Submitted on: 03/08/2024
Revised forme accepted on: 23/01/2025
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Revue Nature et Technologie
https://journals.univ-chlef.dz/index.php/natec

Research Article

ISSN: 1112-9778 – EISSN: 2437-0312

Comparative Study Between Two Processes for Depolluting Waste Water from Two Wastewater Treatment Plants: Activated Sludge (Mascara) and Aerated Lagooning (Ghriss)

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Citation: MAHI, B., BENDAHA, M. E-A., SMAHAT, N. and BELGHERBI, B. (2025, Mars 30) Comparative Study Between Two Processes for Depolluting Waste Water from Two Wastewater Treatment Plants: Activated Sludge (Mascara) and Aerated Lagooning (Ghriss). *Revue Nature et Technologie*, 17 (1), 25-48

Abstract

In this work, a comparative study was carried out between two biological purification processes in a semi-arid climate: activated sludge at the plant of Mascara and aerated lagoon at the plant of Ghriss. This study was based on the analysis of the purification performances obtained through the analyses of raw and purified wastewater samples over a period of 12 months during 2021. Physico-chemical analyses were carried out for the two plants (chemical oxygen demand, biological oxygen demand, suspended matter, O_2, nitrogenous materials, phosphorus materials, water temperature and pH). The variation of these parameters made it possible to determine the influence of local climatological and hydrogeological data on the purification process by activated sludge and Lagooning. Due to the high reliability of both treatment processes, both purification systems can be used as an environmentally friendly alternative.

Keywords: Activated sludge; Aerated lagoon; Chemical oxygen demand; Biological oxygen demand; Suspended matter; Purification system.

1. Introduction

The rapid development of human society, industrial scale and the expansion of cities have brought serious environmental pollution, in this case the problem of water pollution is particularly important [1].

Wastewater is all water that enters pipes whose natural properties are transformed by domestic uses, industrial, agricultural and other businesses. We also include rainwater that flows through these pipes [2]. The availability of good quality water is an essential element to prevent diseases and improve quality of life [3].

Currently, the situation in Algeria is characterized by an increasing demand for water, while water resources are becoming permanently scarce. Indeed, with this growth, drinking water is exhausted more quickly, increasing the volume of wastewater collected which is discharged without treatment and directly into the natural environment and which threatens brutal pollution of nature and especially groundwater.

In 1914, Edward Ardern and William Lockett, developed the first intensive purification process, a basin system where the sludge resulting from the biodegradation of effluents is aerated. Oxygen both activates the work of bacteria and promotes their multiplication. In France, the rise of activated sludge sewage treatment plants in urban areas occurred around 1960 in cities, then in rural areas. Coagulation processes by chemical treatment were also used in some French seaside resorts and in Norway [5].

According to the National Sanitation Office, ONA currently operates 160 wastewater sewage treatment plants across 44 Wilaya in the country, including 21 plants used for agricultural purposes. In 2020, a volume of 18 million m^3 of water purified by these plants was used in the irrigation of 11,494 hectares of agricultural areas, a rate of 31% of the volume purified by the 21 plants concerned.

Wastewater treatment systems using activated sludge and Lagooning are suitable processes, they function as a biological assimilator by removing organic and inorganic materials as well as pathogenic micro-organisms [4].

Our work consists on a comparison of technical and ecological reliability between two purification processes, the activated sludge technique (plant of Mascara) and the aerated lagoon (Plant of Ghriss).

This study was based on the examination of the results of the analyses of wastewater at the entrance and exit of the plant in order to determine the effectiveness of the treatment of each plant.

2. Material and methods

2.1. Sampling

Two types of samples were taken:

a) The spot sample: The spot sample is one where the entire volume constituting the sample is taken at once. This type of sample is useful for determining the composition of wastewater at a given time. This type of sample is produced manually using containers or vials.

b) The composite sample: These are samples prepared by mixing several spot samples. There are two types of composite samples: time-dependent samples, flow-dependent samples [6].

Preserving waste water samples consists of keeping them in a refrigerator at a temperature between 0 and 4°C for a time not exceeding 24 hours (table 1).

2.2. *In situ* parameters

2.2.1. Organoleptic characteristics

Pollution can be characterized by its smell, its color and its appearance, certain pollution can be visible such as oil pollution and also paint discharge. Others are more difficult to detect, such as soluble, colorless, odorless pollution (e.g. releases of mercury or cyanide). The following table gives a description of the organoleptic characteristics of wastewater (table 2).

Table 1
Sample preservation techniques and standards [7].

	Preservation	**Method**
pH	Determined immediately after sampling 1°C to 5°C (6 hours)	NA 751 :2013 (NA ISO 10523)
Conductivity	Determined immediately after sampling 1°C to 5°C (24 hours)	NA 749 :1989 (NA ISO 7888)
Dissolved oxygen	Determined immediately after sampling	NA 1654 :1994 (NA ISO 5814)
Suspended matter	1°C to 5°C (2 days)	NA6345 :2009
Turbidity	Determined immediately after sampling 1°C to 5°C (6 hours)	NA 746 :2006 (NA ISO 7027)
COD	Acidify with H_2SO_4 to a pH between 1 and 2 (1 Month) Freeze at -20°C (1 Month)	NA 1134 :2011 (NA ISO 6060)
BDO5	Store between 1°C and 5°C and away from light (24 Hours) Freeze at -20°C (1 Month)	NA 17682 :2013 (NA ISO5815-1) (NA ISO5815-2)
Ammonia nitrogen	1°C to 5°C (24 hours)	NA 17685 :2014 (NA ISO 11732)
Nitrite	Determined immediately after sampling 1°C to 5°C (24 hours)	NA 1657 :2013 (NA ISO 6777)
Nitrate	Store between 1°C and 5°C (24 hours). Acidify with HCl to a pH between 1 and 2 (7 Days) Freeze at -20°C (1 Month)	NA ISO 10304-1 :2010 NA ISO 10304-3 :2010 NA 17684:2014 (NA ISO 10304-4)
Total phosphorus	Acidify with H_2SO_4 to a pH between 1 and 2 (1 Month) Freeze at -20°C (1 Month)	NA ISO 11885 :2010

Table 2
Organoleptic characteristics of wastewater [8].

