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Evaluation of Rainwater Management in Agri-food Industries: Case Study of Cameroon's Plant Brasseries of Yaounde

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Abstract: Management of rainwater in industries is a challenge in many countries**.** This study, carried out at the Brasseries du Cameroun, at the plant of the Central Region, aimed to evaluate the management of rainwater within the plant. Thus, it was necessary to evaluate the current state of rainwater management according to the rainwater pollution prevention method proposed by the American Environmental Protection Agency in 2009, revised by Christopher Newport University in 2016 in the United. Furthermore, it was important to Characterize the pollutants in the surface water of the Aké River, which is directly located alongside the plant, and to identify the areas at stake in the plant. The range of activities carried out in the workshops, such as handling, the transfer of products from one workshop to another, washing (bottles, crates and tanks) and waste management, are all at risk of polluting rainwater. Solid waste constitutes 39% of the plant's potential pollutants, followed by fermentable products and waste (29%), chemicals (21%), metals (6%), bacteria (5%), biological products (3%), oils and fats (3%). These pollutants threaten the Aké tributary's water quality. This was observed on the results of: chemical dissolved oxygen demand COD reaching a maximum value of 860 mg/l at the brewery delivery station, suspended solids with a maximum value of 600 mg/l at the outlets of the stormwater drains at the wastewater treatment plant, and phosphate content with a value of 100mg/l at the conditioning, in the rainy season. This was observed on the results of: chemical demand for dissolved oxygen COD reaching a maximum value of 860 mg/l at the grain delivery unit, suspended solids with a maximum value of 600 mg/l at the outlets of the rainwater drains at the wastewater treatment plant, and phosphate content with a value of 100mg/l at the conditioning, in the rainy season. For this purpose, 50% of the plant' s areas are critical risk areas for stormwater management, 37.5% are catastrophic risk areas and 12.5% are tolerable risk areas. A corrective action plan worth 8,889,250 CFA francs has been proposed.

Keywords: Assessment, Management, Rainwater, Industries, Agribusiness, Brasseries

1. Introduction

Rain water is runoff that comes from rain, melting snow, hail or ice [1]. When draining urban infrastructures and man-made strutures, they cause significant damage to continental freshwater and coastal shores [2]. Since 2007, the US Environmental Protection Agency (EPA) has provided economic operators with a guide enabling them to develop their stormwater pollution prevention plan (SWPPP). Thus, this plan recommends that establishments set up a stormwater management team, dentify potential pollutants in these waters and adopt control measures that will minimize the release of these pollutants into nature; to date implemented in American industries, cities and universities [3].

In Cameroon, as in several developing countries, fresh water in urban areas is subject to aggression by pollutants that degrade water quality while modifying the ecosystems that constitute it [4, 5]. To protect itself against pollution of waterways, the State of Cameroon has drawn up and promulgated Law No. 96/12 of August 5, 1996 on the framework law relating to the management of the environment in Cameroon, which stipulates in its article 4 that: "spills, flows, jets, infiltrations, burials, spreading, direct or indirect deposits in water, of any solid, liquid or gaseous matter and in particular industrial, agricultural and atomic waste likely to alter the quality of surface or ground water, or sea waters within the territorial limits; harm public health and the aquatic or underwater fauna and flora; to call into question the economic and tourist development of the regions"[6].

The brewing industry produces solid wastes of mineral and organic nature and liquid effluents. Some of this waste is commercialized (drippings, yeasts and packaging) and others are treated by fermentation techniques before being discharged into nature (wastewater) [7]. However, until now, a good quantity of industrial products and waste, including breweries, are still found in nature without being treated, through soil leaching and storage places not covered by rainwater [1].

Les Brasseries du Cameroun, to comply with Cameroon's regulations on environmental protection, and in view of its status as a major consumer of water [8], has set up an environmental management plan that would now make it possible to control the pollution due to its activities in terms of solid, liquid and gaseous discharges. Thus, it invested in building a modern wastewater treatment plant for its liquid effluents at the Yaoundé plant [9]. With this in mind, it has made available to its various workshops systems for recovering hazardous waste (caustic soda, used oils) and fermentable waste (drippings, yeast), in order to reduce any discharge of factory effluents into the nature without treatment. However, so far, nearly 65% of the factory's wastewater is still not sent to the wastewater treatment plant (STEP) [10]. Some hazardous products and waste and fermentable waste are still found in rainwater pipes despite society's investment in environmental preservation [11]. This study set the general objective of evaluating the management of rainwater by the Brasseries du Cameroun, at the plant in the Center region. More specifically, it was a question of: make an inventory of the management of rainwater within the plant; characterize surface water pollutants in the Aké stream, map risk areas within the plant.

