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Environmental licensing in the wine industry: A case study for the implementation and discharge of effluents from a treatment plant

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ABSTRACT
Environmental licensing is a management instrument established by the National Environmental Policy. An environmental license authorizes the location, construction, installation, expansion, modification, and operation of projects and activities considered effectively or potentially polluting. The wine industries have a high pollution potential within the environmental licensing process, being characterized by water consumption in several stages, generating a large volume of wastewater. This work aimed to present the environmental licensing procedures applied for the implementation of a wastewater treatment plant (WTP) in a winery in operation, in Rio Grande do Sul, Brazil. Also, was evaluated the alternatives regarding the destination for the treated wastewater. For the implementation of the WTP, the company obtained the following licenses: Preliminary Expansion License (PEL), Expansion Installation License (EIL), and Operation License Update (OLU). Due to the problem of the river flow, the alternatives described in FEPAM Technical Guideline number 005/2017 were analyzed for the disposal and reuse of treated effluents. WTP quality parameters were obtained. Following each environmental licensing procedure is essential for planning the implementation of a potentially polluting activity, to define the best alternative to minimize and mitigate all possible environmental damage.

Keywords: Environmental License, Wine wastewater, Reuse.

1 INTRODUCTION

Environmental licensing is an instrument established by Federal Law No. 6,938, of August 31, 1981, which provides for the National Environmental Policy (PNMA). Within this context, CONAMA Resolution No. 237, of December 19, 1997, provides for the revision and complementation of procedures and criteria, given the need to implement the licensing system as an environmental management instrument. This resolution defines that an environmental license authorizes the location, construction, installation, expansion, modification, and operation of enterprises and activities that use environmental resources considered potentially polluting. As defined by Article 10 of the Resolution, the environmental licensing procedure follows some steps, the main ones being:

I - Definition by the competent environmental agency;

II - Application for the environmental license, accompanied by the relevant documents, projects, and environmental studies;

III - Analysis by the competent environmental agency of the documents, projects, and environmental studies presented and the performance of technical inspections, when necessary;

IV - Request for clarifications and complementations by the environmental agency, when applicable,

V - Issuance of a conclusive technical opinion and, when applicable, a legal opinion;

VI - Approval or rejection of the license request.

Article 8 of CONAMA 237 defines the concepts and stages for environmental licensing, and the first license issued by the competent environmental agency is the Preliminary License (PL). As described in the Resolution, the PL is granted in the preliminary phase of the planning of the project or activity, approving its location and design, attesting to the environmental feasibility, and establishing the basic requirements and conditions that must be carried out in the next phases of its implementation.

The PL stage represents an important instrument to support the decision to implement or not a project and is considered fundamental for sustainable development. The Environmental Impact Assessment (EIA) occurs at this stage and has a preventive character, is the stage of the planning of a potentially polluting activity, subsidizing the decision regarding the alternatives for its implementation. As the main objective of EIA is the prediction and dimension of the possible damages, Andreoli and Donha (2021) state that it is a valuable instrument for planning alternatives, preventive measures, and control of environmental impacts. EIA is considered an important mechanism for the protection and defense of the environment and the conservation of natural resources.

After the PL, the second step is the Installation License (IL). This document, as described in Article 8 of CONAMA Resolution No. 237, authorizes the installation of an enterprise or activity by the specifications contained in the approved plans, programs, and projects, including environmental control measures and other conditions. The third and final step is to obtain the Operating License (OL) that authorizes the operation of the activity or enterprise, after verifying the effective compliance with what is contained in the previous licenses, with the environmental control measures and conditions determined for the operation.

Article 7 of CONAMA Resolution No. 237 also defines that the enterprises and activities will be licensed at a single level of competence. In the state of Rio Grande do Sul (RS), CONSEMA Resolution No. 372/2018, of February 22, 2018, provides for the enterprises and activities subject to environmental licensing, highlighting those with a local impact for the exercise of municipal competence in environmental licensing. In other words, this legislation defines which activities, based on the pollution potential and their size measure, must be licensed by the state agency (FEPAM), or by the municipal agency (Municipal Department of the Environment).

1.1 WASTEWATER GENERATION OF WINEMAKING PROCESSES

Within the environmental licensing process, wine industries have high pollution potential, according to CONSEMA Resolution No. 372/2018. In the Serra Gaúcha region, in the state of Rio Grande do Sul (RS), Brazil, the winery is of great importance, for its economic and cultural significance, as well as for its environmental impact. According to data presented by Embrapa Grape and Wine, in 2021, the South Region represented 73% of the total area with viticulture in Brazil, with RS being the main producing state, representing 62.41% of the national viticultural area, which corresponds to an area of 46,815 hectares. RS state accounts for more than 90% of the total production of wines and grape juice and about 85% of the sparkling wines produced in the country (EMBRAPA, 2022).

Winemaking generates wastewater at all production stages, mainly in the washing of floors and equipment. The main sources of wastewater generation in wine production do not refer to the manufacturing stages themselves, but to the washing operations, which occur during the crushing and pressing of the bunches, as well as in the cleaning of fermentation tanks, barrels, and other equipment and surfaces (LATESSA; HANLEY; TAO, 2023).

