LIQUID WASTE PROCESSING OF CELLARS BY BATCH STORAGE WITH AERATOR TWEAKING AND IMPLEMENTATION

World congress of the Vine and the Wine, OIV; 1996

Joel ROCHARD (1); Marie-Noëlle VIAUD, Dominique MONCOMBLE

Interprofessional Committee of the Wine from Champagne

5, rue Henri Martin, 51,200 EPERNAY - FRANCE

Tel. 33. 03. 26. 51. 19. 30 - Fax. 33. 03. 26. 55. 19. 79

Professional: joel.rochard@vignevin.com

(1) Deprived: rochard.joel@gmail.com

Dominique PLUCHART

***ORCATE** - 1, rue Eustache de Conflans - 51035 Champagne Châlons - FRANCE*

Tel. 33. 03. 26. 66. 25. 75 - Fax. 33. 03. 26. 65. 59. 79

Francis DESAUTELS

***ITV France** - 5, rue Henri Martin - 51200 EPERNAY - FRANCE*

Tel. 33. 03. 26. 51. 19. 30 - Fax. 33. 03. 26. 55. 19. 79

Key Words: Aired Storage, viticultural effluents, processing of purification, environment.

Key Words: Aerated storage, winery wastewater, wastewater treatment, environment.

Summary

Ventilated storage is a technique of extensive aerobic purification realized by batch which makes it possible to ensure the viticultural liquid waste processing over one period from 30 to 40 days.

Tests of tweaking carried out in microcomputer-purifications made it possible to stress the importance of the factors temperature and to a lesser extent of ventilation and the complementation in nutritive elements.

Studies complementary to industrial purpose are in hand within the framework of an European project Clean Enology.

Abstract

Extensive The aerated storage is year aerobics treatment realised by way. After 30 to 40 days, the effluent are treated.

Many parameters open to improve the treatment cuts been tested in microcomputer-sewage treatment. The parameters involved was the temperature, the ventilation, the addition of nitrogen and phosphorus.

The european project Clean Enology is year industrial program which the aim is to develop has biologic treatment of the winery wastewater.

I. INTRODUCTION

The linked activities with the development of the wines, are at the origin like any process of transformation of agricultural products, of organic rejections often prejudicial for the environment.

Compared to the other agro-alimentary sectors, the cellars have many specificities which do not make it possible to consider the direct application of the traditional techniques of depollution. Among the typicity of the cellars, one can retain the seasonal character of the rejections with an often important point at the time of the grape harvest, a frequent urban establishment thus limiting the place available and a great variability related to the viticultural production (development process, size, mode of organization). All these characteristics justify the tuning of specific processes of purification, associated with a fine characterization of the effluents.

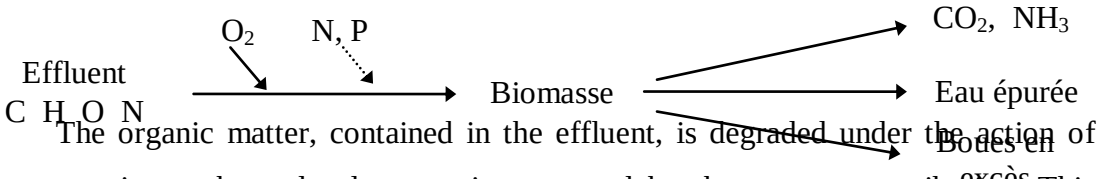
The Interprofessional Committee of the Wine from Champagne (CIVC) carried out investigations by 1980 to quantify the sources of pollution and to test devices of processing. Among these devices, the aired storage, which is an extensive aerobic processing, was retained in several cellars, in particular when spreading could not be implemented. In Parallel, tests in microcomputer-purifications were carried in order to optimize this process.

Currently, the Interprofessional Committee of Champagne is integrated in a European research program, Clean Enology, which aims at the tuning of an aerobic system of processing specifically adapted to the cellars.

II. PRESENTATION

II-1. Principle

The principle of purification by biological way can be summarized in the following way:



The organic matter, contained in the effluent, is degraded under the action of micro-organisms whose development is supported by the oxygen contribution. This

biological process involves the mud formation which is separated from the effluent treated by sedimentation. The purified supernatant is then evacuated towards the natural environment and formed muds are spread.