Smell	Color	Aspect	Causes
No smell	Very light yellow	Translucent	Rainwater, infiltration water
rotten egg, sour, dish water	Black-Grey	Very fine suspended matter	Septic water
Sour	White cream	Fat mixture	Fats, oils
Feces	Black-Grey	Heavy water	Drain material
Characteristic smell	Rainbow pink	Surface film	Hydrocarbons
Sudden variations	Sudden variations	Sudden variations	Industrial water

The methods for analyzing temperature, electrical conductivity, dissolved oxygen, chemical oxygen demand (COD), biochemical oxygen demand (BOD5), ammoniacal nitrogen ($N^{-}NH_4^{+}$), nitrite ($N^{-}NO_2^{-}$), nitrate ($N^{-}NO_3^{-}$), and phosphorus materials were conducted according to [6]

2.2.2. Temperature and electrical conductivity

Measurement of the temperature and conductivity of water carried out by a conductivity meter with an integrated thermometer (Crison 35 cm).

The water temperature is taken at the same time as the sample is taken. The immersion in the environment to be studied must be of sufficient duration for the displayed value to be stabilized. The water will be collected in a 1-liter capacity bottle and the carefully calibrated measuring device will immediately be immersed in it. The temperature is read as soon as stabilization is observed by leaving the probe in the water.

The measure of electrical conductivity is made by immersing the electrode in the liquid and stabilizing the value.

2.2.3. Potential of hydrogen (pH)

It is recommended to determine the pH of water in situ so as not to modify the ionic balance due to transport or a more or less prolonged stay of water samples in vials.

The reading was taken after stabilization of the measurement using a pH meter type WTW 315i.

2.2.4. Dissolved oxygen

The main effect of biodegradable materials on the receiving environment is the depletion of dissolved oxygen in this environment, which results from their degradation.

Dissolved oxygen is measured using a HANNA 9146 portable oximeter, the results are expressed either in mg/L or as a percentage (saturation rate) [6].

2.3. Parameters measured in the laboratory

2.3.1. Suspended matter

In the case of wastewater analysis, it is recommended to carry out vacuum filtration with a fiberglass filter membrane [9].

This method is based on passing a water sample of volume V through a 0.47 µm fiberglass filter. The weight of material retained by the filter, noted P, is determined by differential weighing (before and after filtration). The concentration of suspended matter will be the ratio of this weight to the volume of water analyzed :

a) Rinse the filter with distilled water and dry it in an oven at 105°C for approximately 30 to 60 min.
b) Allow to cool then weigh the dry filter and note its weight P1.
c) Homogenize the sample to be analyzed.
d) Vacuum filter a volume V of the measured sample using a graduated cylinder.
e) Dry in an oven at 105°C for 2 hours, cool and weigh the filter a second time. Its weight is noted P2.

The concentration of suspended matter in mg/L in the sample analyzed is obtained by the following relationship:

Suspended matter = $\frac{(P2-P1)*1000}{V}$ mg/L (Uncertainty of the balance is 0.1 mg)

P1: Weight of the dry filter before filtration (in mg).
P2: Weight of the dry filter after filtration (in mg).
V: Volume of the water intake (in liters).

The analyses described below were carried out according to the protocols described by Rodier *et al.* [6]

2.3.2. Chemical oxygen demand (COD)

COD was determined according to method 8000 (Reaction digestion method approved by the USEPA for the analysis of waste water).

2.3.2. Biochemical oxygen demand (BOD5)

The BOD5 is expressed in mg of O_2/L and is obtained by multiplying the value displayed by the Oxitop after 5 days of incubation at 20°C by the factor corresponding to the volume sampled which is given by the range of estimation.

2.3.4. Nitrogenous materials (N-NH_4^+, N-NO_2^-, N-NO_3^-)

They are measured by colorimetry, using an AQUAMATE Thermo Spectronic spectrophotometer which gives the concentrations of each element by direct reading.

2.3.4.1. Ammoniacal nitrogen (N-NH_4^+)

Ammoniacal nitrogen (N-NH_4^+) was determined according to method 8038 (Nessler Method Accepted by the USEPA for Waste Water Analysis).

2.3.4.2. Nitrite (N-NO_2^-)

Nitrite (N-NO_2^-) was determined according to method 8507 (USEPA Approved Diazotation Method for Waste Water Analysis, 1979).

2.3.4.3. Nitrate (N-NO_3^-)

Nitrate (N-NO_3^-) was determined according to method 8192 (Cadmium reduction method for water, waste water and sea water).

2.3.3. Phosphorus materials (Orthophosphate PO_4^{-3})

Orthophosphate PO_4^{-3} was determined according to method 8048 (PhosVer 3 Method (Ascorbic Acid) Accepted by the USEPA for waste water analysis reporting).