The pollution loads of the wine industry depend on the period of work (harvest, racking, bottling) and the technologies used for production (of red, white, or specialty wines, among others). Wastewater contains by-product residues (stems, seeds, skins, lees, sludge, and tartrates), losses of raw products (musts and wines caused by accident or during washing), products used for the treatment of wine (glues and filter soils) and cleaning and disinfection products used to wash materials and soils (AMOR *et al., 2019*). The wastewater produced in wineries is low pH with high organic strength, and contains different microorganisms, essentially bacteria, and yeasts, making them very toxic when discharged into water bodies (LATESSA; HANLEY; TAO, 2023).

Different forms of treatment can be used for wastewater treatment plant wineries, including chemical, physical, and biological processes. Regardless of the type of treatment, the sizing of the treatment system is also decisive for its effectiveness. Thus, the adoption of a certain treatment system must result from the analysis of factors such as characteristics of the winery, volume of effluents produced and pollutant load, geographical location, climate, legislation, investment and operating costs, operational aspects, and, especially, the receiving environment for the treated effluent (JORDÃO AND CONSTANTINO, 2017; LATESSA; HANLEY; TAO, 2023).

1.2 DISCHARGE AND REUSE OF TREATED EFFLUENT

Regarding alternatives for the discharge and reuse of treated effluents in the state of Rio Grande do Sul, FEPAM created Technical Guideline No. 005/2017, to assess the environmental feasibility of

licensing activities that generate sanitary or industrial wastewater, regarding the discharge treatment system. This Guideline establishes six alternatives for the environmentally appropriate final disposal of wastewater after its treatment, and enterprises may adopt more than one alternative simultaneously. Some of the main general guidelines of each alternative are outlined below:

1.2.1 Alternative 01: Sending liquid effluents for treatment in an external unit

In this type of destination, the effluent is sent in its raw form for treatment in another enterprise. The company that will receive the effluent must request "Authorization for the Receipt of Wastewater for Treatment" from FEPAM and must guarantee the system's capacity to receive and treat effluents from third parties. In this case, the control of compliance with emission standards will take place through the licensing process of the unit that contains the wastewater treatment plant (WTP).

1.2.2 Alternative 02: Treatment of liquid effluents and discharge into surface waters, including indirectly, through the rainwater network

In this alternative, the effluent is treated in a WTP operated within the company and the discharge of the treated effluent must meet, in others, the following general conditions:

- Verify the existence of a compatible water resource for release, indicating the form, whether direct (through its outfall) or indirect (rainwater channeling);
- The discharge of effluents must be channeled from the outlet of the WTP to the point of direct or indirect discharge;
- Verify compliance with CONSEMA Resolution No. 355/2017, regarding the standards for effluent emission in surface waters, and obtain the reference flow of the receiving water body through a Hydrological Study;
- If there is an indirect release, the entrepreneur must present a document certifying the agreement of the company operating the rainwater system to receive the treated liquid effluents.

According to CONSEMA Resolution 355/2017, the flow of the discharged liquid effluents must be related to the reference flow of the receiving water body, so that its discharge does not imply a quality lower than that established for the class in which the receiving body is framed.

1.2.3 Alternative 03: Treatment of liquid effluents and reuse for agricultural and forestry purposes

In this case, the effluent treatment will be intended to reuse the treated effluent as a nutrient in agricultural or forest soil. In this way, it will observe - among others, the following criteria:

- For a disposal volume greater than 20 m^3/day, the opening of a specific process for the activity must be requested. For lower volumes, the request must be attached to the project's OL.
- The application of treated liquid effluents is only allowed for crops that are not consumed raw;
- The maximum sodium adsorption ratio (SAR) allowed in the effluent will be 12 and the maximum concentrations for the other parameters must meet the standards established in CONSEMA Resolution No. 419/2020.

1.2.4 Alternative 04: Treatment of liquid effluents and discharge in the soil

After treatment at the WTP, the effluent can be disposed of in soil through sinks, basins, ditches, and infiltration and evapotranspiration lots. This alternative is feasible only for wastewater generated in food industries or effluents predominantly composed of organic substances. It is conditioned to the performance of studies that prove its environmental feasibility, containing an assessment of the impact on soil and groundwater, and must meet the determinations of FEPAM Ordinance No. 68/2019, which provides for the criteria for the final disposal of sanitary and industrial wastewater on land. It depends, among other studies, on:

- Determination of the infiltration rate of the area from a minimum number of tests: six tests in the planned area;
- Monitoring of groundwater quality according to specific plan;
- Treated effluent must meet the quality standards defined in the legislation.

1.2.5 Alternative 05: Treatment of liquid effluents and reuse for urban purposes

The treated effluent, in this case, should be used in landscape irrigation (observing the concentrations of chlorides and sodium, aiming to minimize impacts on soil and vegetation), washing of public places and vehicles, civil construction, and buildings in the urban area, among others. In addition, an alternative solution should be provided when is not possible to discharge effluents.

1.2.6 Alternative 06: Effluent treatment and industrial reuse

In this situation, the treated effluent will be used for purposes other than discharge into surface waters or disposal on land, such as reuse in industrial practice. In this case, concentrations and parameters must be defined to ensure quality in reuse. A monthly report on reusing water should also be made, and an alternative should be provided for the disposal of the effluents generated, in case of operational problems.

Given the above, this paper aims to present the environmental licensing procedures for the implementation of an WTP in a winery, in operation, located in the Serra Gaúcha region. In addition, it shows the problem of the generation and management of winery effluents regarding the disposal, reuse, and monitoring of wastewater, within the scope of the state of Rio Grande do Sul, Brazil.