2. Materials and Methods

2.1. State of Play on Rainwater Management Within the Factory

To achieve this objective, it was necessary to verify the existence of a rainwater pollution prevention team, describe the workshops and identify the potential pollutants of the factory according to the procedure for manufacturing the products of the breweries. This was done using the Stormwater Pollution Prevention Plan Development Guide for Industrial Operators proposed by the United States Environmental Protection Agency in 2009, revised by the Department of Environmental Sciences. Earth from Christopher Newport University in the United States in 2016 [3].

Thus descents on the ground, animated interviews and inspections of all the work units of the company were carried out.

During the visit to the field, it was necessary to have an interview with the head of the Health, Safety, Workplace Safety and Environment (HSWSE) department. The latter presented the stormwater management system that his department has put in place and the stormwater prevention team that is under his responsibility. Interviews were also conducted with the heads of other departments, and with employees in the workshops. These surveys made it possible to find out if the staff is involved in the management of rainwater through training and to find out the origin of the pollution from the plant on the Aké River.

These interviews focused on: the training of employees, the sites and activities at the origin of the potential pollutants of rainwater, more specifically, the waste management method with laid particular emphasis on the management of liquid waste (wastewater and specials) and storage of hazardous products (chemicals, hydrocarbons, etc.) and measures to control rainwater pollution.

Once informed by the employees, inspections in all the workshops were used to verify the veracity of the answers obtained during the interviews. To this end, a checklist was designed to facilitate observation of all the points highlighted during the interviews.

2.2. Characterization of Surface Water Pollutants Surrounding the Plant

The purpose of this objective was to better assess the effect of the plant's activities on the quality of surface water in the Aké River. Thus, it was necessary to take samples of surface water along this watercourse and analyze their physico-chemical parameters during rainy and dry periods, in order to characterize the pollutants coming from the plant.

Taking into account the fact that part of the plant is crossed by a river (the Aké River), and that another part discharges its effluent directly into the Mfoundi River, four sampling stations were targeted. It's about the:

1) station A1: point on the river located before crossing the packaging plant (TC);
2) station A2: point of the river located at the crossing of the TC;
3) station A3: point on the river located after the WWTP discharges;
4) station A4: point located near the spent grain distribution.

Station A1 03.84156°N 11.51762°E at an altitude of 697m is located approximately 100m from the plant. It is located in the district of Yaoundé 4, in a marshy area, of culture which is transformed into a residential area. This area also houses a beauty salon. The vegetation is quite abundant and dominated by the species Acroceras zyzanoides, Tithonia diversifolia on the right bank, Acroceras zyzanoides and Echinochloa pyramidalis on the left bank. Station A1 is located upstream from the plant. It receives only domestic wastewater, that of the home gardens and the beauty institute which is near the river.

Station A2 with coordinates 03°84017'N, 011°51339'E is located approximately 30 m from the packing area, at an altitude of 647 m. The vegetation is dominated on the right bank by Setaria barbata, Tithonia diversifolia and Echinochloa pyramidalis on the left bank. Station A2 is located downstream of the beer packaging plant. The water from station 2 which crosses this zone of the plant mixes with the effluents which come out of it. These effluents are mainly made up of water from the bottle washer and debris from Kieselghur.

Coordinate station A2 03°84031'N, 011°51339'E; is located about 100 m from the source, at an altitude of 713 m. Effluents from WWTP treatment, those from the hot syrup plant and part of the pipes from the Liquids and Fluids Production Center (CP) mix with those from Stations A1 and A2.

The A4 station with coordinates 03°84151' N and 011°515388' and an altitude of 634 m, is located 5 m from the yeast and spent grain distribution zone and 50 m from the Tank Out Doors (TOD). The effluents sampled mainly come from the pipes in the cellars, the machine rooms and the spent grain distribution area.

The water collected using clean polyethylene bottles of 1.5 l and 1 l in volume is brought back to the laboratory for physico-chemical analyses. The parameters of the water sampled to be analyzed in this study are: pH, electrical conductivity, temperature, water turbidity, COD, BOD5 and traces of certain ions present in the water.

Measurements of pH and redox potential (Eh) were determined using a WTW brand pH meter. After prior calibration of the pH meter using buffers with values of 7.00 and 4.01, the glass electrode was introduced into 100 ml of sample and the values are read on the digital display screen [6].

The electrical conductivity measurements were made using a WTW brand conductivity meter. This apparatus is fitted with a standard probe which is plunged vertically into the solution whose concentration is to be determined. The conductivity value is read on a digital display screen. This conductivity is expressed in µS/cm or in mS/cm depending on the concentration of the sample [6].

