Plant for the Production of Compost from Food and Agricultural Wastes mixed with Tree Bark

1. Aim of the Project

The aim is to built and demonstrate a composting installation for the management of the waste streams of agro-industrial residues produced by CAVIRO. In addition the composting installation will eliminate a significant environmental impact by avoiding the landfilling of the waste streams and reduce the operational costs by producing a soil conditioner (or organic fertiliser) and eliminating completely the landfill costs.

Photo 1: General view of the composting plant

2. Introduction

CAVIRO is a nation-wide co-operative of wine producers, and fruit and vegetable distributing companies of Emilia-Romagna. The objective of CAVIRO are the cultivation, processing and selling of its products as well as secondary products produced from the residues of the wine processing. The co-operative runs four plants for the distillation of wine and residual products of wine production.

CAVIRO consists of 41 social and co-operative wine cellars, wine and fruit and vegetable co operatives representing over 50,000 farmers. Its overall annual production includes 300,000 anhydrous hectolitres of alcohol from wine, marc and lees, fruit, corn and molasses; 15,000 tones of rectified concentrated must, 1,500,000 hectolitres of bottled wine and various other valuable products such as tartaric acid, cream of tartar and Rochelle salts.

The majority of CAVIRO's production (90 %) is sold in its home market while the rest is exported.

3. Technical Description

The CAVIRO operations produce both liquid and solid waste streams. The liquid stream is centrifuged in order to thicken the suspended organic fraction. The thickened organic fraction is conveyed to the composting installation. The solid waste (all of biological origin) are stored in dedicated storage areas and then by means of hoppers and conveyor belts are weighted and fed in the composting plant.

All the residues are conveyed to a mixer where they are mixed under specific concentrations in order to produce a starting mixture of appropriate physico-chemical composition for the composting process. The ready mixed substrate is fed by means of a screw and one conveyor belt to the top of the nine rows (60m x 2.9 m) that form the processing unit of the installation (shown in photo 2). A specifically designed mixer (shown in photo 3) mixes it and pushes it gradually along the rows. The mixer, which is fully automated and computer aided, runs on the walls of the rows. Every six meters the mixers takes inside the compost for control purposes.

Photo 2: View of the rows

The mixer device pushes the compost along the rows and provides for the following integrated functions:

- turning over and moving of the substrate along the rows,
- moisturising, if necessary, the substrate by watering while turning over,
- oxygenating the substrate
- homogenising and crushing the substrate to prevent sod formation,
- measuring of oxygen and temperature

Air is supplied in the rows via distributed orifices under control conditions supplied by 8 fans. The air supply as well as the operation of the mixer are operated by a computerised control system.

After a retention time of 25 days the substrate has reached the end of the rows and it is then transferred to the curing station where it stays for another 20 days. After curing, the compost is refined by a rotating screen. The oversize from this screen is recycled back to the

composting process for microbial inoculation of the untreated material. The under screen size, is transported to the packaging installation where it is placed in sacks or it can be pelletised.

Photo 3: The mixing device during operation

4. Performance of the Composting Plant

The operating temperature increases up to 60 °C during the first days of reaction and it stabilises in the range of 45 – 55 °C in the successive stages of the composting process. The fans supply 0.1 m^3 air /min for each ton of treated raw substrate. The compost obtained is commercialised as an organic fertiliser and is used by the farmers of the co-operative too. Table 1 gives the composition of several of the substrates used in the plant while table 2 gives the average composition of the compost produced.

Table 1:Analysis of raw materials

Raw Materials	Processed Grapes #1	Processed Grapes #2	Chestnut Peel	Olive Husk	Centrifuged fruit	Cnetrifuged Sludge	Molasses Waste	Centrifuged waste	Marko
Moist.. %	55.0	14.5	62.3	65.7	70.5	79.0	43.	79.1	63.4
C % ss	55.7	50.3	47.8	57.8	26.0	38.9	31.5	31.9	44.4
S.O. %ss	96	86.5	82.3	99.5	44.7	66.9	54.2	54.8	76.6
N tot %ss	2.0	2.2	1.2	1.9	1.5	3.1	5.1	3.8	1.4
C/N ss	27.8	23.1	28.9	29.8	17.8	12.6	6.2	8.4	31.3
pH (1:2.5)	5.7	4.2	4.5	5.2	3.9	3.7	5.2	8.0	4.5
K2O %ss	1.6	1.6	0.6	1.5	0.5	1.1	9.6	1.6	0.6
P2O5 %ss	0.8	0.6	0.3	0.3	0.3	1.5	0.6	1.7	0.2
Pb ss ppm	<5	<5	35	12	11	45	<5	22	7
Cu ss ppm	85	97	25	13	63	55	<5	128	16
Cd ss ppm	0.9	0.5	0.8	2.0	0.8	0.3	1.0	1.2	0.3
Cr ss ppm	8	19	15	10	7	73	9	7	9
Zn ss ppm	35	32	355	450	31	220	450	124	35
Ni ss ppm	<50	<5	9	8	9	7	<5	13	11

(Note: ss= Solid State)

Table 2:Average composition of the compost

Raw Materials	Value
Moist.. wt%	34.0
Residue 105 °C wt%	66.0
C % ss	40.0
S.O. %ss	69.0
N tot %ss	2.9
C/N ss	14.3
pH (1:2.5)	7.5
K2O %ss	1.2
P2O5 %ss	1.7
Pb ss ppm	5.4
Cu ss ppm	138.0
Cd ss ppm	0.7
Cr ss ppm	9.3
Zn ss ppm	90.0
Ni ss ppm	30.0

The plant treats 80 tons waste a day for 6 days a week for a total of about 25,000 ton per year. The output of the installation is 40 ton per day compost for about 12,500 ton per year.

5. Economic Performance

The quality of the compost is very good and there has been no problem in its marketing to the farming community. The project has been so successful that CAVIRO is considering to double or even treble the capacity of the installation by a modular approach.

The whole production of high quality loose compost (about 9,000 t/y) is sold at 75,000 Lira per ton. The automated operation of the plant results in very low personnel (about 516 man-hours per month) and thus the operating and maintenance costs are relative low amounting to 265 million Lira.

The simple pay back calculation gives 3.8 years while the lifetime of the installation has been estimated to 15 years.

6. Project Identifiers

Project: **BM/238/92-IT**
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Technology: **BRECO sas, DEPRO srl**
Total Cost: **5,210,470 ECU**
EC Support: **989,989 ECU**