2 METHODOLOGY

The methodology used in this work was exploratory qualitative research, presenting a case study. The environmental licensing procedures for the installation of a wastewater treatment plant of a winery in operation in Serra Gaúcha/RS/Brazil. Additionally, was analyzed the alternatives for the disposal and reuse of treated effluents according to Technical Guideline No. 005/2017.

2.1 CASE STUDY

The company's activity is the "Manufacture of wines and sparkling wines", with an area of 20,000.00 m². According to Annex I of CONSEMA Resolution No. 372/2018, the pollution potential is high and its size is large. With these characteristics, the competent agency for environmental licensing is the state (FEPAM).

When it started its operation, the company did not have a WTP of the effluents generated, which were transported for treatment at the WTP of another unit of the same business group. As described in the OL at the time, the company was authorized to send its liquid effluents for treatment by a third-party company. With the condition that it sends to FEPAM, every quarter, reports on the shipment of the liquid effluent containing the volumes sent monthly, a form of packaging, and the corporate name of the transport company licensed by FEPAM, in compliance with the provisions of Alternative 01 of Technical Directive No. 005/2017 (sending liquid effluents for treatment in outdoor unit).

Subsequently, there was a need to install a proper system for the treatment of effluents, due to the following factors:

I – The unit responsible for the treatment of effluents needed to increase its production capacity, and, consequently, the flow of the liquid effluents generated. As a result, could not receive external effluents ;

II – The logistics and cost of transporting this raw effluent, which must be carried out by vehicles licensed by FEPAM for the transport of dangerous cargo, made the process more expensive.

2.2 ENVIRONMENTAL LICENCES

To ensure the feasibility of the implementation of the WTP and a compatible alternative for the discharge of the treated wastewater, the current legislation was analyzed, and the procedures for obtaining environmental licenses were applied. For all stages, the state's Online Licensing System (OLS) was used and, as the industrial activity was already in operation, the licensing procedures went through the following phases: preliminary expansion license (PEL), expansion installation license (EIL), and Operation License Update (OLU). Thus, all the procedures for obtaining the licenses were presented and the conditions of the environmental licenses issued by the environmental agency were analyzed.

Within the licensing phases, the feasibility of two alternatives contained in Technical Guideline No. 005/2017 for the disposal of treated effluent was also analyzed: "Alternative 02 - Release into surface waters, including indirectly, through the rainwater network" and "Alternative 03 - Reuse for agricultural and forestry purposes".

2.3 EFFICIENCY OF THE WASTEWATER TREATMENT PLANT

After obtaining all the necessary licenses, and with the WTP in place, samples of the raw effluent and the treated effluent were collected for monitoring the quality parameters, to comply with the items described in the OL. The efficiency of the implemented WTP was determined as a percentage, from the comparison of the results of the parameters obtained in the analysis of the input effluent with the results of the parameters obtained in the analysis of the output effluent. The calculations were developed using the following equation formula, for each parameter independently:

$$\text{Efficiency (\%)} = \frac{\text{Input WTP} - \text{Output WTP}}{\text{Input WTP}} \times 100$$

The effluent samples were collected in plastic bottles, which were stored in a refrigerator until they were sent to an accredited laboratory according to ABNT NBR ISO/IEC 17025. The results obtained were compared with the launch standards described in the OL, by CONSEMA Resolution 355/2017.

3 RESULTS AND DISCUSSIONS

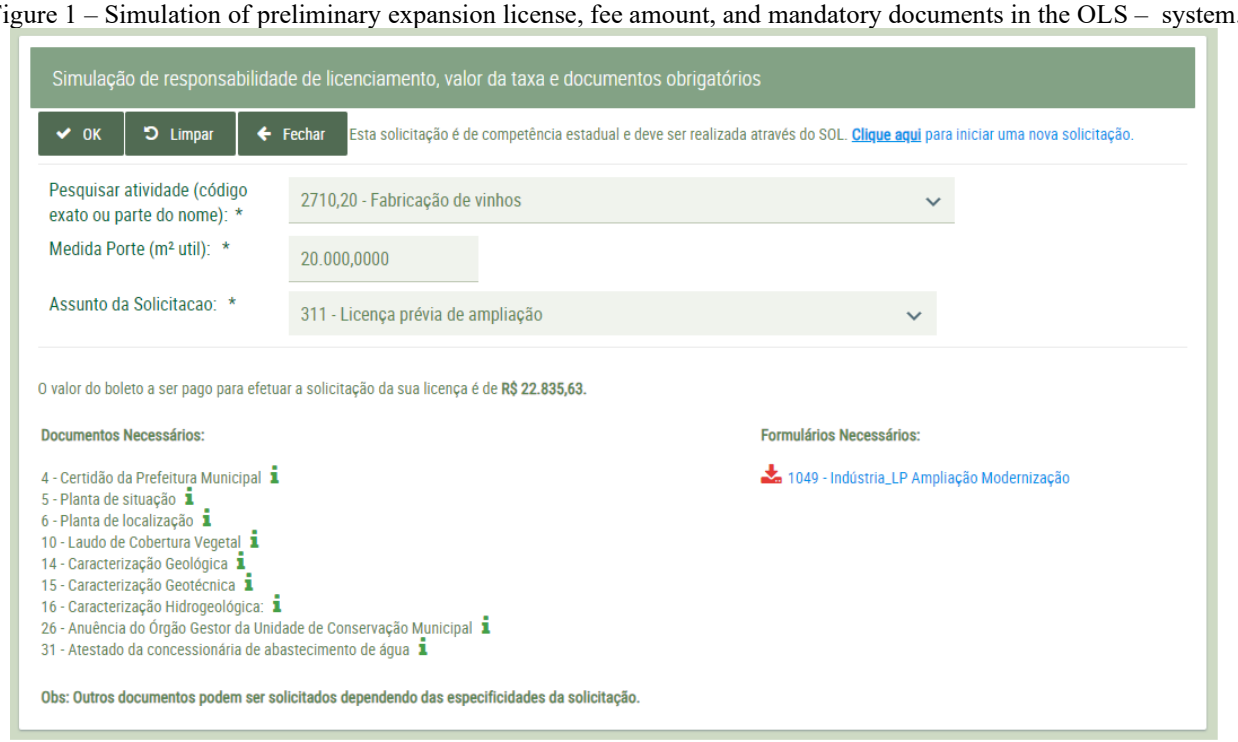
The procedures for obtaining environmental licenses for the implementation of the wastewater treatment plant and the release of effluents treated by the winery are presented below.

