# Analysis and Evolution of Solid and Leachates Residues at the Level of the Gas Complex

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***Abstract*— The purpose of this work was to identify and recover sludge from the Wastewater treatment plant WWTP and sludge from the CPS. Sampling is one of the most important operations in monitoring the proper functioning of a Wastewater Treatment Plant WWTP and Corrugated Plate Separators CPS. This is because the representativeness of the sample is the most important parameter because it makes it possible to make the necessary adjustments for the proper operation of the equipment. Sampling. however. requires means adapted to the types of pollutant and difficulties that the site or facility offers. This problem is not solved at GL1Z. because the sampling is carried out according to archaic techniques using This point is considered as priorities which must be supported by the GL1 / Z. The conservation of the samples must itself meet standards and criteria. and requires means. This aspect of the problem is not properly taken into account by the GL1/Z. it is necessary to operate a directive to respect in terms of taking and conservation of the samples. The various analysis that we have carried out. respecting the instructions of the manufacturer are: BOD5. COD. total phosphorus. dissolved oxygen. oils and fats. Suspended Matter SM. heavy metals. pH and Temperature.This forces the GL1/Z complex to rehabilitate these two sanitary : water treatment plants and oily water of corrugated plate separators of CPS. the problem that arises and that has always been how to do with these sludge and how to reduce their volumes. and their imapcts on the aquatic environment.Long considered. as a subsidiary operation of water treatment. the treatment of sludge can not obviously to be more lightly defined.To be able to properly and rationally solve a sludge problem. it is absolutely essential to know how to characterize the "Waste" product and choose a treatment system depending on the type of sludge and the final destination possible.And for this we chose to study the establishment of drying beds at the GL1/Z complex. Drying is used for very different products such as granular materials. liquid products. pasty materials. etc. The purpose of this work was to identify and recover sludge from the WWTP and sludge from the CPS. This is why it was recommended to set up the drying beds and a sludge treatment unit. It can be said that the requirement of the quality and the reliability of the treatment of the water has a direct impact on the management. sludge which is particularly expensive and needs to be optimized. taking into account. in particular. the possible final destinations for sludge. Oily water deposits do not have to be dried in drying beds because the weight of the sludge after drying is negligible in front of the water eliminates either by evaporation or sand filtration; and since it has an oily sludge it can be used for incineration.This slude can not be used in agriculture because of the very high amount of heavy metals that are very toxic to humans and are environment it can be used in a dead land or landfill.**

***Keywords*— Sludge .WWTP . CPS . environnement . drying.**

## I. INTRODUCTION

The activity of certain chemical and petrochemical industries. considered as being responsible for the degradation of the environment. appears as an undesirable parasitic activity. In this context. it is not only the image of the company or its competitiveness in some markets that are at stake [1]. but its own survival in general. Inevitably. almost all purification processes applied to effluents from industrial sectors. whether biological or physico-chemical. result in the concentration of pollutants in the form of aqueous suspension or sludge.

For some years. sludge treatment has been a real environmental. economic and social issue. Urban sludge is characterized by a high water content and a potentially harmful composition for the environment (heavy metals. pathogenic micro-organisms) and poses a real management problem for the farmers. The sludge disposal channels are moreover in addition regulated. Incineration is relatively flexible (little storage. few intermediates) but remains very expensive (transport. operation. maintenance. disposal of slag. treatment of fumes) and demanding quality of sludge (prior drying of sludge to to have sufficient dryness). And finally the agricultural valorization (spreading or composting); This treatment process is based on the input of nutrients to the cultivated soil contained in the sludge. However. this sector is very controversial by the public opinion. Our study falls


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within this framework; and in agreement with the technical services of GL1/Z. we have been proposed to identify pollution in general. to focus on the treatment of sludge and to propose solutions [2-7].

## II. IDENTIFICATION OF AQUEOUS POLLUTION AT GL1/Z [8]

Contamination of water with foreign bodies such as microorganisms. chemicals. industrial waste or other degrade the quality of water and make it unsuitable for the desired uses. Regarding the complex GL1/Z . water contamination has been identified in different areas: the utility zone. the process zone. the sanitary water treatment plant (WWTP) and the Corrugated Plate Separators (CPS).

### *A. Traitement of Effluents*

From domestic water treatment plant (WWTP) The treatment of sanitary water is provided by a purification plant operating by aeration (activated sludge system), by means of air diffusers. it is designed to treat a daily volume of 177m3 / d, to obtain a final effluent that will be discharged into the sea in accordance with the quality standard of 40mg / l BOD (biological oxygen demand) and 30 mg / l of solid in suspension. Finally a disinfection is made before the discharge to the sea, the effluent is treated with chlorine. A residual chlorine content of 0.5 mg / l is maintained [9].

The different treatment phases are :
• Collection of sanitary water in a network and then return to a lifting station located in the zone of train 400.
• Transfer of the effluent by one of the two pumps to the sanitary water treatment plant.
• Screening - grinding
• Ventilation.
• Clarification.
• Chlorination.
• Rejection to the sea.

