

# The impact of EL HARIA technical landfill on the environment: degradation of microbiological water quality

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## Abstract

The EL HARIA Technical Landfill TL (location: 40 kms North of Constantine, Algeria) is operated from 2010 until 2015 (the official site closure date), beyond which the waste is evacuated to another uncontrolled landfill (Next to TL), which causes another source of contamination.

The leachate produced by the controlled and uncontrolled landfills, constitute a real source of an intense biological contamination, which degrades the microbiological quality of the superficial and underground water.

To examine the impacts on the environment, we executed several sampling outputs during these periods (six various points), we presented the results to identify the strain. However, Enterobacteriaceae, Total coliforms and staphylococcus. The results gives more than 200 cfu / 100 mL staphylococcus (for a 50 m of deep well), more than 200 cfu / 100 mL coliforms (for a well of 120 m depth), these two points are located at 800 m down of the landfills, we have isolated 100 strains, or we find several pathogenic strains such as *staphylococcus*, *enterobacter*, *acinetobacter*, *pseudomonas serratia phymuthyca*, , *salmonella spp*, *klepsiella*, *serratia marcescens* ..... these results have shown that leachate causes several adverse effects on human health, Animal health and the environment so the lagoon treatment adopted by the technical landfill is no longer effective.

**Keywords:** *Landfill, leachate, contamination, total coliforms, staphylococcus.*

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## 1. Introduction

The term landfill is used to describe the final operation for the disposal of household, industrial or other wastes. There are two types of landfill: uncontrolled (open pit) or controlled (Technical Center Landfill TCL). This is done in order to minimize the impact of waste on the environment. In our country, several landfills are in operation. The major problem recorded is the leachate resulting from the degradation of buried waste. Generally this leaching undergoes treatment by lagooning, then it is rejected outside the landfill which constitutes an important source of physical, chemical and biological contamination [1] and [2].

In this context, several studies have been carried out; D.Hall Boothe et al (2001) [3] showed that the leachate contains more than 20 pathogenic bacterias (*staphylococcus*, *enterobacter*, *acinetobacter*, *pseudomonas*.....). The same results were demonstrated by C.Trois et al (2010) [4]. According to Kattabi et al (2007) [5], the leachate of the Etuefont landfill (France) contains more than 106 cfu / mL in 1998, on the same site E.Belle (2012) [6] showed in the leaching the presence of enterococci at the rate of 320 cfu / 100 mL (wet and cold region). The Oued Smar-Algerie landfill (surface water) (Bouhezila et al 2011) [7] records an average of  $2.5 \times 10^4$  cfu / 100 mL in total coliforms and 150 cfu / 100 mL in

clostridium. According to Tshibanda et al (2014) [8], results revealed high concentration of faecal indicator bacteria, with the maximum values of  $1.6 \times 10^3$  and  $2.7 \times 10^3$  cfu /100 mL for E. coli and Enterococcus for surface water (N'Djili River) exposed to landfill leachate.

Similarly Mekaikia et al (2007) [9] have shown that groundwater is contaminated with 10-100 cfu / 100 mL in total coliforms, 100 cfu / 100 mL in streptococcus. For the El-Kerma landfill, Algeria, Bennama et al (2011) [10] recorded more than 1800 cfu / 100 mL in total coliforms, more than 2000 cfu / 100 mL in faecal streptococcus and the presence of sulphito-reducers (clostridium) and salmonella.

The first step in this work is the microbiological characterization of two leachates leaving the technical landfill and another open-air landfill near from the first one. Surface water for agriculture utilization has also been characterized in order to study microbial community. Within the second step, an enumeration was carried out for the groundwater located downstream of the two landfills, suspected to be polluted by the leachate. Finally biochemical identification on API20E galleries was carried out for the strains isolated from these waters.

## 2. Materials and methods

### 2.1. Study area

The technical landfill is 4 km east of the commun IBN Badis (El haria) which is about 40 km from the city of Constantine (figure 1). He returned to operation in 2010 until 2015. It received 800 tons of waste per day in 2015, official closing date. Beyond this date, the city's waste is transferred to the uncontrolled landfill near CET.