3.1 PRELIMINARY EXPANSION LICENSE (PEL)

The expansion or modification of already licensed projects also needs to be previously licensed, in which case, the first license to be requested is the preliminary expansion license (PEL). The PEL is the license requested by the entrepreneur to change a project with an operating license, when, among other cases, the intended changes imply an increase in the effluent flow or change in the discharge point (FEPAM Ordinance No. 301/2023).

As the studies to obtain any PL aim to predict environmental impacts in the planning and design phase of the project, its result can identify ways to reduce negative impacts, adapt projects to become viable, and, consequently, reduce costs for the entrepreneur. In this sense, Andreoli and Donha (2021) state that there are environmental and economic advantages associated with obtaining LP, because if the impacts caused by a project are raised only after its implementation, the costs for recovery or remediation of damage caused can be immeasurable, and the negative impact can be permanent and irreparable. According to the consultation carried out *in* FEPAM's Online Licensing System (SOL), the documents required for the PEL stage are presented in Figure 1.

Figure 1 – Simulation of preliminary expansion license, fee amount, and mandatory documents in the OLS – system.



Source: OLS System (2023).

Among the documents requested is the certificate from the City Hall, which is mandatory according to Article 10 of CONAMA Resolution No. 237/1997. This document is issued by the Municipal Government based on the Master Plan and indicates the permitted uses for the area subject to licensing, specifying the existence or not of restrictions on its use for the proposed activity. In the case of the winery analyzed, its area is in industrial zoning, and there are no restrictions for the implementation and/or expansion of the activity on the site, according to the current municipal legislation.

Also, the following was required: vegetation cover report, contemplating the area that will undergo intervention; descriptive report of the local fauna and surroundings, with its probable interaction with the flora; geological, geotechnical, and hydrogeological characterizations, containing a geological mapping of the land area with the description of the lithologies of the substrate and the indication of the respective formations where they are inserted, and an indication of the depths of the levels of the phreatic aquifer. In addition to a plan of the situation and location containing an indication of the existing buildings or to be built, surface water bodies, Permanent Preservation Area (PPA) and, if existing or projected, WTPs, waste storage, and disposal areas, chimneys, product storage tanks, etc.

To prepare all the related studies, it was necessary for a multidisciplinary team composed of technicians with training in various areas, such as biologists, geologists, and engineers, to evaluate the possible data for the physical, biotic, and anthropic environments. As established by Article 11 of CONAMA Resolution No. 237/1997, all studies necessary for the licensing process must be carried out by legally qualified professionals, and the entrepreneur and the professionals who subscribe to the planned studies will be responsible for the information presented, subject to administrative, civil and criminal sanctions.

In the case of the winery in question, as it is an expansion for the installation of the WTP in a licensed useful area, there was no need for suppression of vegetation or interference with the local fauna. The main impacts to be evaluated in this case were due to the discharge of treated effluents.

The first alternative analyzed for the disposal of treated effluents was alternative No. 02 of Technical Guideline No. 005/2017, "Release into surface waters, including indirectly, through the rainwater network". In the case of the company, the direct discharge into a water body that passes through the company's property was analyzed, as it was not possible to prove whether the existing rainwater network is fully channeled to the point of release into the water body. An agronomist prepares a Hydrological Technical Report to determine the minimum flow of the water body intended for the discharge of effluents treated by the company. As described in CONSEMA Resolution No. 355/2017, for the emission of treated effluents into surface water bodies, the carrying capacity of the receiving body must be considered so that the impact of the discharge of the treated effluent is as minimal as possible, not significantly altering its quality.

Through the Hydrological Technical Report, it was found that the intended point for the discharge of the treated effluents is an unnamed watercourse, which is inserted in the Taquari – Antas River Basin, approximately 0.5m wide and 0.2 meters deep. Also, the maximum flow of treated industrial effluents that could be discharged into the water body in question was determined, as being 5.0 m^3/day or 0.0000578 m^2/s.