It was obtained directly when reading the pH values on the "pHep" brand pH meter. After prior calibration of the pH meter, the glass electrode was introduced into 100 ml of sample and the values are read on the digital display screen.

Turbidity is an organoleptic parameter of water. It was measured by a Eutch TN-100 thermoscientific turbidimeter. The measurements read by the turbidimeter in this study are in NTU (Nephelometric Tirbidity Unit) [6].

The suspended solids induced on ø90mm fiberglass filter paper are weighed using an AG 204 Analytical Balance and dried in an oven at a temperature of 105°C [6].

The measurement of the chemical oxygen demand was made by the so-called "reactor digestion" method. After homogenization of the waste water samples, 2 ml are taken and introduced into COD tubes, then incubated in the presence of a witness at 150°C for 2 hours in a Hach brand COD reactor (multi-tube heater).. After the tubes have cooled, the COD value of the sample is read in mg/l, using a Hach DR/890 colorimeter, at a wavelength of 600 nm [12].

The nitrate ions were determined by the cadmium reduction method using a Hach DR/890 spectrophotometer. After introducing 10 ml of waste water sample into a spectrophotometric cell, a sachet of Nitraver 5 reagent is added. The mixture is then homogenized and left to stand for 5 minutes (reaction time). The color developed in the presence of NO^{3-} is then read with a spectrophotometer at a wavelength of 500 nm. The content of the parameter considered is read on the digital display screen of the device by reference to a control consisting of 25 ml of the waste water sample and the result is expressed in mg/l [13].

It was determined by the so-called "molybdovanadate". 0.5 ml of the molybdovanadate reagent is added to each waste water sample as well as to a control (distilled water). If orthophosphate molecules are present, they will react with molybdate in an acid medium to form the phosphomolybdate complex. In the presence of vanadium, vanadomolybdophosphoric acid which has a yellow color. The intensity of the color is proportional to the concentration of phosphates present in the medium. The reading is done with a Hach DR/890 spectrophotometer at a wavelength of 430 nm, and the values are displayed in the form of orthophosphates (PO_4^{3-}), and expressed in mg/l [13].

Their presence in water is generally linked to the presence of gypsum in the soil. It is a natural compound that corresponds to the presence of sulfur in the water. Maximum presence limited to 250mg/l in drinking water [13].

2.3. Characterization of Surface Water Pollutants Surrounding the Plant

The mapping of risk areas makes it possible to identify the major risks of an organization and to present them in a synthetic way in a hierarchical form [1]. The objectives of risk zone mapping are to:

1) Set up an adequate internal control or risk management process.
2) Assist management in the development of its strategic plan and its decision-making;
3) Guide the internal audit plan by highlighting the processes at which the major risks are concentrated;
4) Ensure the good image of the organization.

It is a key tool in the risk management process which makes it possible to respond to the first three phases of the Risk Management Plan, namely:

1) Identify and assess risks;
2) Treat them;

3) And monitor their progress.

The mission of the mapping is to identify and prioritize the risk factors (or benchmark) and to draw up a complete inventory of the vulnerabilities.

For the case of this study:

1) The identification of risks consisted of:
2) Divide the company into work units;
3) Brainstorm to establish cause and effect diagrams of tasks that may have impacts on stormwater in each workshop.
4) The evaluation and ranking of all the risks identified made it possible to define the action priorities for their treatment. The assessment is based on two parameters: the probability or frequency of occurrence of a risk (F) and the impact or severity (G) which represents the consequences of this event. The assessed risks are placed on a matrix having the frequency of occurrence of the risk as the order and the severity of the risk as the abscissa. They evolve on scales numbered from 1 to 4. When the frequency of appearance of the risk is:
5) "low", it is scaled "1";
6) "average", its scale is "2";
7) "strong", it is located on scale "3";
8) "very strong", the rating of its scale is "4".

The same ratings are assigned to gravity. When the dangerousness of the risk is:

1) "minor", the scale of "1" is assigned to the risk;
2) "moderate", a scale of "2" is assigned;
3) "important", it obtains the dimension "3";
4) "very important", she gets the rating "4".

The combination of these two events (frequency and severity of the risk) determines the criticality of the risk (C). $C=F\times G$ (1).

It is from this criticality that all action priorities for their treatment are set up (Figure 5). When the frequency-gravity combination forms:

1) 1, 2 or 3, the risk is tolerant;
2) 4, 6 or 8, the risk is critical;
3) 9, 12 or 16, the risk is catastrophic.