Figure1. IBN BADIS plan location

### Lagooning system

The leachate produced by the buried waste is sent to a lagoon system to treat it, which is composed of 3 successive lagoons of different volumes (see figures 2 and 3) which presents the first lagoon), the samples which should be analyzed are always taken from the outlet of each lagoon.



Figure2. Sampling points and wells location

### 2.2. Sampling points

The sampling points (figure 3) are chosen in such a way to respect the microbial representativity of the quality of the water and the leachate, our samples are taken always in the months of April and May, in order to keep the same climatic conditions for more significant results.

For the study of the microbiological impact on groundwater we chose three wells, whose characteristics are:

Table 1: Groundwater characteristics

| wells | Depth | use                       |
|-------|-------|---------------------------|
| 1     | 10 m  | Household Consumption     |
| 2     | 40 m  | Agriculture and livestock |
| 3     | 100 m | Agriculture and livestock |

### 2.3. Conservation and Transport

The closure and the tightness of the vials used ensure total protection against any contamination. The vials are made of 250, 500 and 1000 mL in borosilicate glass; they are washed beforehand and sterilized in an autoclave for 15 minutes at 120°C [11].

These flasks are transported in a cooler whose temperature is between 4 and 6°C. The bacteriological analysis is done within a maximum of 24 hours after the collection of the samples [11].



Figure 3. View the first lagoon (the same as the second and third)



Figure 5. Surface water, resulting from groundwater runoff, 400 m downstream of the 2 nd landfill

#### 2.4 Used Media

##### ✓ *Total Aerobic Mesophilic Flora*

The total aerobic mesophilic flora (FMAT) is counted on PCA (Plat Count Agar) agar by 1ml surface seeding of the different dilutions carried out on 1 sample. The reading is performed after 24 hours of incubation at 37 °C. This group provides information from the overall bacterial load of the water to be analyzed.



Figure 4. Leachate leaving the landfill (after 3rd lagoon).

##### ✓ *Total Coliforms*

The germs are accustomed to the digestive tract of humans or animals. They also considered as indicators of the hygienic quality of the product to be analyzed. The coliforms are searched on BCP agar [12] incubated for 24 to 48 hours, at 37 °C.

##### ✓ *Sulphito-reducers (clostridium)*

They are counted on the culture medium: meat-liver-sulphite-iron in tubes. The culture is carried out under the conditions of anaerobiosis. It is preceded by a heat treatment of 10 min at 80 °C to eliminate all vegetative forms and leave only the spores of clostridiums and probably other thermotolerant germs. The tubes are incubated for 24 to 48 hours at 37 °C.

##### ✓ *Group D enterococcus*

Group D enterococcus (intestinal enterococci) are indicators of fecal contamination in water; enterococcus faecalis, and enterococcus faecium are pathogenic, these organisms are searched in the Slantz and Bertly medium, incubated for 24 hours at 37 °C [12].

*Staphylococci*

Staphylococci are ubiquitous germs that can live in nature, the mucous membranes of man. Some strains are pathogenic for humans and animals, such as *S.aureus* (human or animal origin) they are detected on Baird Parker medium [12].

✓ *Enterobacter- E.coli*

Those bacteria are present in the environment, commensals of digestive tract of man and animals. Some strains are pathogenic such as; *Enterobacter aerogenes*, *E. cloacae*, *E.sakazakii*, *E.ergoviae*, and some strains of *E. coli*. These germs are searched in the EMB medium (Eosine Methylene Blue) incubated 24h at 37 °C [12].

✓ *Salmonella - shigella*

Salmonellas and shigellas are enterobacteria, they are intestinal parasites of the vertebrae (salmonellas) and humans (shigellas), most of these species are pathogenic; shigella dysenteriae; shigella sonnei, salmonella typhi, paratyphi, S.enteritidis .... They are researched in XLD or Hektoen media, incubated 24h at 37 °C [12].