3. Results and discussion

3.1. Temperature

Temperature of water at the inlet and outlet (Figure 1 and 2) is between 11.3 and 15.3°C for the Mascara plant and between 10.2 and 28.2°C for the Ghriss plant. These temperatures correspond perfectly to the discharge standards (≥30°C).

These temperatures provide a favorable environment for the development of microorganisms, the solubility of gases and mineral salts. Water temperature is strongly linked to local climatic conditions and biological activity is strongly linked to temperature; it is more intense in summer than in winter. According to Bachi [10], pollution parameters are greatly influenced by the climate; they increase as the air temperature increases and vice versa.

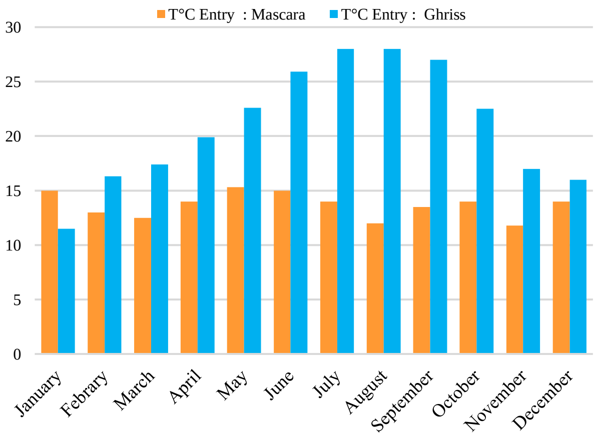

Figure 1: Result of the temperature of water at the entrance.

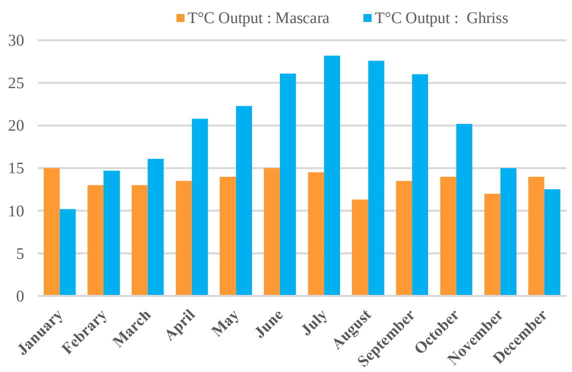

Figure 2: Result of the temperature of water at the exit.

3.2. Electrical conductivity

Electrical conductivity measurements for raw water from the Mascara plant (Figure 3) vary from 2478 to 4078 us/cm and for treated water from 2347 to 2980 us/cm (Figure 4). We notice an increase at the entrance in August (4078 us/cm), this increase is due to the overload of mineral salts and the bacterial overactivity responsible for the mineralization of organic matter. The output results during the year all comply with the rejection standard (≥3000 us/cm)

The electrical conductivity for the raw waters of the Ghriss plant (Figure 3) vary from 2359 to 4277 us/cm and the treated waters vary from 2163 to 2865 us/cm (Figure 4). An entry value above the norm was noted in April. The other measurements all comply with the rejection standard (≥3000 us/cm).

This reduction at the outlet is explained by the settling of mineral salts in the settling basins.

3.3. Potential of hydrogen (pH)

The pH for either raw water or purified water is between 7.8 and 8.56 for the Mascara plant and for the Ghriss plant between 7.5 and 9.07 (Figures 5 and 6). These results comply with the discharge standards (6.5 and 8.5) and constitute a favorable environment for microbial activity.

During our investigation, we note for the months of April and May that the pH of the outlet in the Ghriss plant is above the standard (9.05 and 9.07), this increase is due to the algal proliferation which gives an alkalinity to the environment. pH increased up to values close to 7.4, due to the degradation of organic acids in the aerated processes [4]. According to Masotti [11], pH must range between 6.0 and 8.5 with very gradual temporal variations, acid pH of wastewater has negative effects on biological processes.

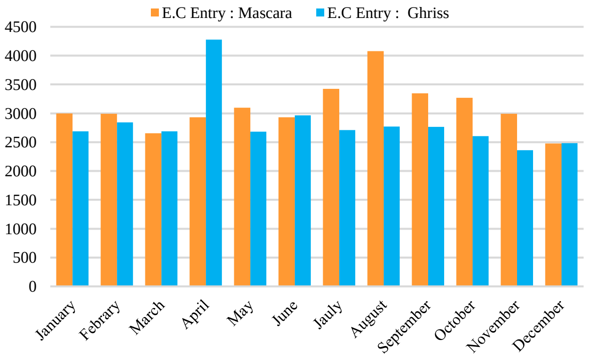

Figure 3: Result of the electrical conductivity of water at the entrance.

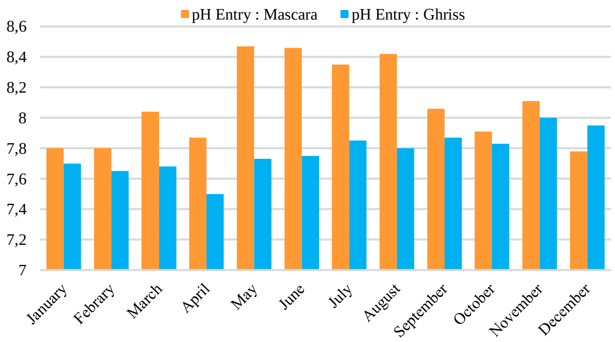

Figure 5: Result of the pH of water at the entrance.

