mill factories can produce about 4,910,000 cubic meter of methane from wastes. Other studies are necessary to verify benefit for these factories depending by their size.

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