Vital energy for the aerobic micro-organisms is obtained by reactions of oxydoreduction of the components of the substrate which lead into final to CO2, H2O and NH3.

Ventilated storage is comparable to a processing by activated sludge (free culture) in batch, i.e. the following operations are carried out in the same tank (Fig. 1):

- storage of the whole of the effluents of the vintage,
- ventilation and mixing allowing the development of aerobic micro-organisms; those ensuring the degradation of the very concentrated organic matter,
- decantation of muds thus formed.

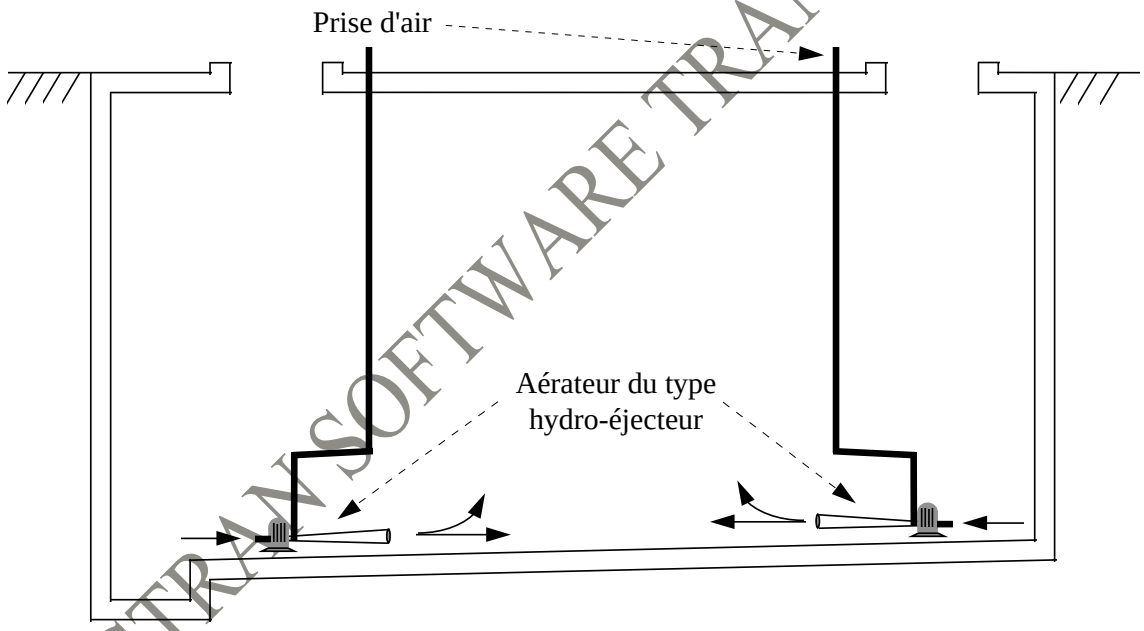


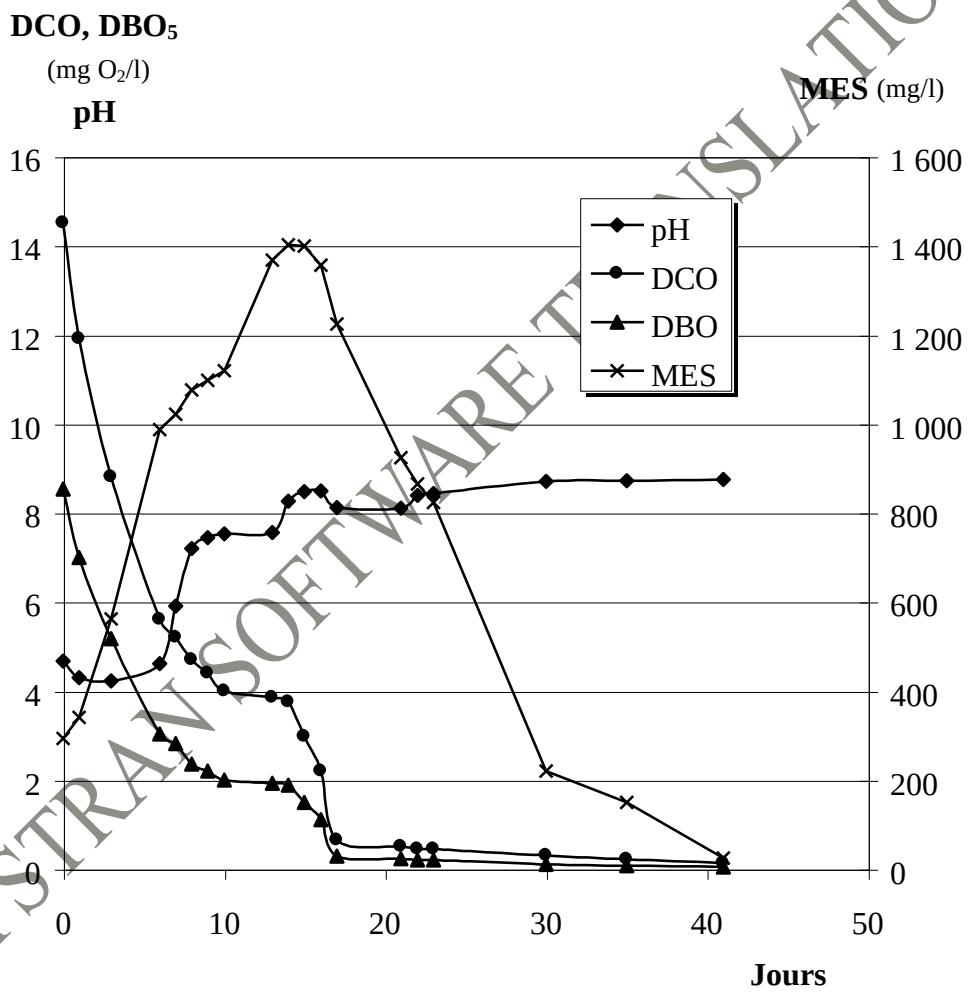
Figure 1: PRINCIPLE of operation of ventilated storage

The rejection with small flow of treated water can be then carried out on a period of time compatible with the network of cleansing or the receiving natural environment. Produced muds, which represent less than 5% of total volume, can be spread in agriculture.

II-2. Characterization of a cycle of depollution

During a cycle of processing the DBO5 and the DCO decrease rather quickly in the initial phase, then the speed of degradation decreases gradually (Fig. 2). One can suppose that the first phase corresponds to the degradation of the easily biodegradable compounds (sugars, acids, alcohol) while the final stage utilizes the transformation of made up biodegradable (macromolecules). Studies are currently conducted to characterize this called not easily biodégradée fraction "DCO hard".

Figure 2: Evolution of the DCO, the DBO5, MY and the pH during a ventilated storage