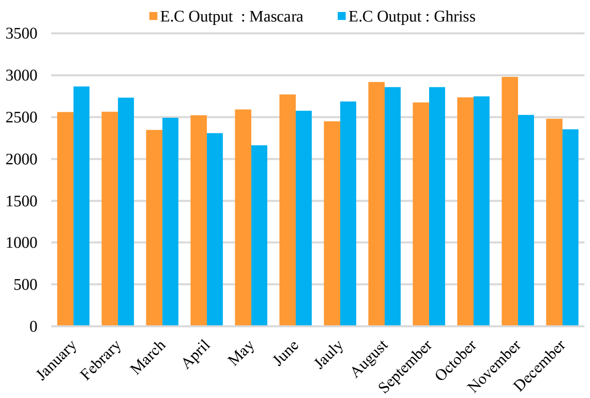

Figure 4: Result of the electrical conductivity of water at the exit.

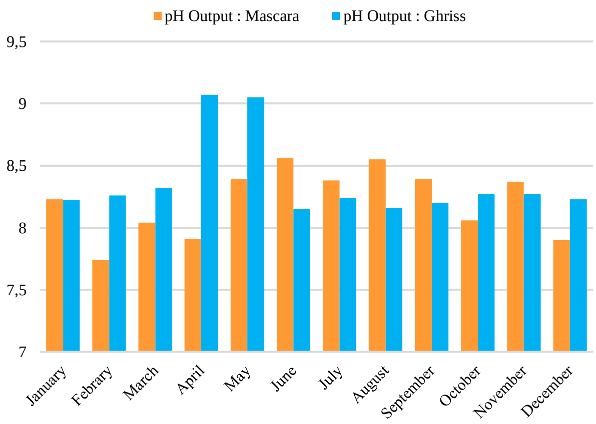

Figure 6: Result of the pH of water at the exit.

3.4. Dissolved oxygen

Dissolved oxygen is a very important parameter for the activity of microorganisms and the solubility of polluting organic matter. According to Figures 7 and 8, the dissolved O_2 measurements from the Mascara plant for raw water vary between 0.24 and 0.68 mg/L and the purified waters are between 1.17 and 2.7 mg/L.

The decrease in inlet measurements is explained by the absence of oxygen due to the organic load of the raw water and its turbidity. on the other hand, the output results all comply with the rejection standard (1-2 mg/L).

For the Ghriss plant (Figures 7 and 8), the dissolved O_2 at the inlet varies between 0.39 and 0.75 mg/L, and at the outlet is between 1.86 and 8.81 mg/L. These results are directly linked to the climatic conditions of the environment, the temperature and the atmospheric pressure which have a direct impact on the process of oxygen solubility and also the action of the wind which causes mixing of the water.

We notice a significant increase in dissolved O_2 at the outlet in April (8.81mg/L), this is due to the artificial supply of oxygen by the mechanical aerators installed in the aeration basins and the photosynthetic activity of algae.

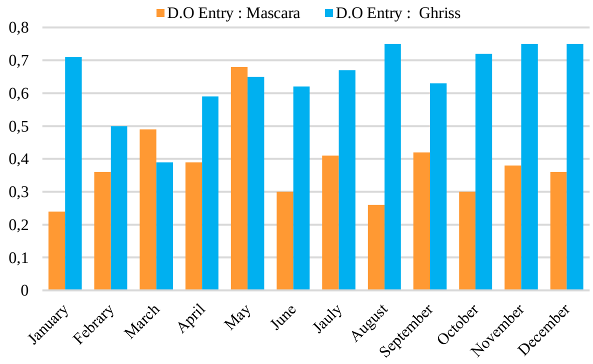

Figure 7: Result of the dissolved oxygen of water at the entrance.

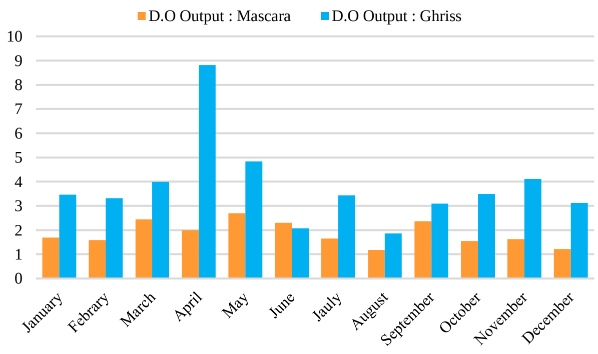

Figure 8: Result of the dissolved oxygen of water at the exit.

3.5. Parameters measured in the laboratory

3.5.1. Suspended matter

The values of suspended matter for the Mascara plant vary between 74 and 138 mg/L and at the outlet between 19.5 and 74 mg/L (Figures 9 and 10), which gives an average annual yield of 63.9%. This significant difference between the input and output confirms the proper functioning of the plant.

During the months of January, February, April, June and July, increases in suspended matter were noted at the outlet compared to the standard (30 mg/L). This increase is due to clarifier failures.

The results obtained for the Ghriss plant at the inlet (Figures 9 and 10) are between 159 and 500 mg/L, and the outlet between 19.3 and 83 mg/L with a purification efficiency of 84.2%. Which explains the effectiveness of treatment.

The increases observed in the months of January, March, May, June, July, August, September, October and November are due to the proliferation of algae in the settling basins.