As the maximum effluent flow generated by the project was 25.0 m^3/day, it was necessary to think of another alternative to the project. Technical Guideline No. 005/2017, for disposal of the remainder of the effluent generated. Because the company has a large area available for irrigation, alternative No. 03, "Reuse for agricultural and forestry purposes", was simultaneously chosen. As the difference in volume to be applied was 20.0 m^3/day, there would be no need to open a specific process for the activity. Also according to CONSEMA Resolution No. 372/2018, when the effluent application takes place in the same area as the generating project, the authorization for this application must be included in the license of the project itself, and this area is not computed in a useful area.

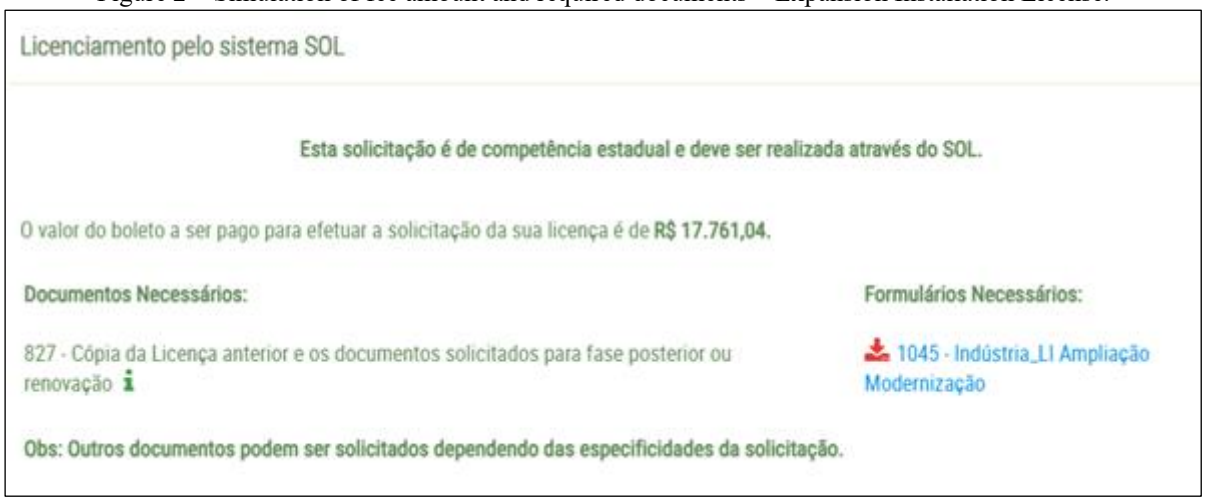
Therefore, a PEL request was filed with FEPAM in January 2018, presenting the Hydrological Technical Report for the release of treated effluent into the receiving water body, with a maximum flow of 5.0m^3/day. The Technical Report, prepared by an agronomist, regarding the feasibility of applying the rest of the treated effluent, utilizing sprinklers, in an area of 2.21 hectares on the entrepreneur's property, that is, application of a maximum flow of 9.049 m^3/ha/day.

To prove compliance with the proposed alternatives for the discharge of the maximum effluent flow, through two alternatives of the Technical Guideline No. 005/2017 At the same time, FEPAM issued the PEL in June 2018, attesting to the environmental feasibility of the intended expansion, indicating the requirements to be met in the next phase of its implementation. The PEL does not authorize the start of the expansion works, and the change will only begin after the issuance of the Extension Installation License.

3.2 EXTENSION INSTALLATION LICENSE (EIL)

As defined in Ordinance No. 301/2023, the EIL is requested by the entrepreneur for the implementation of the project change with OL emitted, preceded by PEL. According to the simulation carried out in the OLS system (Figure 2), the documents required to obtain the EIL are described in the PEL.