✓ *Enterobacteriaceae*

This type includes all that is described above; they are sought quantitatively on VRBG medium incubated 24h at 37 °C.

The research techniques used are:

- Dilution technique and surface seeding for low or highly polluted environments.
- Membrane filtration technique using sterile 0.22 µm cellulose membranes. Results

**3. Results***3.1 Results of the first part of the work**3.1.1 Leachates and surface waters*

The results obtained for the analysis of polluted water are presented in the following tables and figures (the unit is cfu /mL in all the tables:

Table 2. Microbiological results obtained for the leaching of two lagoons (point 1 and 2)

|      | Enterobacteriaceae |                   | Total Coliforms   |                   | Salmonilla-shigella | Clostridium |
|------|--------------------|-------------------|-------------------|-------------------|---------------------|-------------|
|      | Lagoon 1           | Lagoon 2          | Lagoon 1          | Lagoon 2          | 1 and 2             | 1 and 2     |
| 2016 | 9x10 <sup>7</sup>  | 5x10 <sup>5</sup> | 2x10 <sup>4</sup> | 5x10 <sup>3</sup> | ≥300                | Exist       |
| 2017 | 2x10 <sup>7</sup>  | 2x10 <sup>6</sup> | 5x10 <sup>5</sup> | 10 <sup>4</sup>   | ≥300                | Exist       |

Table 3. Microbiological characterizations of leachates leaving the landfill (Point 3)

|      | Total Flora      | Enterobacteriaceae | Total Coliforms    | Staphylococcus  | Streptococcus       | Salmonella-shigella | Clostridium |
|------|------------------|--------------------|--------------------|-----------------|---------------------|---------------------|-------------|
| 2012 | ≥10 <sup>7</sup> | 2x10 <sup>6</sup>  | 25X10 <sup>4</sup> | ---             | -                   | ≥300                | exist       |
| 2013 | ≥10 <sup>7</sup> | 10 <sup>6</sup>    | 30X10 <sup>4</sup> | --              | --                  | ≥300                | -           |
| 2014 | --               | 10 <sup>7</sup>    | 5X10 <sup>6</sup>  | 10 <sup>3</sup> | 36 x10 <sup>5</sup> | 10 <sup>3</sup>     | -           |
| 2015 | --               | 12X10 <sup>7</sup> | --                 | --              | --                  | ---                 | -           |
| 2016 | --               | 5x10 <sup>6</sup>  | 8x10 <sup>5</sup>  | --              | --                  | --                  | exist       |
| 2017 | ≥10 <sup>7</sup> | 60X10 <sup>5</sup> | 4X10 <sup>5</sup>  | --              | --                  | --                  | exist       |

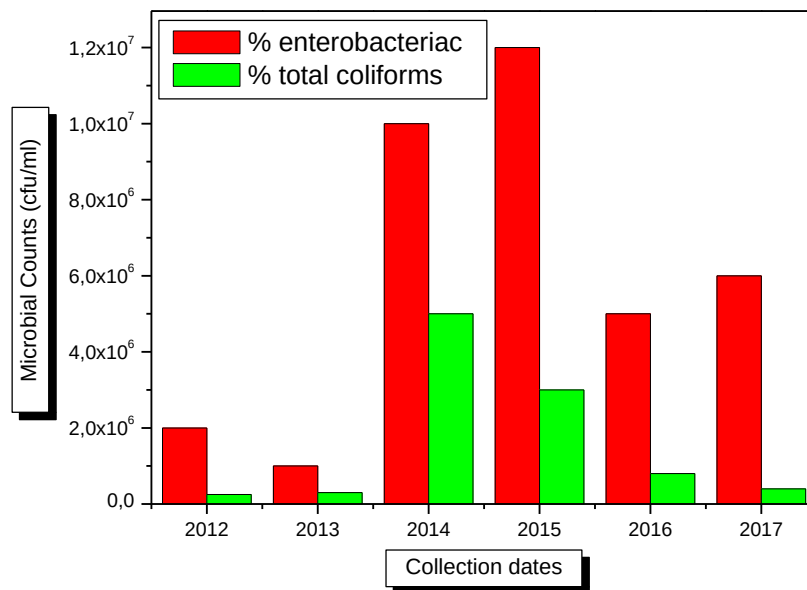


Figure 6. Spatiotemporal evolution of total coliforms and enterobacteria for Leachates emerging from the landfill.