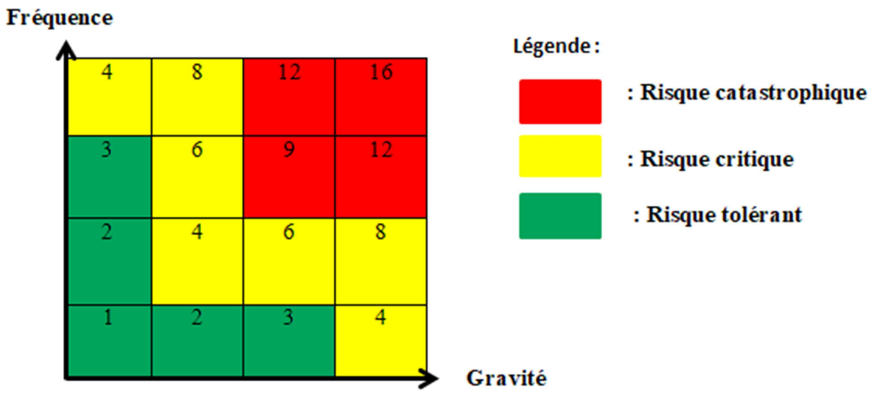


Figure 1. *Risk Assessment Matrix.* [1].

It is from the risk assessment matrix (Figure 1) that the risk zoning map for the plant's rainwater is drawn up. It should be remembered that the form of risk mapping facilitates its appropriation as a tool for managing the risks of rainwater pollution. Documentation can be organized by work unit, workshop, activities or process [14].

3. Results

3.1. State of Play on Rainwater Management Within the Factory

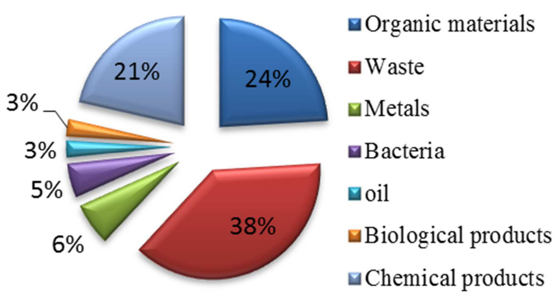


Figure 2. *Summary diagram of the potential pollutants found in the various workshops of the plant.*

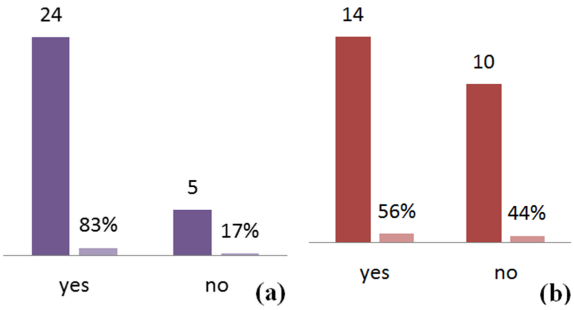
The process of making beer requires the use of various substances that are very often inert or dangerous for the environment. The resulting potential pollutants are: organic matter, waste, metals, bacteria, oils and greases, biological products, and chemical/hazardous substances (Figure 2.).

Accidental and voluntary spills are observed in stormwater gutters. This is the case of dead yeasts dumped out of the retention or at the thermolysis station (Figure 3) of spent grain deposited around the rainwater pipes in the distribution area.

Figure 3. *Incident occurring during the transfer of the yeast to the various thermolysis tanks.*

The retention basins available in the factory are mainly made of plastic and metal. The capacities of these retentions vary between 250 l and 1000 l.

Figure 4a shows that, out of 83% of workshops that use retention tanks, only 56% have compliant retention basins (Figure 4b). These same results showed that 7% of the workshops and storage areas visited do not have any (Figure 4a).



a: availability of retention basins; b: conformity of retention basins

Figure 4. *Condition of retention basins.*

The hazardous waste collected in the factory workshops is: used oils, soiled rags, hoses, date stamp ink cartridges, electronic waste and laboratory waste. This waste is collected and stored sheltered from bad weather and separately from other solid waste from the plant. When improperly collected, they can spill into the factory yard (Figure 5).

Figure 5. *Case of spillage of used oil from a container still containing the remains of chemicals.*

Both the factory's garbage bins and the kieselguhr bins are placed on the floor. The nature of the waste (wet labels, household waste) they contain facilitates the formation of leachate and their percolate under the tanks and the transfer of pollutants to the rainwater pipes during the rain and in the dry season (Figure 6).