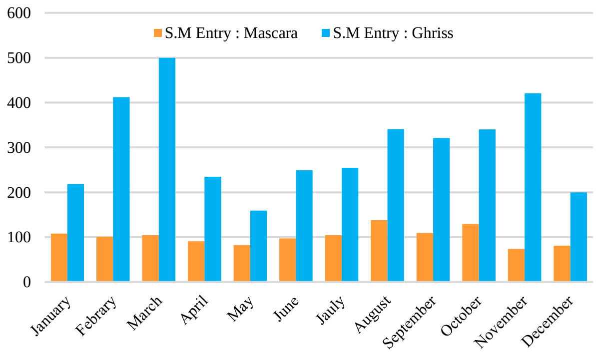

Figure 9: Result of the suspended matter of water at the entrance.

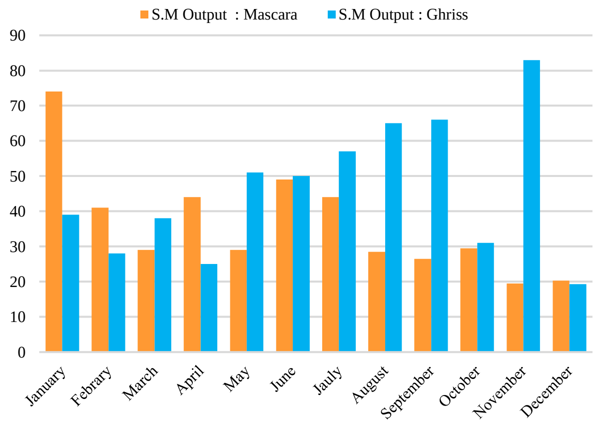

Figure 10: Result of the suspended matter of water at the exit.

3.5.2. Chemical oxygen demand (*COD*)

Chemical oxygen demand is an essential parameter for determining biodegradable and non-biodegradable organic pollution. According to the results obtained (Figures 11 and 12), the Mascara plant shows CODs at the inlet varied between 611 and 1231 mg/L, at the outlet between 57 and 142 mg/L with a purifying efficiency of 91.2%.

We notice increases in COD in the months of January, February, June and July compared to the standard (90 mg/L), this is due to the purifying dysfunction in the aeration basins.

For the Ghriss plant, the inlet is between 869 and 2821 mg/L and the outlet are between 111 and 315 mg/L with a purifying efficiency of 80.6%.

All output COD values are out of norm (90 mg/L). This non-compliance is due to the absence of an oil separator at the pretreatment level, presence of abnormally loaded effluents (oils and hydrocarbons) and hydraulic overload in the biological basins.

Zema *et al.* [12] found that COD removal rates and temperature are correlated, they also hypothesized that the increase of COD removal rate of the depuration process is highly influenced by supplied oxygen which is quickly used in the aerobic degradation of the organic matter, this confirms the high efficiency of oxygen exploitation shown by the Lagooning systems compared to activated sludge plants.

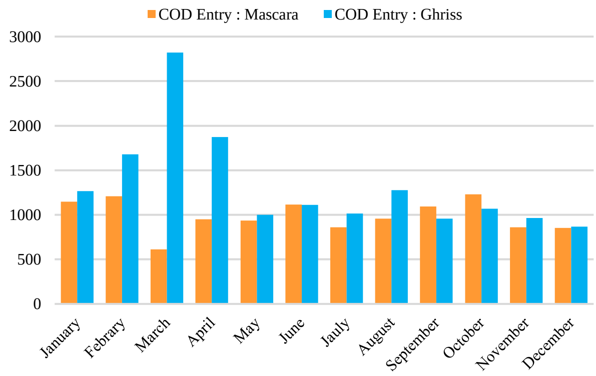

Figure 11: Result of the chemical oxygen demand (COD) of water at the entrance.

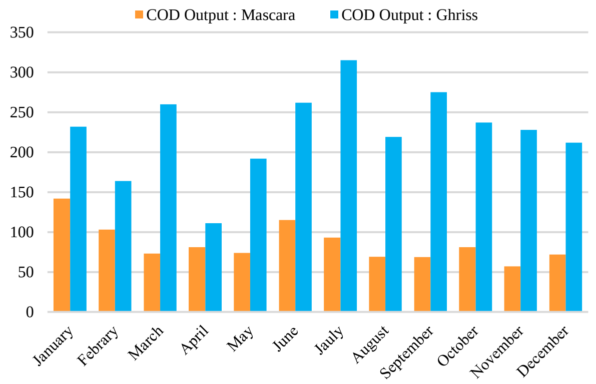

Figure 12: Result of the chemical oxygen demand (COD) of water at the exit.

3.5.3. Biochemical oxygen demand (*BOD5*)

BOD5 is the consumption of oxygen by microorganisms to solubilize biodegradable organic matter. This reaction is illustrated in figures 13 and 14 where the results from the Mascara plant show a BOD5 at the inlet which varies from 244 to 750 mg/L and at the outlet between 20.5 and 85 mg/L with an average annual reduction of 91.7%.

For the Ghriss plant, the BOD5 at the inlet is between 283 and 713 mg/L, the outlet is between 12 and 169 mg/L with an annual yield of 84.4%. According to these results, we confirm the proper functioning of the two plants and the effectiveness of these two treatment processes.

Increases compared to the discharge standard (40 mg/L) in the two plants, during the months of : January, February, April and June for the Mascara plant and during the months of: February, March, May, June, July, August, September, October and November for the Ghriss plant. This increase in BOD5 is explained by the high organic load, microbial activity and algal proliferation.