Table 4: Microbiological analyzes of surface water (point 4)

|      | Total Flora        | Total Coliforms   | Enterobacteria ceae | Staphylococcus | Streptococcus     | Salmonilla-shigella | Clostridium |
|------|--------------------|-------------------|---------------------|----------------|-------------------|---------------------|-------------|
| 2012 | 10 <sup>5</sup>    | 10 <sup>3</sup>   | 2x10 <sup>3</sup>   | --             | --                | ≥300                | exist       |
| 2014 | 10 <sup>7</sup>    | 10 <sup>5</sup>   | 1.3x10 <sup>3</sup> | 900            | 2x10 <sup>3</sup> | 230                 | exist       |
| 2016 | 50x10 <sup>8</sup> | 10 <sup>5</sup>   | 10 <sup>4</sup>     | --             | --                | --                  | --          |
| 2017 | 10 <sup>11</sup>   | 2x10 <sup>5</sup> | 10 <sup>6</sup>     | --             | --                | --                  | --          |

Table 5: Microbiological analyzes of surface water (point 5)

|      | Total Flora       | Enterobacteria ceae | Total Coliforms   | Staphylococcus | Streptococcus     | Salmonilla-shigella | Clostridium |
|------|-------------------|---------------------|-------------------|----------------|-------------------|---------------------|-------------|
| 2012 | 2x10 <sup>4</sup> | 10 <sup>3</sup>     | 100               | --             | --                | ≥300                | exist       |
| 2014 | 10 <sup>7</sup>   | 800                 | 500               | 30             | 3x10 <sup>3</sup> | 280                 | exist       |
| 2016 | --                | 2x10 <sup>3</sup>   | --                | --             | --                | --                  | --          |
| 2017 | --                | 7x10 <sup>3</sup>   | 3x10 <sup>2</sup> | --             | --                | --                  | --          |

Table 6: Microbiological analyzes of leachates leaving the open-air landfill (points 6 and 7).

|      | Total Flora         |                   | Enterobacteriaceae |                    | Total Coliforms   |                   |
|------|---------------------|-------------------|--------------------|--------------------|-------------------|-------------------|
|      | Point 6             | Point 7           | Point 6            | Point 7            | Point 6           | Point 7           |
| 2016 | 10 <sup>6</sup>     | 8x10 <sup>8</sup> | 20x10 <sup>4</sup> | 30x10 <sup>3</sup> | 2x10 <sup>3</sup> | 3x10 <sup>3</sup> |
| 2017 | 40x10 <sup>10</sup> | 9x10 <sup>9</sup> | 30x10 <sup>5</sup> | 60x10 <sup>4</sup> | 4x10 <sup>5</sup> | 2x10 <sup>4</sup> |