Figure 6. *Casting leachate under the garbage bins.*

3.2. Characterization of Surface Water Pollutants Surrounding the Plant

The water discharged by the plant does not have a considerable influence on the temperature of the receiving environment in the first three sampling stations during the two seasons. With the exception of sampling station number 4 (draff storage area), where the temperature rises to 38.5°C in the dry season. This temperature is significantly higher than the discharge standard authorized by the Ministry of Water and Energy of Cameroon, which is on average 30°C (MINEE) (Figure 7).

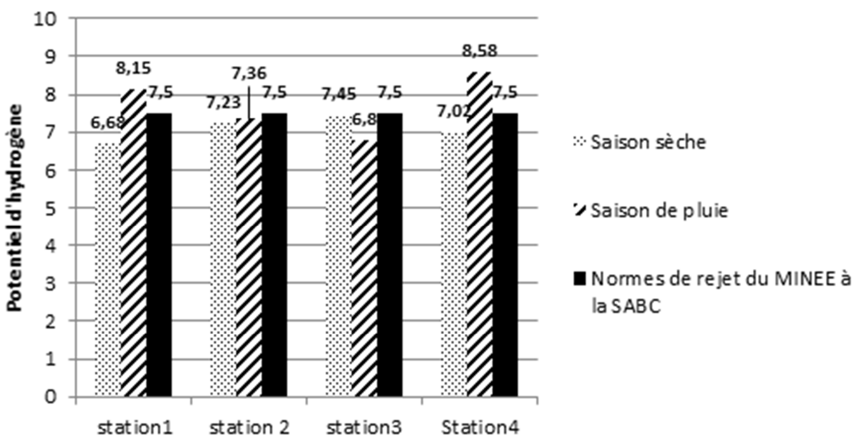


Figure 7. *Evolution of the temperature in the four sampling stations during the two seasons.*

Legend: Station A1: point on the river located before crossing the packaging plant (TC). Station A2: point of the river located at the crossing of the TC.
Station A3: point on the river located after the WWTP discharges.
Station A4: point located near the spent grain distribution.

The COD results are very remarkable. The effluents sampled during the dry season show satisfactory results in relation to the requirements of the discharge standard in Cameroon, that is to say between 29 and 55 mg/l. In the rainy season, however, this curve is much above the normal curve. These values reach 730 mg/l at the WWTP (station 3) and 860 mg/l at the spent grain distribution zone (station 4) (Figure 8).

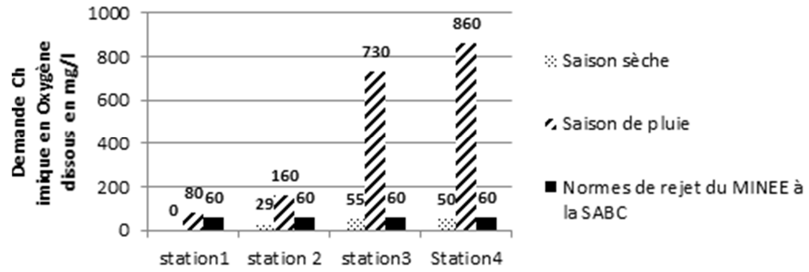


Figure 8. *Evolution of the Chemical Demand for Dissolved Oxygen (COD) in milligrams per liter.*

Legend:
Station A1: point on the river located before crossing the packaging plant (TC). Station A2: point of the river located at the crossing of the TC. Station A3: point on the river located after the WWTP discharges. Station A4: point located near the spent grain distribution.

The SS variation curves show that the waters are very stable during the dry season and very turbid during the rainy season. The values of the concentration of suspended matter in the water sampled during the rainy season are much higher than the discharge standard authorized by the MINEE, at all the sampling points and can reach 600 mg/l at stations 2 and 3 (Figure 9).

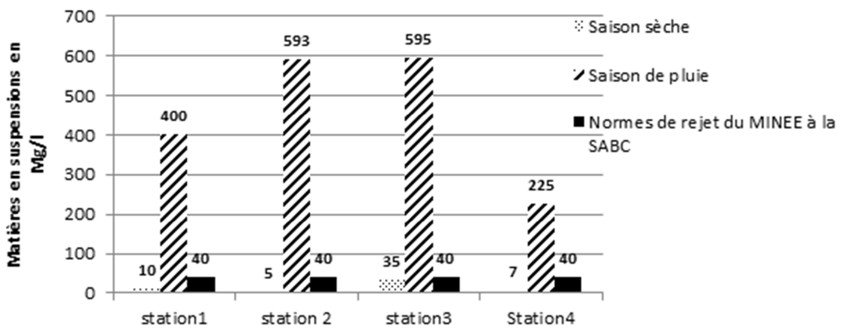


Figure 9. *Evolution of suspended solids (SS).*

Legend:
Station A1: point on the river located before crossing the packaging plant (TC). Station A2: point of the river located at the crossing of the TC. Station A3: point on the river located after the WWTP discharges. Station A4: point located near the spent grain distribution.

