The Management & Sizing

of a Waste Water Treatment plant (with special regards to the local wine industry)

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Introduction

In Northern Italy a waste water treatment plant is in operation which besides treating the waste water originating from the sewer relative to the nearby town, also processes more specific water flows coming from a local winery.

When the treatment plant was built, at the beginning of the 80's, it was established as joint-that is for both public and private industrial uses.

The reasons that led up to this decision are the following:

- the polluted load relative to plant discharge from the private sector was almost completely composed of organic matter of vegetal origin (mostly alcohol and sugar) and was therefore compatible with the public municipal water discharge.

- The site of the plant, near the town, made it possible to adopt the same technological solutions for the various discharges of the entire area.

The plant

The Criteria adopted when deciding on the type and size of the plant was the result of approximately six months of tests made with small pilot plants.

At the end of the above period, a small pre-treatment plant for waste water was designed with the following characteristics:

Volume	**=**	**200 m³**
pH	**=**	**4,8 - 5,5**
Total Solids (110 °)	**=**	**3 - 6 g/l**
Volatile Solids	**=**	**2 - 5 g/l**
Fixed solids (600 °)	**=**	**0,5 - 1 g/l**
Sedimenting Solids (2 h)	**=**	**4 - 10 cc/l**
C.O.D.	**=**	**5000 mg/l**
T.O.C.	**=**	**1600 mg/l**
BOD5	**=**	**2500 mg/l**
Iron	**=**	**1 - 3 mg/l**
Copper	**=**	**traces**
Calcium	**=**	**20 - 40 mg/l**
Phosphates	**=**	**1 - 2 mg/l**
Total Nitrogen	**=**	**8 - 12 mg/l**
Ethilic alcohol	**=**	**1 - 2 g/l**
Total sugars	**=**	**1 - 2 g/l**

The waste water entering the plant which is composed of rinse water used to clean machines, surfaces, and wine casks is neutralized and clarified by means of a chemical-physical treatment called "clari-flocculation", using milk of lime and polyelectrolyte, and then finally mixed with toilet waste water, cooling waters (a minimum) and rain waters.

The waste waters are then discharged into a sewage collector in compliance with the acceptable limits as foreseen by Italian law.

Experimental tests were carried out in pilot plants with the analysis of water samples with COD values of about 2000 - 3000 mg/l.

The test results demonstrated that the best solution would be construction of a biological plant with activated sludge, prolonged aeration, very low organic load factor and periods of 3 days for waste water stagnation in the oxidation tank.

During construction of the plant, researchers continued doing tests in the laboratory on sewage treatment in order to identify the best conditions for obtaining the best purification performance in the least amount of time.

The main chemical-physical characteristics of the water entering the biological plant are as follows:

C.O.D.	**=**	**1.300 mg/l**
T.O.C.	**=**	**400 mg/l**
BOD5	**=**	**1.000 mg/l**
pH	**=**	**7 - 7,5**
Total Nitrogen	**=**	**20 mg/l**
Total Phosphorus	**=**	**6 mg/l**
Volume	**=**	**700 - 800 m³**

Because the best ratio of Organic Carbon, Nitrogen and Phosphorus (for the assurance of good bacteria growth) is 100 : 10 : 2, integration of Nitrogen and Phosphorus was made in order to ensure this ratio.

Later, a series of tests was performed using small off-line plants to evaluate the efficiency of a particular lyophilized bacterial culture, suitable in a facultative environment (aerobic or anaerobic) for the break-down of organic matter found in oenological waste water.

The initial results of these preliminary tests revealed that water, together with the bacterial culture, was already able to form active sludge after the second day of oxidation.

Upon the second day of areation, water inoculated by bacteria indicated a fifty percent less COD value, and after the third day the demolition of the polluted load increased to 95%, thus bringing the liquid matter to a limit acceptable according to the Italian law.

As the tests progressed, the necessary period for liquid to remain in the tank in order to obtain a COD value within legal limits was reduced.

Because of the positive test results, biological plant implementation was settled on.

At the beginning the plant was fed with diluted waters to begin the preliminary active sludge forming phase.

Later on (and presently) industrial waste waters were used.

During tests, a need was verified to shorten the analysis times in order to know, as soon as possible, the progress of processing at any given moment.

The purchase of a Total Organic Carbon process analyzer was considered with the assumption that the measured TOC value could be correlated with COD value.

A number of tests were performed in order to verify an invariable ratio between TOC values, continuously measured on the plant effluent, and related COD laboratory values.

Test outcomes were satisfactory, and from comparative analysis it was established that the COD/TOC ratio for waste waters is approximately 3.2.

By means of on line TOC analysis, it is therefore possible to know, at any given moment, the COD value of waters leaving the plant.

The TOC unit was installed just upstream of the entry of waste waters to the main sewer where analyzes on line and 24 hours per day, pre-filtered water samples (pre-filtration is done to avoid risks of clogging of the process instrument) on line.

Output is immediately recorded by means of a data logger connected to the instrument.

In such a way a daily graph can be obtained, which reproduces the contamination trend during a particular working day.

It is possible therefore to do on line analytical control which allows for the observance of COD values established by the law.

The instrument, thanks to its off-line system of sample extraction, can analyze water samples obtained separately.

Analyses have also been made on pure samples having a known TOC concentration: organic carbon revealed by the instrument matched with the real content of tested solutions, and with a 4 - 6 % deviation.

On line control of the plant effluent allows for the rapid verification of discharge contamination.

As a result it is possible to intervene in the treatment process in the event of overload.

Moreover the activities of the assigned staff can be supervised.

In fact, any incorrect operation causing the accidental spillage of the product is immediately detected by the resulting prompt deviation of TOC value from the average.

Conclusion

Management problems in the plant have decreased considerably thanks to selected microflora which assure the prevalence of the most appropriate bacterial strain for a certain organic load; moreover, the availability of a TOC analyzer, which determines the organic load of water flowing into the treatment plant, allows for precise knowledge of the actual situation.

In such a way it is possible to intervene with the right strategy, thus preventing possible problems that could otherwise arise in the plant.