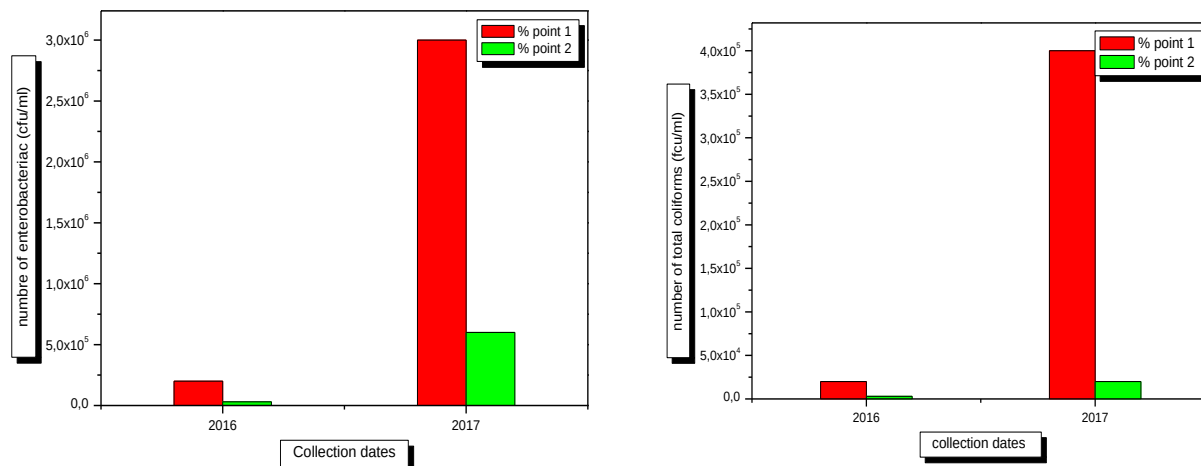


Figure 7. Evolution of coliforms and Enterobacteriaceae in the leachate of the open-air landfill.

Table 7: Microbiological analyzes of other sampling points.

|           | Enterobacteriaceae | Total Coliforms   | Enterococcus       | Staphylococcus    | Salmonella-Shigella |
|-----------|--------------------|-------------------|--------------------|-------------------|---------------------|
| 8 (2016)  | 20x10 <sup>5</sup> | 3x10 <sup>5</sup> | ---                | ---               | ---                 |
| 9 (2016)  | 10 <sup>4</sup>    | 10 <sup>3</sup>   | ---                | ---               | ---                 |
| 10 (2012) | 10 <sup>3</sup>    | 2x10 <sup>2</sup> | ----               | ---               | 280                 |
| 11 (2016) | 10 <sup>8</sup>    | 2x10 <sup>6</sup> | 12x10 <sup>6</sup> | 2x10 <sup>5</sup> | 5x10 <sup>4</sup>   |

10- Source of water in the landfill

11- Point at 100 m downstream of the technical landfill.

### Discussion:

- Total aerobic mesophilic flora (TAMF) is used as an indicator of global pollution. They are able to grow at optimum growth temperatures between 25 and 40 °C. The TAMF provides information on the indigenous microflora brought by pollution [13]. The results of the microbiological analyzes show that the average content of the total aerobic mesophilic flora fluctuates enormously according to the years, of the order of 10<sup>2</sup> cfu / mL for leachates leaving the controlled landfill, 10<sup>10</sup> cfu / mL for the outgoing leachates from 2 nd landfill and 10<sup>4</sup> for surface waters, Tables 2, 4 and 6.

- Enterobacteriaceae, this family gathers all the germs to study, it contains pathogenic germs and not, we find that the presence of enterobacteriaceae in the leachates (point 3) rises from 2x10<sup>6</sup> in 2012 to 12x10<sup>7</sup> cfu / mL in 2015, which is a maximum value, after it decreases following the transfer of waste to the second discharge, or the flow of leachate decreases, automatically, the amount of

enterobacteriaceae increases in the leachates of points 6 and 7. It is of the order of 30x10<sup>5</sup> cfu / mL in 2017.

- Total coliforms are gram (-) rods, aerobic and optionally anaerobic; non-sporulating agents capable of fermenting lactose. The results relating to the variation of the average coliform content, shows that its organisms have average values recorded in the leachate of the controlled landfill of 4x10<sup>5</sup> cfu / mL, a value comparable to that of the 2 nd landfill, the amount of coliforms in the lagoon is also important of the order of 10<sup>4</sup> cfu / mL, these values are comparable to that of the Kenitra landfill 3.10<sup>4</sup> cfu / 100 mL , April 2013 [13], the maximum value for the leachates of technical landfill was registered in April 2015. After this date the amounts of coliform decrease (Figure 6).