The values of sulphate concentrations fluctuate between 250mg/l and 270mg/l in sampling stations 1, 2 and 3 during the rainy season (Figure 10) and are almost zero in the dry season.

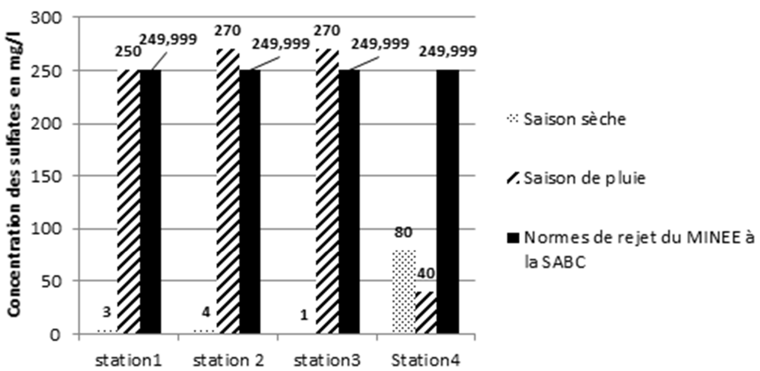


Figure 10. *Evolution of sulphates in the four sampling stations during the two seasons.*

Legend:
Station A1: point on the river located before crossing the packaging plant (TC). Station A2: point of the river located at the crossing of the TC. Station A3: point on the river located after the WWTP discharges. Station A4: point located near the spent grain distribution.

3.3. Mapping of Risk Areas in the Factory

The stormwater pollution risk assessment grid shows that the plant records (Figure 11):

1) Fifteen (15) areas at catastrophic or major risk for rainwater, or 37.5% of the study area in total. They are divided into six (06) at the Liquids and Fluids Production Center (CP) and nine (09) at the Courtyard (TC);
2) Twenty (20) medium risk areas for stormwater pollution 50% of the total areas of the study area. To this end, eight (08) medium risk areas are counted at CP level and ten (10) areas are identified at TC level (Figures 11 and 12);
3) And five (05) zones with tolerant or minor risks, i.e. 12.5% of the total of the two zones.

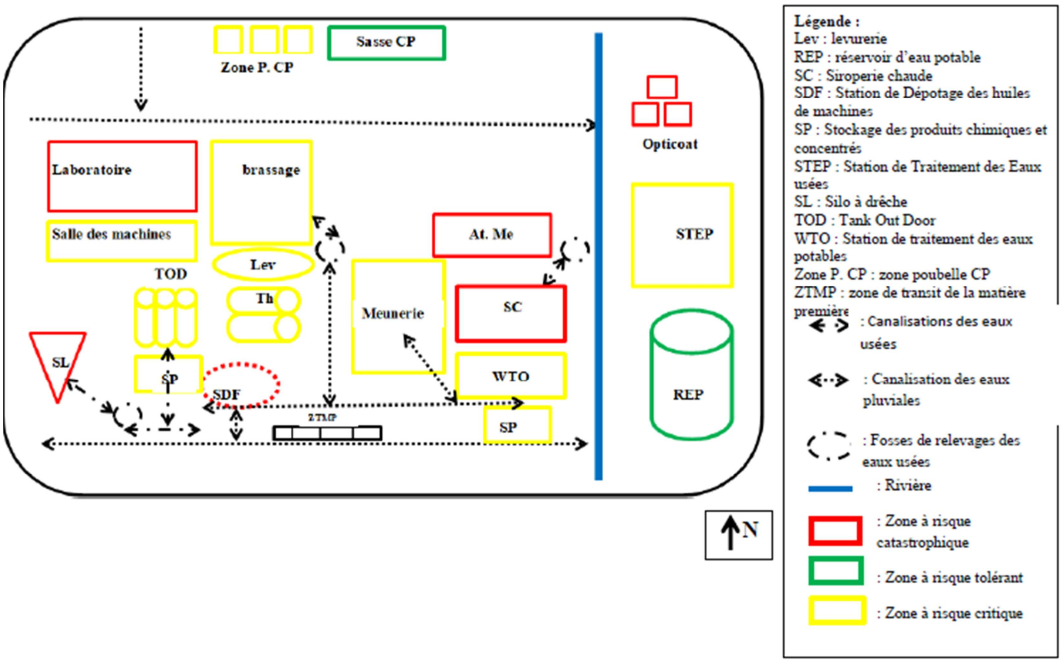


Figure 11. Mapping of risk areas in the Liquids and Fluids Production Center (CP).