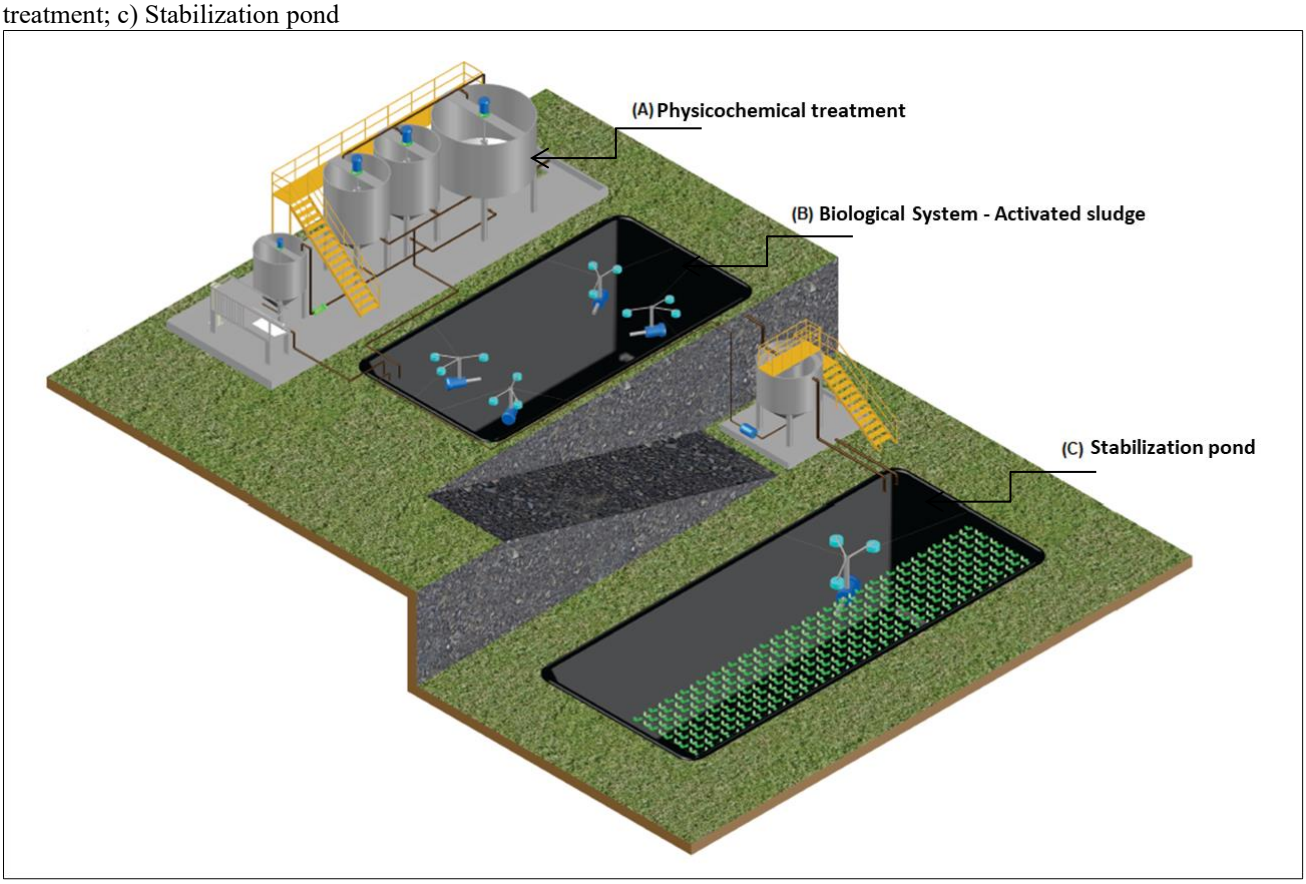
Figure 2 – Simulation of fee amount and required documents – Expansion Installation License.



Source: OLS System (2023).

Among other documents, FEPAM requested the Project of the WTP to be implemented, which was prepared by an engineering professional. In the case of the winery, industrial waste is generated in the washing of floors and equipment of the industrial process and bottling. The proposed system consisted of physicochemical treatment, a biological system of activated sludge with prolonged aeration, and a stabilization pond, as shown in Figure 3.

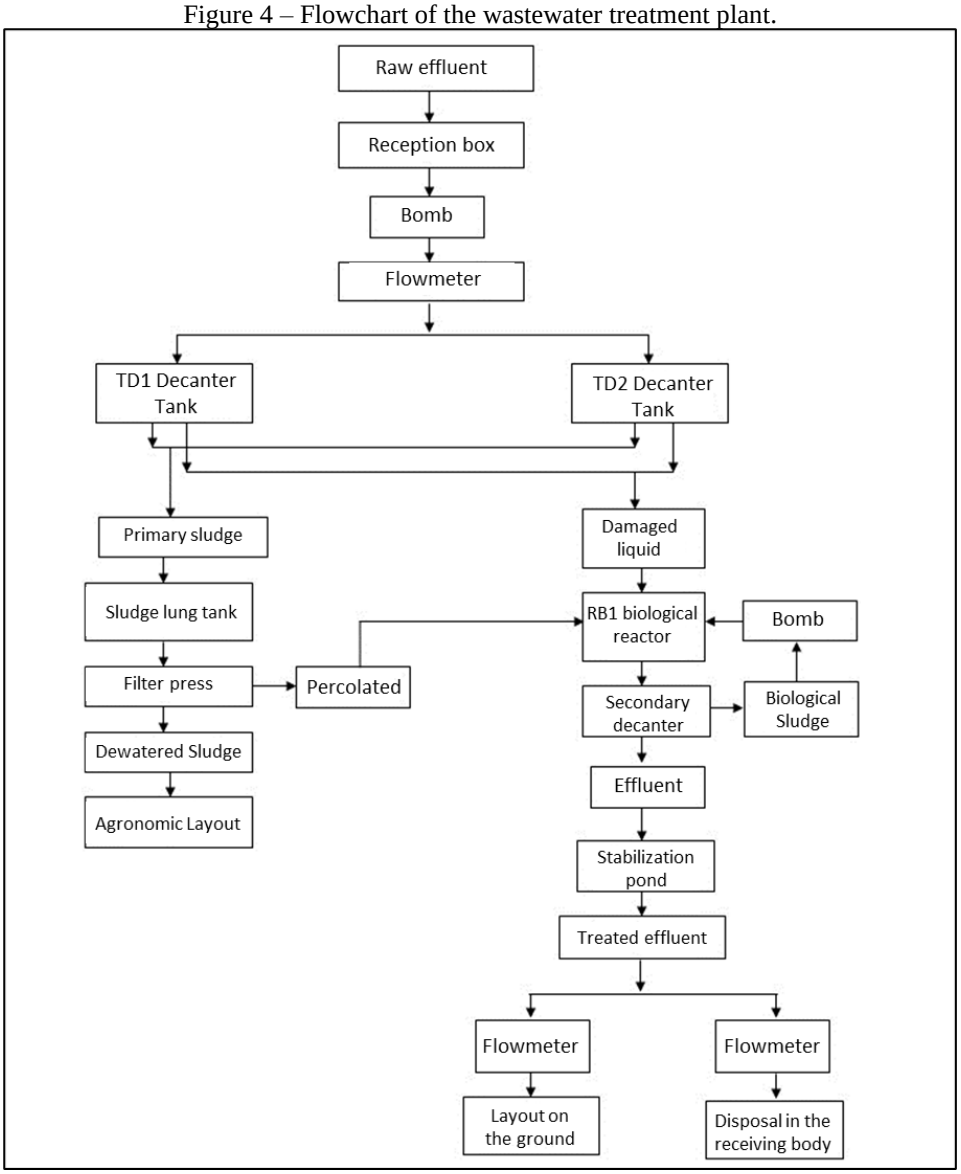
Figure 3 – 3D image of the project of the proposed wastewater treatment plant: A) physicochemical treatment; B) biological treatment; c) Stabilization pond