- staphylococcus are still present, they are found in wastewater and contaminated by feces, they survive less time than coliforms in water [14] which explains their quantity, 10<sup>3</sup> for the leachate and 30-900 cfu / mL for surface waters (Table 5).

• Group D enterococci are also fecal coliforms, in the leachate they are of the order of  $36 \times 10^5$  cfu / mL, a high value, which can be explained by the survival time of enterococci in water (it is more than coliforms) according to Edberg et al. 1997 [15] and by the moderately high temperature (25-30°C) of the region, it is found that this amount is also high in the surface waters, it is order of 2000 cfu / mL, this value can be explained by the contamination by the leachate, on the one hand, and the external inputs coming from the hearths or the rejections of the animals, because the region is agricultural on the other hand.

• Salmonella and Shigella are also present in the rejected leaching and two lagoons with important values of the order of 200-300 cfu / ml, this quantity can be explained by the presence of vertebrae including dogs, rodents and birds, main vectors of salmonellas [16].

These results show that leachates are highly loaded with enterobacteriaceae and total coliforms (Tab 3 and 6). The throw of leachates of two landfills into the environment is a major source of microbial contamination

of surface waters, enterobacteria, total coliforms, Staphylococcus, Streptococcus, Salmonella and sulphito-reducers (Tab 4, 5 and 7) are also present. Abdalla et al (2018) [17], Drieux et al (2014) [18], tested the presence of other organisms such as Salmonella, Pseudomonas, Klebsiella, Aeromonas spp others that are mentioned above.

Since these waters are also used for watering crops, humans can be indirectly contaminated by ingesting contaminated plants, which is a danger to public health, they are also used for animal husbandry, which may constitute reservoirs of pathogens such as salmonella [19].

### 3.1.2 Groundwaters

The results recorded for the three wells are presented in the following tables (units in cfu /mL).

Table 8: Microbiological analyzes of well-1 water (point 12)

|      | Total flora | Enterobacteriaceae | Total Coliforms | Enterococcus | Staphylococcus | Salmonella-shigella | Clostridium |
|------|-------------|--------------------|-----------------|--------------|----------------|---------------------|-------------|
| 2012 | $\geq 300$  | $10^3$             | 300             | ---          | ---            | $\geq 300$          | exist       |
| 2014 | $\geq 300$  | $5 \times 10^3$    | $10^3$          | 150          | abs            | 30                  | exist       |
| 2016 | $\geq 300$  | 900                | 700             | 100          | ---            | abs                 | exist       |
| 2017 | $\geq 300$  | $10^3$             | 300             | 60           | ---            | abs                 | exist       |

Table 9: Microbiological analyzes of natural spring water (point 13)

|      | Total flora | Enterobacteriaceae | Total Coliforms | Enterococcus | Staphylococcus | Salmonella-shigella | Clostridium |
|------|-------------|--------------------|-----------------|--------------|----------------|---------------------|-------------|
| 2012 | 200         | Abs                | 40              | abs          | abs            | abs                 | exist       |
| 2014 | $\geq 300$  | 800                | 500             | $\geq 300$   | 25             | 50                  | exist       |
| 2016 | $\geq 300$  | 900                | 300             | 20           | ---            | 10                  | exist       |

Table 10: Microbiological analyzes of wells water (wells 2 and 3)

|      | Enterobacteriaceae |       | Total coliforms |       | Enterococcus |       | Total flora |       | Staphylococcus |       |
|------|--------------------|-------|-----------------|-------|--------------|-------|-------------|-------|----------------|-------|
|      | Well2              | Well3 | Well2           | Well3 | Well2        | Well3 | Well2       | Well3 | Well2          | Well3 |
| 2016 | 250                | ---   | 100             | ---   | 30           | ---   | $\geq 300$  | ---   | abs            | ---   |
| 2017 | 120                | 80    | 50              | 60    | 20           | abs   | $\geq 300$  | 200   | abs            | abs   |

The results obtained with the three wells (Tables 8, 9 and 10), showed that waters contains significant amounts of pathogenic germs (total coliforms, faecal coliforms (fecal enterocotococcus) but no staphylococcus, indicating a bacteriological pollution of the underground waters.