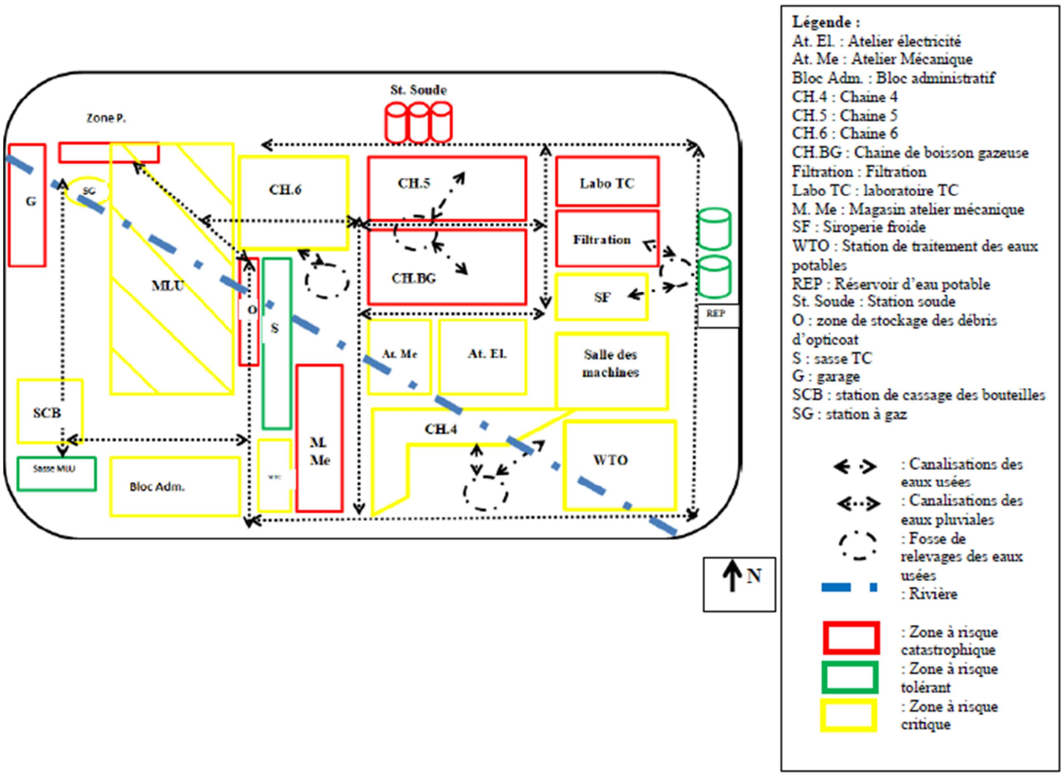


Figure 12. Mapping of the risk areas of the Terrain Court (TC).

4. Discussion

In general, this work shows that all the activities in the factory workshops are potential sources of rainwater pollution because each workshop contains at least one pollutant. The results of the identification of potential pollutants showed that waste (solid waste and liquid waste) are the main pollutants in the factory, followed by fermentable products or brewery by-products (yeast and spent grains) and chemicals. To avoid spills of these pollutants in rainwater, a system for managing the pollution of these waters; made up of retention tanks for products and hazardous waste, a separative network of rainwater and waste water drainage, and absorbent sponges has been set up. This system has flaws.

Failures of this system are due to (to): non-compliance with good environmental practices by plant employees; the incapacity of workers in certain workshops and the non-compliance of retention basins. These failures were observed during: spillage that occurred during yeast thermolysis due to the incompetence of the agents responsible; runoff of waste water in the rainwater channels for conditioning and mixing caused by the malfunction of the secondary treatment of the WWTP because the filtration grids, pits and valves are clogged with solid waste. This result corroborates those of Ayina in 2018, who worked on the impact of the use of soda in the brewing industry, and was able to demonstrate that nearly 21, 60% of the caustic soda used in the plant is lost every year. Similarly, those of Magang in 2017, who carried out a study on improving the rate of recovery of wastewater at the SABC group purification station in Yaoundé, from which it emerged that the rate of recovery of water waste is an average of 35% per month at the WWTP of the Center Region plant.

The analysis of the waters around the site revealed that the physico-chemical parameters such as the temperature of the Aké River stream are ambient, with the exception of that of station 4 which is out of the ordinary. is to say equal to 38.5°C. This rise in temperature at this sampling point is caused by the hot water from the closed circuit washes.