*Principle of operation*

For the treatment to work successfully, it is necessary to understand how the system works.
There are two basic components of the system, a ventilation chamber and a settling tank.
In the aeration chamber the wastewater is aerated in order to obtain the ideal conditions for growth of aerobic organisms. In the settling tank, these organisms can settle and are collected and proportionally recycled to the aeration chamber and the holding tank. These organisms represent the means for which the purification of wastewater is accomplished [10].

*a ) Grinder*

The pumped effluent from the general lifting station is oriented towards the entrance of the grinder / grate with a receiving box.
This grinder decreases large particles to facilitate the activated sludge treatment operation and to ensure the non-clogging of the pipe by these particles as shon in fig.1.

Fig.1 : photo of screen / grinder

b) Aeration chamber
Leaving the mill-sprayer, the flow of wastewater enters the aeration chamber.
The wastewater solution is aerated by means of 40 diffusers equipped with air regulating valves, and the air is supplied by two blowers, each having a capacity of 546 $m^3$ / hr.
Once the growth conditions combined, we notice the gradual appearance of a brown flocculated sludge and generally the purification of wastewater is completely completed only when this sludge is present in sufficient quantity.
The organisms have time to exhaust their food sources and self-destruction occurs resulting in reduced growth rate and hence minimal sludge production as shown in fig.2.Fig.2 :

photo of aeration chamber

*d) Chlorination tank*

The protection of the environment is an important activity in the development of petrochemical plants. In this sense. the GL1/Z complex has set to this policy and proceeded to the rehabilitation of the units and systems installed for the protection of the environment. For this purpose. during the project renovation of the facilities of the complex. two ( 02) new stations were installed. one for the treatment of oily water and the other for the treatment of sanitary water as shown in fig.3.


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Fig. 3 : Disinfection basin

*B. Oily Water Treatment System*

The treatment of contaminated water. consisting of oily water and runoff water. is provided by a battery of 4 separators called CPS separators which are inclined. corrugated and alternating plates to separate the oils and suspended solids from the water by gravity and using the principle of coalescence in order to obtain oily effluent levels towards the seawater discharge channel of less than 15 mg/l. given that the allowable limit of discharges of industrial effluents is 20 mg / l of water for oils and fats.

## III. PROBLEMATIC

The treatment of sludge is a difficult phase of the fight against pollution. a puzzle for the scrubber. for multiple reasons: scarcity of land available for spreading and disposal. necessities and requirements of the environment and public hygiene. etc.The GL1/Z complex has been certified since 2006 with 3 types of certifications: ISO 14001 (environmental management) .ISO 9001 (Quality Management System). OHSAS 18001 (British Standard Occupational Health and Safety Assessment Series ) .And so the complex GL1 / Z is committed to ensuring the implementation of the Quality Health Safety Environment QHSE policy that leads to manage all types of liquid discharge. solid and even This obliges the GL1/Z complex to rehabilitate these two sanitary water treatment plants of WWTP¨ and CPS oily water the problem which arises and which has always been:

- What to do with the sludge issues?
- How to reduce their volumes?
- Are they harmful?

And for that we chose to study the establishment of drying beds at the GL1 / Z complex. Drying is a unitary operation which consists in eliminating totally or partially a liquid impregnating a material by supply of thermal energy. It considerably reduces the mass and volume of products which facilitates their transport. storage and handling.

## IV. MATERIAL AND EXPERIMENTAL METHODS

*A. Sampling*

The taking of samples is one of the most important operations in monitoring the proper functioning of a WWTP and the CPS or a structure intended for the protection of the environment. Indeed. the representativeness of the sample is the most important parameter because it makes the necessary adjustments for the proper operation of equipment. Sampling however requires means adapted to the types of pollutant and to the difficulties of the site or the installation. This problem is not solved in GL1/Z. in fact the sampling is carried out according to archaic techniques using weak This point is considered as a priority to be taken care of by the GL1/Z. The conservation of the samples must itself meet standards and criteria. and requires means. Table 1 gives the conservation rules in force. This aspect of the problem is not properly taken into consideration by GL1/Z. it is necessary to introduce a directive to be observed in terms of taking and storing samples [11-17]. The various analysis that we have carried out. in following the manufacturer's guidelines are: phosphate. dissolved oxygen. oils and fats. suspended matter SM. heavy metals. pH and temperature. Sampling points are represented In fig.3 , fig.4 , table 1 and table 2.