During the cycle, the suspended matter increases gradually, because of the multiplication of the biomass, then decrease, the substrate necessary to the rarefying development of this biomass. Some studies were conducted to characterize the biomass. Initially, the micro-organisms resulting from the cellars are prevalent (yeasts, lactic and acetic bacteria), then gradually the biomass evolves to the protozoa. At the end of the

processing, the presence of parameciums translates an important free bacterial mass and an availability into dissolved oxygen, sign of a reduction in the demand for oxygen of the micro-organisms.

The pH of about 4 in the initial phase of the processing increases little by little to reach a value of 8-9 at the end of the processing. This evolution seems related to the progressive degradation of the organic acids.

II-3. Implementation

The installments are dimensioned in order to be able to store the whole of the effluents of vintage. The volume of the basin is computed starting from a ratio generally varying between 50 and 100 liters of water per produced hectolitre.

Ventilated storage is generally made out of concrete in the form of a buried basin. This solution makes it possible to be freed from the problem of freezing, to obtain a processing faster related to the increase in the internal temperature, and to be able to use the higher zone of the basin, when this one comprises a flagstone, which contributes to its integration in the site. Some suckers, for economic reasons or difficulties of establishment, chose different options: storage in metal cisterns or creation of open basins of standard lagoon, provided with cover of sealing.