The concentration of dissolved oxygen (DO) decreases when the water temperature increases, the aerobic bacteria activity also decreases, and there is no degradation of organic matter which induces high concentrations of BOD_5, COD at the exit of the systems [10].

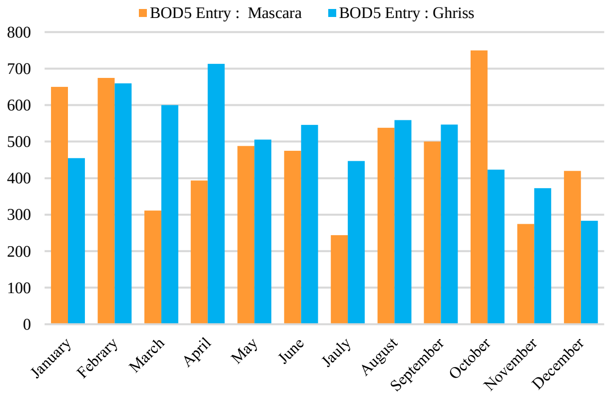

Figure 13: Result of the biochemical oxygen demand (BOD5) of water at the entrance.

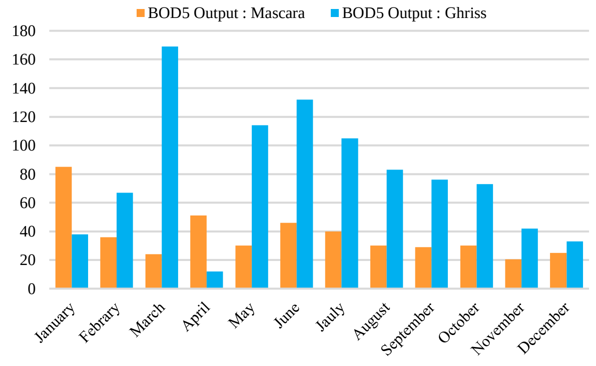

Figure 14: Result of the biochemical oxygen demand (BOD5) of water at the exit.

3.5.4. *Nitrogenous materials* ($N\text{-}NH_4^+$, $N\text{-}NO_2^-$, $N\text{-}NO_3^-$)

3.5.4.1. *Ammoniacal nitrogen* ($N\text{-}NH_4^+$)

The nitrogen present in waste water comes mainly from urine in the form of urea and uric acid. During the transport of effluent to the sewage treatment plant, ammonification reactions take place, transforming this organic nitrogen into ammonium (NH_4^+), a form that is particularly harmful to surface water resources. To evaluate nitrogen in waste water and to monitor its evolution in the networks and during purification, it is essential to measure ammoniacal nitrogen or $N\text{-}NH_4^+$.

According to the results found (Figures 15 and 16), the input to the Mascara plant varies from 5 to 20 mg/L, the output varies from 3.75 to 16 mg/L.

For the Ghriss plant, the input varies between 5.7 and 12.5 mg/L and the output is between 2.79 and 11.38 mg/L. All measured results comply with the discharge standard (≥40 mg/L) for the two wastewater sewage treatment plants, which confirms the treatment efficiency of the two processes.

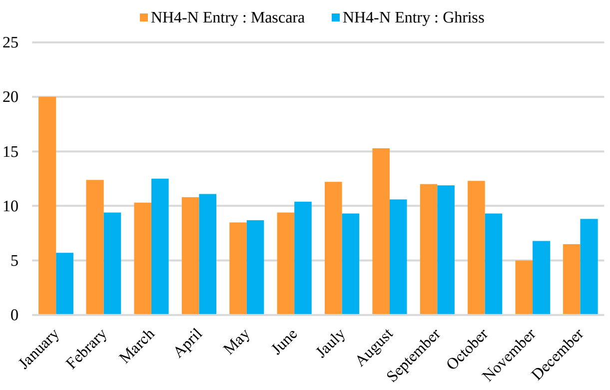

Figure 15 : Result of the biochemical ammoniacal nitrogen (N-NH_4^+) of water at the entrance.

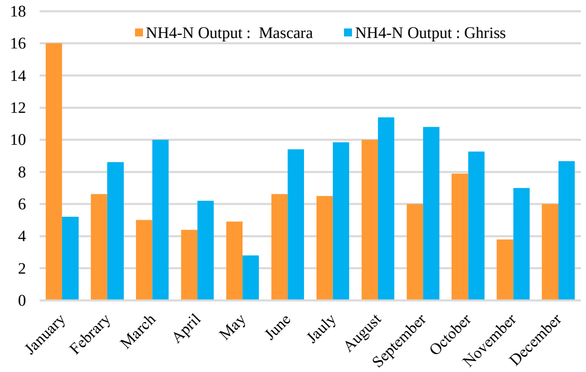

Figure 16 : Result of the biochemical ammoniacal nitrogen (N-NH_4^+) of water at the exit.

3.5.4.2. Nitrite (N-NO_2^-)

Nitrite ions (NO_2^-) are an intermediate stage between ammonium (NH_4^+) and nitrate ions (NO_3^-). Nitrifying bacteria (Nitrosomonas) transform ammonium into nitrites. This operation, which requires a high consumption of oxygen, is nitridation.

Nitrites are very dangerous for aquatic organisms, even at very low concentrations, their toxicity increases with temperature.