Although the pH values conform to those of the guidelines proposed by the MINEE (values between 6 and 9), they nevertheless show a variation in water quality. In the dry season, the water withdrawn tends to become more basic as it passes through the plant. This change in water quality is caused by the caustic soda contained in the conditioning effluents [15]. These waters tend to become increasingly acidic during the rainy season. This acidity is due to the dominance of the concentration of the opticoat in the water.

The difference in suspended solids values shows that these waters are very stable in the dry season and very turbid, on the other hand, in the rainy season. The concentration difference of 200 mg/l observed at stations 1, 2 is due to the leaching of pollutants from the plant by rainwater. This shows that the plant's stormwater drainage network is clogged with pollutants. The COD values meanwhile lead to the conclusion that these pollutants are of an organic nature (degraded spent grains and yeast) because the peaks of the COD concentration curves are high in the rainy season in stations 3 and 4. The values of phosphates and sulphates show that they are contained in the washing water with regard to the values obtained at station 4 (sulphates) in the dry season and the modifications of the value of phosphate in stations 2 and 3 in the rainy season.. The spatio-temporal variations of the waters of the Aké River lead to the conclusion that the effluents from the plant have a negative influence on the quality of this watercourse. This conclusion is in agreement with the results of [16] who noted the degradation of water quality in the area subject to domestic, industrial and agricultural wastewater discharges from the cities of Missour, Outat El Haj and Guercif in Morocco. The spatio-temporal variations of the waters of the Aké River lead to the conclusion that the effluents from the plant have a negative influence on the quality of this watercourse. This conclusion is in agreement with the results of [16] who noted the degradation of water quality in the area subject to domestic, industrial and agricultural wastewater discharges from the cities of Missour, Outat El Haj and Guercif in Morocco. The spatio-temporal variations of the waters of the Aké River lead to the conclusion that the effluents from the plant have a negative influence on the quality of this watercourse. This conclusion is in agreement with the results of [16], who noted the degradation of water quality in the area subject to domestic, industrial and agricultural wastewater discharges from the cities of Missour, Outat El Haj and Guercif in Morocco.

The results of the mapping of risk areas in the plant show that 50% of the areas of the plant are at critical or medium risk. This criticality is due to the nature of the potential pollutants whose dangerousness is very serious for nature, but the frequency of discharge is lower. This is the case with the raw material of breweries which is fermentable and is a serious danger for the aquatic environment. In addition to this raw material, there are hazardous substances from the ancillary activities of breweries (engine oils from machines, chemical substances (beer additives, caustic soda, opticoat, dater anchor, analysis reagents) and concentrated solutions) and all resulting waste. 37.5% of the study area is at catastrophic risk or at major risk. The catastrophic nature of these areas is due to the very high dangerousness of these risks and the repeated frequency of their discharge into the rainwater drainage network without corrective action. The remaining 12.5% of the areas are those where the impact on rainwater is tolerated or at minor risk areas. The risk tolerance in the case of this study is due to the fact that the nature of the pollutants in these areas has characteristics similar to those of households. This is the case for hand washing products in sasses. The results of the mapping of risk areas in this study are contrary to those of [14], who counted areas of minor or tolerable risk much higher than areas of medium and major risk during the assessment of industrial risks at the industrial level.

5. Conclusion

The objective of this study was to assess the management of rainwater by the Société Anonyme des brasseries du Cameroun, at the Center plant. To achieve this objective, a general inventory of the factory was carried out in order to verify the rainwater management system that exists there. This was possible from the rainwater pollution prevention method proposed by the United States Environmental Protection Agency in 2009, revised by Christopher Newport University in 2016 in the United States. Next, it was important to diagnose the state of surface water pollution on the Aké River, which is the plant's direct tributary. This diagnosis facilitated the development of the map of the zones at risk of pollution of the factory's rainwater,

The general observation made is that all the activities carried out within the workshops, such as: handling, transfer of products from one workshop to another, washing (bottles, racks and tanks and waste management, are risks of rainwater pollution. Thus, solid waste constitutes 39% of the plant's potential pollutants, followed by fermentable products or waste (29%), chemical substances (21%), metals (6%), bacteria (5%), organic (3%), oils and fats (3%). Despite the rainwater pollution control and prevention measures implemented by the SSSTE service, these pollutants degrade the quality of the water in the Aké tributary.

To this end, 50% of the plant areas are critical risk areas for stormwater management, 37.5% are catastrophic risk areas and 12.5% are tolerable risk areas. In view of the above, a corrective action plan worth 8,889,250 FCFA has been proposed. And so far 75% of the corrective actions have already been carried out and the SSSTE service monitors the said actions.

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