From a practical point of view, one can announce that the basins concrete, sensitive to the acid attack of the effluents must be the object of a specific processing. In the same way, the basins metal, likely to lead to an increase in the content of iron of the effluents must be coated with an adapted coating.

The technique of ventilation-mixing retained until now is composed of a submerged pump provided with an hydro-ejector for Venturi purpose. The open basins are generally equipped with surface aerator which ensure the oxygenation of the medium by effect of mixing. Studies are currently conducted on other devices of ventilation by taking of account the aspects reliability, nuisance, performance.

II-4. Some examples of equipment

According To the constraints related to the cellar, ventilated storage can be conceived various manners (. 1). The processing time is more or less long according to the design of ventilated storage (storage of the effluents in one or more tanks), according to the addition or not of effluents during the processing (effluent of

vinification) and according to the temperature of ventilated storage (buried or opened basin).

Nevertheless, whatever the mode of design, parameters (DCO, DBO5, MY, NR and P) of the effluent at the end of the processing are lower than the limiting values of rejection in the natural environment.

Methods	**Cellars equipped with a ventilated storage**		
	Romeny	**Serzy and Prin**	**Vincelles**
Type of ventilated storage	Tank underground	Open Basin	Isolated air Tank
Material of ventilated storage	Concrete resistant to the pH acids	Clay sealed by géomembrane	Covered Metal of a epoxydic resin
Capacitance of ventilated storage	120 m3	1,300 m3	Engine 70 m3 Storage 250 m3
Ventilation	Hydro-Ejectors (2)	Surface Aerator	Hydro-Ejectors (2)
Treated Effluents	Pressing	Pressing, vinification	Pressing
Processing Time	30 days	8 months	4 times 30 days
Destination of treated water	Natural Environment	Natural Environment	Natural Environment

Table 1: EXAMPLES of achievements of ventilated storage

III. TWEAKING OF THE PROCESS

The need for carrying out the storage of the totality of the effluents during the grape harvest is an important constraint in the implementation of aired storage, in particular in urban environment. Thus the CIVC were fixed like objective to shorten the cycle of processing in order to limit the volume of storage as much as possible.

A feasibility study carried out by microcomputer-purification made it possible to release the independent factors intervening on depollution. Following this study, a European research program Clean Enology was started in order to develop an aerobic process adapted to specificities of the cellars.

III-1. Tests in microcomputer-purifications

The experimentation was made out of engines of 120 liters starting from an effluent of pressing which had a DCO of 15 grams per liter and a pH of 3.7.

A device of aerator fines bubbles allowed an oxygen contribution of 30 mg/l/h, except for the batch n°6 for which the contribution was of 45 mg/l (Tab.2).

Batch	Factor	pH	Ventilation mg/l/h	Addition N+P	Temperature
1	Witness	3.7	30	not	ambient
2	pH 7	7	30	not	ambient
3	N+P	3.7	30	yes (1)	ambient
4	pH, N+P	3.7	30	yes (1)	ambient
5	Temperature	3.7	30	not	35°C
6	Ventilation x1,5	3.7	45	not	ambient

Table 2: Experimental Conditions of the tests carried in microcomputer-purifications

(1) A biammonic phosphate complementation (3 g/l) made it possible to approach proportions 100/5/1 of report DBO5/N/P.

The complementation of the nitrogen effluent and cogitates (batch 3) has a significant effect. Neutralization (batch 2) presents way a less positive effect. The combination of the neutralization and the phosphorus and nitrogen addition (batch 4) does not make additional improvement compared to the only nitrogen complementation and cogitates (Fig. 3).

The heating of the effluents at a temperature of 35°C (batch 5) contributes to accelerate purification significantly. The increase in the oxygen content to 45 mg/l/h also presents a positive effect, but to a lesser extent compared to the factor temperature.