According to figures 17 and 18, the Mascara plant and the Ghriss plant present results consistent with the discharge standard (≥01 mg/L), with a slight increase in the month of October concerning the release of Mascara plant, this increase is linked to the lack of oxygen in the basins.

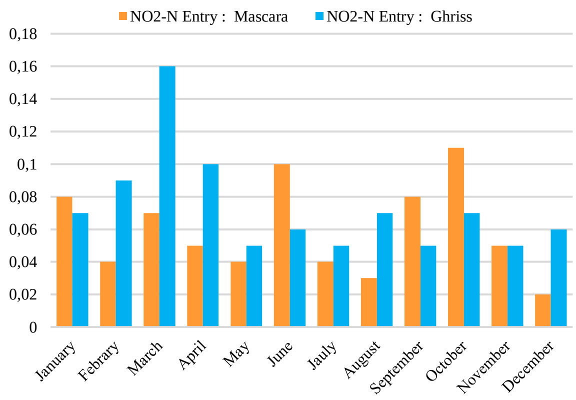

Figure 17: Result of the nitrite (N-NO_2^-) of water at the entrance.

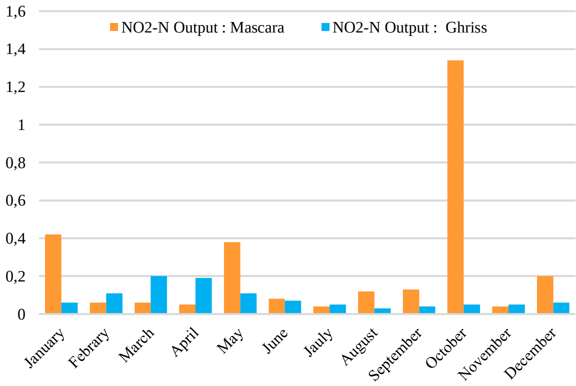

Figure 18: Result of the nitrite (N-NO_2^-) of water at the exit.

3.5.4.3. Nitrate (N-NO_3^-)

Comparing the results found from the two treatment plants (Figures 19 and 20) with the results of the quality of the water purified in nitrate (N-NO_3^-), all the values are less than 5 mg/L and present very good rejection quality.

Nitrates are not toxic but high levels cause algal proliferation which contributes to the eutrophication of the environment. Their potential danger is related to their reduction in nitrates.

Citation: MAHI B., BENDAHA M. E-L.A. , SMAHAT N. and BELGHERBI B. (2025, Mars 30) Comparative Study Between Two Processes for Depolluting Waste Water from Two Wastewater Treatment Plants: Activated Sludge (Mascara) and Aerated Lagooning (Ghriss). *Revue Nature et Technologie*, 17 (1), 25-48.

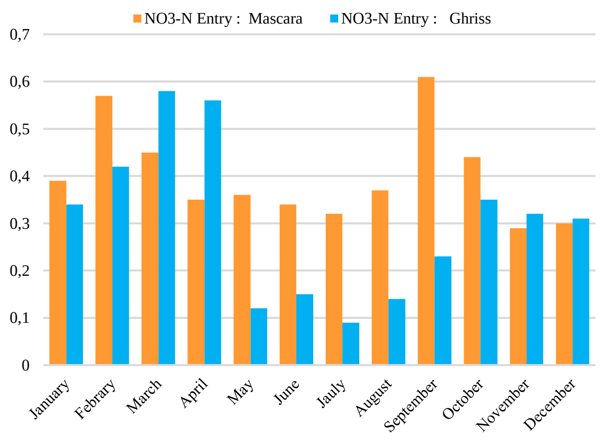

Figure 19: Result of the nitrate (N-NO_3^-) of water at the entrance.

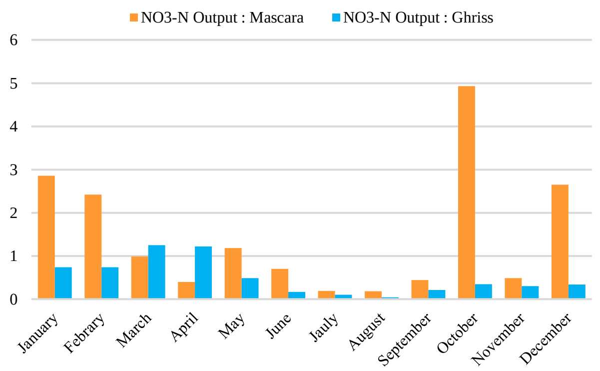

Figure 20: Result of the nitrate (N-NO_3^-) of water at the entrance.

In wastewater treatment plants, the reduction of nitrogen or organic matter (BOD, COD) occurs during the aeration process. During nitrification, the oxygen requirement increases due to the oxidation of ammonia and nitrite to nitrate. This process has a high impact on oxygen consumption [13].

Performed analyses on nitrite and nitrate at the exit were lower than those of the standard and joined the results obtained by Bachi *et al.* [10].

3.5.5. Phosphorus materials (Orthophosphate PO_4^{-3})

Phosphorus comes from human metabolism, laundry and cleaning products, industrial discharges (effluents from food industries, slaughterhouses, industrial laundries) and agricultural or natural discharges. Orthophosphates (PO_4^{3-}) and Poly-P which turn to PO_4^{3-} after slow hydrolysis are the typical phosphorous forms present in urban wastewaters [14].