Well 1, located downstream of the controlled landfill is the most polluted bacteriologically .This pollution results from the fact that this well is located in the waste accumulation zone and therefore close to the leachate production area, the same explication is adopted for wells 2 and 3, except that the duration of exposure to the leachate is less than that of the first.

In the same context, Tairu et al (2015) [20] showed that groundwater around a source of faecal contamination (latrines), 9 to 15 m away, is polluted by *E. coli*, *Staphylococcus*, *Pseudomonas*, *Enterococcus* and *Enterobacter*. This contamination increased with the decreasing of the distance between wells and latrines. Adeyemi et al (2007) [21] showed that well water and

boreholes at 1 to 1.5 km are polluted by the leachate of a landfill (presence of streptococcus, *E. coli*, salmonella sp and shigella sp).

### 3.2 The results of the second part of the work

100 ml of the surface water (well 1, well 2 and well 3) are filtered on a 0.45 mm diameter cellulose membrane, the sterilization conditions are respected, these membranes are cultured on VRBG, haktoen, EMB media, after 24 h of culture, they are subcultured on the same medium for the purpose of purifying the strains, then transferred to a non-colored medium (TCC). After 24 h of culture, they are subjected to a biochemical identification on API20E gallery incubated 24 h at 37 °C., the necessary reagents are added and the oxidase test is carried out, the reading results, with reference to the API20E catalog are presented in the following table:

Table 11: Results of identification of strains obtained from groundwaters

| Strains                          | number | Source          |
|----------------------------------|--------|-----------------|
| <i>Pasteurilla</i>               | 5      | Well 1          |
| <i>Pasteurilla pneumotropia</i>  | 7      | Well 1          |
| <i>Non fermenter spp</i>         | 3      | Well 2          |
| <i>Acinetobacter baumannia</i>   | 5      | Well 1 and 3    |
| <i>Pseudomonas aerogenas</i>     | 9      | Well 1 and 2    |
| <i>Pontoea spp3</i>              | 10     | Well 1 and 2    |
| <i>Flavimonas hyzihabita</i>     | 3      | Well 2          |
| <i>Klebsiella pneumoniae spp</i> | 3      | Well 1          |
| <i>Shigella spp</i>              | 4      | Well 1          |
| <i>Acinetobacter</i>             | 4      | Well 1          |
| <i>Acinetobacter pneumonia</i>   | 5      | Well 1 and 3    |
| <i>Chryseomonas lutela</i>       | 8      | Well 1 and 2    |
| <i>Serratia phymuthca</i>        | 6      | Well 1 and 3    |
| <i>Seerratia marcescens</i>      | 5      | Well 1 and 3    |
| <i>Serratia odorifera</i>        | 4      | Well 3          |
| <i>Enterobacter gergovine</i>    | 14     | Well 1 and 2    |
| <i>Enterobacter anmigennes</i>   | 6      | Well 1 and 2    |
| <i>Enterobacter cloacae</i>      | 7      | Well 2          |
| <i>Citrobacter broaki</i>        | 5      | Well 1          |
| <i>Citrobacter fendii</i>        | 3      | Well 2          |
| <i>E. coli1</i>                  | 10     | Well 1, 2 and 3 |
| <i>Salmonella arizonae</i>       | 4      | Well 1 and 3    |
| <i>Salmonella spp</i>            | 3      | Well 1          |
| <i>Proteaus pennai</i>           | 6      | Well 1          |
| <i>Aeromonas hydrophile</i>      | 3      | Well 1          |