Source: Project of the wastewater treatment plant of the project (2018).

According to the flowchart of the WTP (Figure 4), in summary, all the effluent generated in the industrial process drains by gravity through channels located on the factory floor to the reception box with a sieve to remove coarse solids (remains of husks, seeds, and sludge). Then, the effluent is pumped into the decanter tanks for primary (physicochemical) treatment, where the pH of the input effluent, which is usually low, is corrected. Once the clarification and decantation reactions are completed, the effluent is taken to the biological reactor, where the secondary treatment is carried out through an activated sludge process with prolonged aeration. Activated sludge is composed of flakes, formed by the continuous growth of microorganisms in the presence of dissolved oxygen (supplied by air blowers), which degrades organic substances. When it reaches the required volume, the effluent flows to the secondary decanter, where, after decantation of the biological sludge, the treated effluent goes to the stabilization pond to later be discarded in the receiving body or to be used in irrigation.

Figure 4 – Flowchart of the wastewater treatment plant.



Source: Project of the wastewater treatment plant of the project (2018).

After the opening of the administrative process at OLS in August 2018, requesting the EIL, with the presentation of all the necessary documents, the process went to the stage of analysis by the competent environmental agency. FEPAM requested clarifications and additions to ensure that the treated effluent discharged into the receiving body does not exceed the maximum flow allowed for discharge, which is 5.0 m^3/day. To solve this issue, the company proposed the installation of a flow meter to control the volume of effluent discharged into the water body. Therefore, the EIL was issued in December 2018, authorizing the start of the expansion works, referring to the installation of the WTP.

Concerning the watercourse provided for the disposal of treated effluents, FEPAM in the EIL established as a condition of the license, that of the PPAs corresponding to the 30 (thirty) meter-wide strip of the stream. It also established that, during the installation of the pipe, there should be no intervention with excavation in the PPA strips, and should preferably carry out the installation of overhead pipes or in a less invasive way about the soil and vegetation.

3.3 OPERATING LICENSE (OL)

After the completion of all the installation works of the WTP, the next step was the updating of the Operating License (OL) to include the expansion. The request is required in the administrative process that generated the license. In this case, the following were attached: an updated floor plan with a clear indication of all areas used by the project (built and circulation and/or outdoor activities); a technical report describing all the changes made, accompanied by a photographic survey of the modified/expanded areas and their surroundings, and form - duly completed and updated in all its items. The protocol requesting an update of the OL to include the completed expansion took place in September 2019, and the update was only issued in October 2021. The deadline for issuing the license was longer than that established by CONAMA Resolution No. 237/1997, which is six months, from the time the application is filed until it is granted or rejected.

In addition, flow meters were installed at three: one at the input of the WTP, another at the output WTP to the receiving body, and another at the output WTP for irrigation.

During the period in which the WTP was implemented and the OL was outdated, the company maintained internal monitoring of the system's efficiency, through periodic analyses, to ensure compliance with the standards for the discharge of treated effluents. With the issuance of the updated OL, in October 2021, conditions and restrictions related to the monitoring of the liquid effluents generated were established, such as:

The maximum total flow of the wastewater treatment plant is 25.0000 m^3/day, where:

✓ The maximum flow allowed for the discharge of industrial liquid effluents into the unnamed stream is 5.0000 m^3/day.

✓ The surplus treated effluent must be disposed of in the soil at a maximum flow rate of 20.0000 m³/day.

To monitor the treated effluents that pass through the flow meter and are discharged into the water body, FEPAM requests:

✓ A technical responsible for the operation of the WTP must be maintained, as well as a technical report signed by the respective technical manager, describing the operating conditions of the WTP, must be presented every six months, in January and July;

✓ It must be submitted to FEPAM, the result of a physicochemical analysis of its treated liquid effluents, every six months, in January and July, and the result of a physicochemical analysis of its input effluents with annual periodicity, in March;

At the exit of the WTP, the liquid effluents must meet the emission standards established by CONSEMA Resolution No. 355/2017. Regarding the monitoring of the treated effluent applied to the soil, FEPAM required that the application be carried out uniformly in the areas, using equipment equipped with a spreader mechanism, or another irrigation system, and the application through a hose was prohibited. In addition to establishing the parameters and standards for application on agricultural soil, it also requests:

- An annual soil analysis report of the lots where the effluent was applied, at a depth of 0 to 20 cm, must be sent to FEPAM, at an annual interval, accompanied by the respective collection reports and an indication of the analysis methodology used;
- An effluent analysis report must be sent to FEPAM, every six months, in June and December;
- A report prepared by the technical responsible for the activity must be presented every six months, in June and December, evaluating its performance in all areas of application used by the company.