Biological phosphorus removal is based on the accumulation of phosphorus in the form of polyphosphates by microorganisms. Biological phosphorus removal results in a transfer of phosphorus from the liquid phase (wastewater) to the purifying biomass which is gradually enriched in phosphorus. The results found either for the Mascara plant or the Ghriss plant (Figures 21 and 22) show unstable orthophosphate values (PO_4^{-3}). This instability is due to the organic load arriving at the entrance to the plant and seasonal temperature variations. As the temperature decreases with the arrival of autumn, biological activity is reduced. Therefore, there is a decrease in the rate of conversion of phosphates to orthophosphates. The values in both sites are consistent compared to the norm (≥10 mg/L).

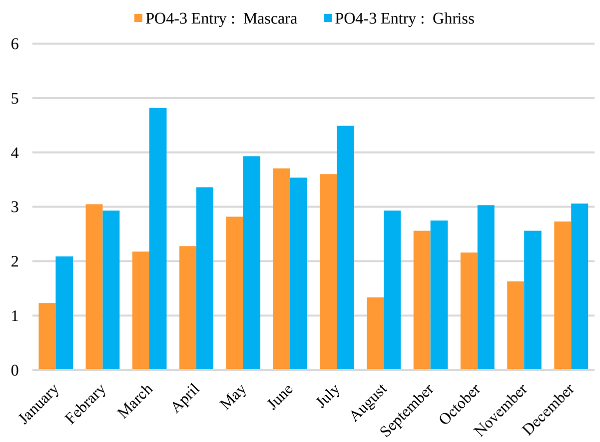

Figure 21: Result of the phosphorus materials (Orthophosphate PO_4^{-3}) of water at the entrance.

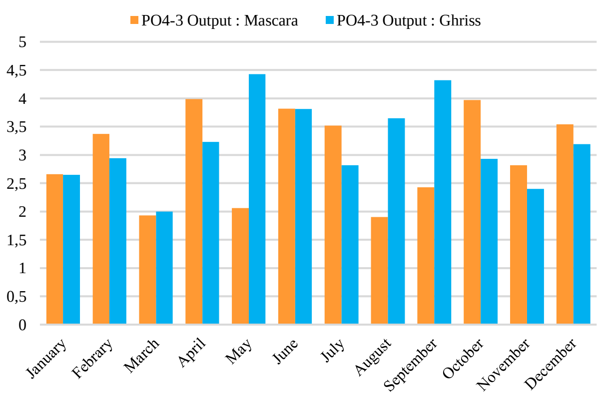

Figure 22: Result of the phosphorus materials (Orthophosphate PO_4^{-3}) of water at the exit.

4. Conclusion

Environmental protection is a collective concern in sectors of public activity; it is becoming a priority necessity in the politics of developing countries. The choice of a process for the treatment of wastewater depends on a certain number of factors, the most significant of which are: The composition of the effluent, the type of reuse, the quality of needs and the size of the installation.

Effluents can have variable characteristics with regard to their volumes and concentrations of pollutants. The treatment of these wastes is usually done via a physico-chemical sector coupled with biological treatment. Raw wastewater is highly concentrated in pollutants and its use presents a high potential health risk.

After examining the physicochemical quality of waste and purified water for each plant over the twelve months during 2021, we can conclude:

The pH of the two treatment plants is ideal for the survival of microorganisms (6.5-8.5).

The artificial addition of oxygen (O_2) in the two processes clearly shows the increase in purifying performance.

Results of the analysis of nitrogenous materials ($N\text{-}NH_4$, $N\text{-}NO_3$, $N\text{-}NO_2$) in the two plants comply with the discharge standards.

Orthophosphate (PO_4^{-3}) shows low results and confirms the good functioning of both treatment processes.

Suspended matter: Yield=63.9% for activated sludge compared to 84.2% for aerated Lagooning.

Biochemical oxygen demand (BOD5): Yield=91.7% for activated sludge compared to 84.4% for aerated lagoon.

Chemical oxygen demand (COD): Yield=91.2% for activated sludge compared to 80.6% for aerated Lagooning.

The activated sludge decontamination process has given very significant results compared to aerated Lagooning, resulting in stable and high yields.

The economic aspect appears to be an advantage for aerated Lagooning presented by the investment cost as well as the very reduced operation compared to activated sludge which requires additional expenses.

Purifying wastewater using the lagoon process remains a perfectly ecological solution that protects the environment and offers landscape integration. In terms of profitability and efficiency, activated sludge is a more reliable biological purification process and allows the reuse of purified water in irrigation, by supplementing the physicochemical analyzes carried out by the plant laboratory with microbiological analyses.

For aerated Lagooning, we recommend tertiary treatment: filters planted with reeds for better environmental protection and also the exploitation of purified water which is produced in significant quantities in the irrigation and industrial sectors.

The purified waters are rich in nitrates and phosphorus, which avoids the purchase of fertilizers, so they can be used for irrigation of non-productive trees and palm trees according to FAO parameters.

The applications of the newly developed methods have perhaps given greater importance to the technical aspect of wastewater treatment. Tertiary treatment processes are secondary effluent treatment techniques. Among these methods, chlorination, ultraviolet irradiation, membrane filtration, microalgae cultivation, constructed wetlands, photo-Fenton and ozonation processes.

Acknowledgment

This work was realized in the research "Laboratory of Geo-sciences and sustainable Development (LGDE), University Mustapha Stambouli of Mascara, Algeria, in collaboration with the laboratory of the National Sanitation Office (ONA) of the plant of Ghriss, therefore our sincere thanks go to the staffs of these two units.

Conflicts of interest

The authors declare no conflict of interest.

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