Aerobic microorganisms are identified for the purpose of confirming the contamination of groundwater (3 wells), by the leachate of the TL during the active phase and after the closure of the technical landfill. More than 100 isolated strains are chosen to identify on API20E galery. These strains are isolated from wells 1, 2 and 3 (the available wells), knowing that the presence of these different bacteria does not eliminate the presence of other genres, because of the sampling dates (always in May/April). The reading results are shown in the table 11, they are presented according to their number and their sources more than 100 different strains were recovered by the membrane filtration technique of 100 mL of water from the samples 1, 2 and 3 on medium VRBG, TCC, EMB and SS, approximately 100 strain was identified, some of these isolated sprouts (*Klebsiella pneumoniae* spp. (3 species) are opportunistic pathogens (percival et al), *Shigella* spp (4 species) as opportunistic pathogens, it causes infections either by direct consumption of contaminated water or by the washing food with this water [22] [23], they are isolated from well 1. Concerning the genera *Serratia* (*S. phymutica*, *S. marcescens*, *S. odorifera*) (15 species), these bacteria are total coliforms; they are opportunistic pathogens [24], they are detected in wells 1 and 3. *Pseudomonas aerogenes* (9 species), *Enterobacter* (*E. gergovine*, *E. amnigenes*, *E. cloacae*) (20 species) and 8 species of *Citrobacter* (*C. brooki* and *C. freundii*) are also recorded, they are fecal coliform pathogens [25]. These latter germs are found naturally in wastewater, soil but originally in human faeces [22] which confirm our hypothesis (contamination by the leachate of TL).

The *Pasteurella* and *Pasteurella pneumotropica* genus (12 species) was isolated from wells1, it is a pathogenic bacterium for animals [3]. We also recorded the presence of other genera such as *Aeromonas hydrophila* (3 species) which is pathogenic, their presence indicates the contamination of the source [26], *Proteus penaei*, and it is also pathogenic [25]. *E.coli*1 is present in all wells and is considered to be the best indicator of recent faecal contamination (100 days) of the aquatic environment by human faeces to warm-blooded animals [22]. *Salmonella arizonae* and *salmonella* spp are also detected in wells 1 and 3, it is properly classified as a pathogenic bacterium, although consuming local water is often unimplicated as a possible source of *Salmonella* disease [12] [22].

The genus *Acinetobacter* is present in well 3, *Acinetobacter* is ubiquitous and opportunistic, and the species *Acinetobacter pneumoniae* is the most frequent in terms of pathogenicity [22]. *Chryseomonas luteola* or also called *Pseudomonas luteola* can cause serious infections

[27]. *Pontoea* spp3 *Flavimonas hyzihabita* is also detected in wells 1 and 2.

#### Distribution of germs in wells:

It is noted that the largest quantity of species is isolated from point 1, 67% against 24.1% was recorded for the well 2 and finally 8.9% for the well3, which is logical, the well (50 m depth and 700 m downstream of the wild dump) it is well exposed to the leachate of the dump, although the well 2 is deeper (120 m deep), these two wells are badly or not treated, the water of these two point is intended for the agriculture and the breeding of the animals, on the other hand the well1 is intended for the consumption of the house, its treatment is regular although it is below the CET by 1500 m approximately.

#### 4. Conclusion

The HARIA landfill, which operated for less than a few years and was transferred to an uncontrolled (open pit landfill), receives an average of more than 10000 tons / year of waste of all kinds.

The leachate generated by these two landfills has shown that the agricultural environment of the landfill has a very high level of pollution, which is characterized by the presence of different enterobacteriaceae especially total and fecal coliforms, streptococcus, staphylococcus, salmonella.

These germs are also detected in the surface waters designated for agriculture, in the ground waters with high depths (50 m). So we see that waters of the region are unfit for human consumption, graciously according to the standards advocated by World Health Organisation, without forgotten that this study was carried out in the months March / April for each year, a period characterized by a moderately high temperature (25-30° C) accompanied by a drought in this region, which explains the high rate of germs that has been registered [23].

For a good exploitation of this controlled landfill, this leachate requires other means of treatment besides the lagooning before the rejected in the environment especially in the winter period, or the rate of run-off is higher.

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