3.4 EFFICIENCY OF THE WASTEWATER TREATMENT PLANT

The raw effluent sample for analysis was collected at input the treatment system and the treated effluent sample was collected in output the WTP, before discharge into the receiving water body.

Table 1 lists the results of the parameters obtained in the analysis of the input and the output in WTP, the emission standards for the discharge of effluents into water bodies, according to the OL and CONSEMA Resolution No. 355/2017, and the efficiency of the treatment.

Table 1 - Analytical results of the input and output in WTP, standards of CONSEMA Resolution 355/2017, and efficiency of the treatment.

Parameter	Input mg/L	Output mg/L	CONSEMA 355/2017 mg/L	Efficiency %
pH	8,9	7,39	Between 6.0 and 9.0	16,96%
BOD5	4.225	34	≤ 150	99,19 %
COD	13.508,33	104,67	≤ 360	99,2%
Ammonia Nitrogen	9,337	<5	≤ 20	46,45%
Oils & Greases Vegetable/Animal	60,9	<10	≤ 30	83,5%
Sedimentable Solids	<0,1	<0,1	≤ 1,0	-
Suspended solids	280	24	Up to 155	91,42%
Phosphorus	25,3	1,849	≤ 4,0	92,7%
Surfactants	2,17	0,17	≤ 2,0	92,1%

Source: Author (2023).

It was observed that the WTP implemented was efficient for all parameters analyzed. At the point of measurement of the input in WTP, the concentrations of almost all parameters are above the limits established by CONSEMA Resolution 355/2017 for discharge into water bodies, except pH, ammonia nitrogen, and sedimentable solids, which, even before treatment, had concentrations below the limits. At the point of measurement of the output in WTP, all parameters comply with the standards set by legislation.

As observed, the evaluated winery has effluents with high biochemical oxygen demand (BOD >2,000 mg) and chemical oxygen demand (and COD > 5,000 mg/L), according to the classification of Jordão and Constantino (2017). The BOD/COD ratio is 0.31, which, according to Metcalf and Eddy (2003), means that it is necessary to be careful in the choice of the treatment system process because purely biological treatments may not be enough. Because of this, the use of a physicochemical system followed by biological systems was very efficient in this case study. This type of treatment is widely used in wineries around the world (LATESSA, HANLEY, AND TAO, 2023).

About the monitoring of the disposal of treated effluents in agricultural soil, soil analyses of the areas where irrigation occurred were also carried out. With the results of the analyses, the agronomist responsible for monitoring calculated the Sodium Adsorption Ratio (SAR) in the effluent, arriving at the result: SAR = 1.9. This result is satisfactory, considering that the legislation determines that the maximum SAR allowed in the effluent is 12. Also considering the results of the soil analyses and the criteria established by CONSEMA Resolution No. 419/2020, it was observed that there are no elements that present higher concentrations of the established values, indicating that the area in question does not present contamination. According to the flow meter, the average volume of effluent disposed in the soil was 8.21 m³/day.

The disposal of winery effluents on agricultural soil is a common practice in several countries around the world. However, guidelines, such as volumetric application rate and pollutant concentrations, vary greatly from country to country (LATESSA, HANLEY, AND TAO, 2023).

3.5 CONCLUSIONS

Environmental licensing is a fundamental environmental management tool for planning the implementation of a potentially polluting activity, defining the best alternative for its execution, and minimizing and mitigating all possible damage to the environment, thus generating economic, environmental, and social benefits to the place where the project is being implemented. By considering all the risks involved in the implementation or expansion of a project, environmental impacts are reduced, thus achieving the main objective of licensing, which is to enable sustainable development.

A PL provides the feasibility of implementing a project. In this case study, it was possible to study the best option for the treatment of the effluent generated, as well as the most viable alternative from an environmental and economic point of view, for the disposal and reuse of the treated effluent, without generating impact to the environment and the company. If the project had implemented the system without prior licensing, and without taking into account the characteristics of the receiving water body, in addition to the fines and other sanctions provided for in the legislation, there could have been extra costs for resizing the system to meet the alternatives of Technical Guideline. Or even, if there was no alternative for reusing the effluent, the company would be unable to dispose of all the treated effluent. That is why it is important to analyze the feasibility of any change before it is implemented.

With the analyses carried out periodically and with the proper operation, the wastewater treatment plant implemented proved efficient in meeting the established parameters, both for discharge into the receiving water body and for reuse in irrigation.

Concerning the deadlines for the issuance of environmental licenses, the PEL and EIL were issued respecting the maximum period of six months, provided for in the legislation. As for updating the OL to include the expansion, the environmental agency took more than two years to issue the document. During this period, the enterprise continued to monitor the system by carrying out analyses. Often, the delay in analyzing and granting a license ends up harming companies, which choose to carry out expansions before the issuance of the license, which can lead to fines or rejections of licenses.

This work showed the importance of any implementation or expansion of polluting activity starting with prior environmental licensing so that any environmental risks are minimized and sustainable development is achieved.

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