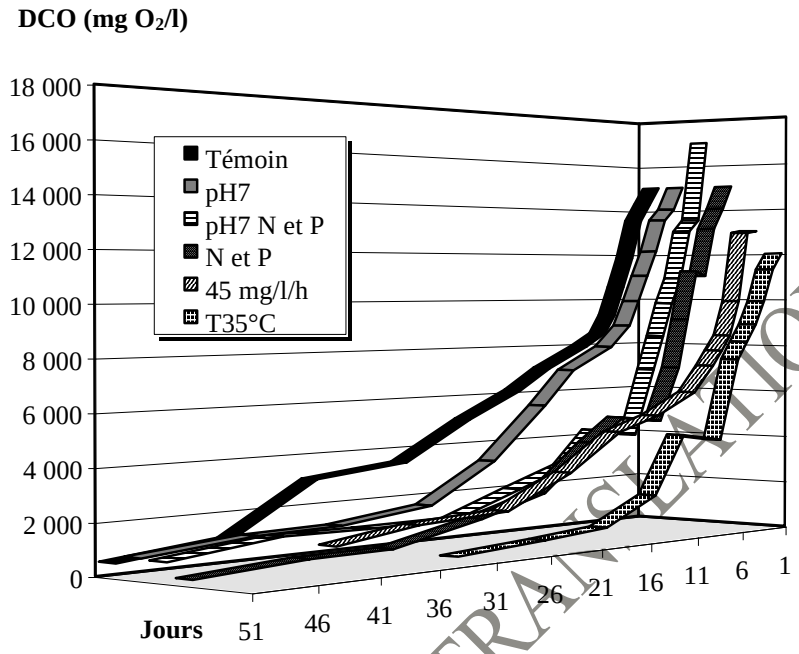


Figure 3 : Suivi de la DCO au cours du traitement en micro-épurations

III-2. Program European Clean Enology

SEVERAL industrialists working in the field of the cleansing and the viticultural world, with the research centres Spanish, German and French, as with the cellars are associated in the program Clean Enology.

Currently, the research tasks are undertaken, either in laboratory, or *in situ* on the pilots present in the cellars.

Search relates to the following aspects:

- characterization of the effluents and search of the specific parameters;
- devices of ventilation;
- biomass: type, support;
- muds: separation, valorization;
- operating process (batch, EDF-batch, on-line);
- processing of completion

- integration in the site (rustled, odor).

A first pilot of 7 m3, set up Champagne in January 1996, allowed to validate and improve the global design. A second modified pilot was established in the area of the Loire Valley in June 1996. A third pilot will be operational in a Spanish cellar for the grape harvest 1996. During the year 1997, a German cellar will be also equipped with a pilot of validation of the results got at the time of the previous year on the other sites.

CONCLUSION

Ventilated storage is a technique adapted well to the viticultural liquid waste processing. Its implementation extensive by batch makes it possible to obtain a level of purification authorizing the networked rejection of cleansing at the end of 15 days of processing, or in the natural environment with a processing time of about 30 to 40 days.

The tests of tweaking of the process show that this lead time can be appreciably reduced, in particular thanks to the combined action of the temperature, the level of ventilation and the nitrogen complementation and cogitates. A better knowledge of the purifying biomass should allow, in the future, to still improve the conditions of processing.

BIBLIOGRAPHY

EDELINE F., 1993. Microbial metabolism. *In the biological purification from water, 4th edition, 9-77.*

GERLAND C., ROCHARD J., VIAUD MN., 1992. Tweaking of the purification of the viticultural effluents by aerobic biological processing. *Report of test CIVC n°92614, 18p.*

PLUCHART D., ROCHARD J., VIAUD MN., 1994. Operation and tweaking of ventilated storage. *Acts of the international congress on the viticultural liquid waste processing June 20th-24th, 1994, 285-290.*

ROCHARD J., 1981. Tests of purification of the effluents of the viticultural establishments Champagne. *Report of tests CIVC, 32p.*

VIAUD MN., ROCHARD J., GERLAND C., DESAUTELS F., PLUCHART D., 1994. Tweaking of the aerobic biological processing of the viticultural effluents. *Acts of the international congress on the viticultural liquid waste processing June 20th-24th, 1994, 87-92.*

VEDRY B., 1994. Follow-up of an experiment of viticultural purification of effluent CIVC. *Report of the follow-up of the SIAAP CRITER, 23p.*