Fig.3. : Levy of sanitary water deposits

Table 1: Measurement of global parameters of the pollution of the depots of sanitary water deposits

| pH | T (°C) | SM (mg/l) | Phosphates (mg/l) | Total phosphorus (mg/l) | Oils and fats (mg/l) |
|---|---|---|---|---|---|
| 8.3 | 21.3 | 147.05 | 36.184 | 11.799 | < 0.1 |

Table 2 : Heavy metals analysis of sanitary water deposits

| Cu (mg/l) | Pb (mg/l) | Zn (mg/l) | Cd (mg/l) | Fe (mg/l) | Ni (m |
|---|---|---|---|---|---|
| <0.001 | < 0.001 | 0.063 | 0.031 | 0.139 | 0.0 |

Fig.4. Sanitary water deposits Dépôt des eaux sanitaires

The physico-chemical characteristics as well as the analysis of the heavy metals of the depots of sanitary water are represented in the tables (1 and 2).

## V. RESULTS AND DISCUSSIONS

### *A. Preparation of drying beds*

Total phosphorus : The phosphate content of the water is related to the decomposition of the organic matter. The analyzes carried out on the deposits of the health waters of the GL1 / Z complex give a value of 11.79 mg / l of phosphorus. which proves that phosphorus is used as a nutrient during the biological treatment is also its presence in the kitchen waters (detergents). Oils and fats: the analysis of oils and fats gives a value < 0.1 mg / l which depends on the rejected materials during the day. For heavy metals traces of copper and lead have been found; and a slightly high value of iron is tantamount to the contamination of the deposition of sanitary water by the corrosion of the walls of the installations. For our experiment we chose 03 uniform bins of the same volume as shown in Figure 3; Height = 15 cm; Width = 25 cm; Length = 35 cm as shown in figures ( 5-7 ).

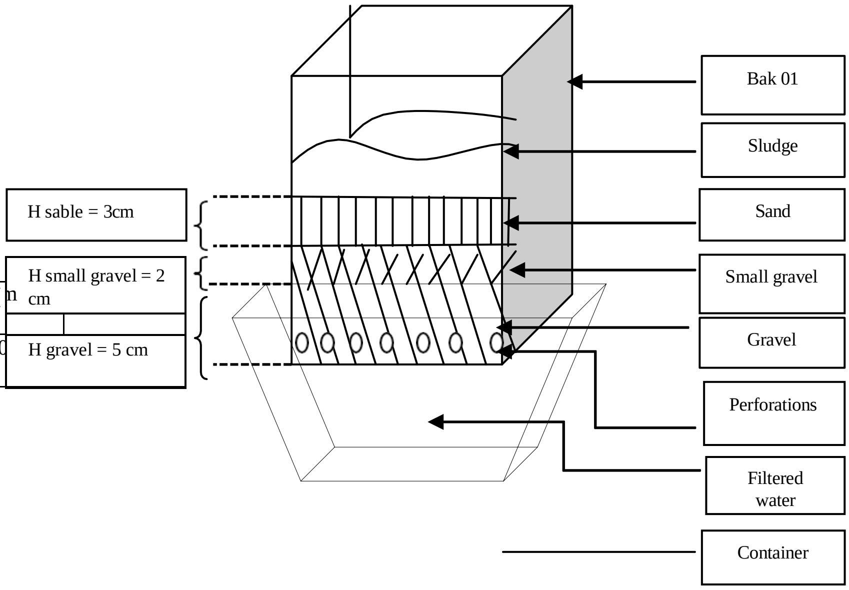


Fig.5 : Representative diagram of pilot A

Fig.6. : Preparation of drying pilots

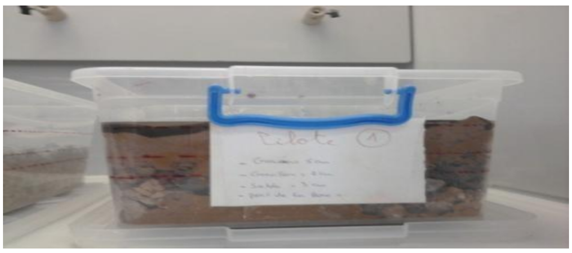

Fig.7 : Set up of pilot A


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*B. Characterization of the filtered water on sand of the pilot A sludge*

*V.4.1 characterization of sanitary water deposits*

The physicochemical characteristics as well as the analysis of heavy metals from the sanitary water deposits are shown in the tables (3-4) :

Table 3 : Measurement of global parameters of sand filtered water pollution

| pH | T (°C) | SM (mg/l) | Phosphates (mg/l) | Total Phosphorus (mg/l) | Oils and fats (mg/l) |
|---|---|---|---|---|---|
| 8.1 | 20.2 | 0.2 | 7.114 | 2.320 | < 0.1 |

Table 4: Heavy metals analysis of filtered water from sanitary sludge

| Cu (mg/l) | Pb (mg/l) | Zn (mg/l) | Cd (mg/l) | Fe (mg/l) | Ni (mg/l) |
|---|---|---|---|---|---|
| <0.001 | <0.001 | <0.001 | 0.012 | <0.001 | <0.001 |

*C. Drying of sanitary water deposits*

Drying of sanitary water deposits was carried out in a period of six days in the open air; the drying results are shown in Table 5 and figures ( 6-11 ):

Table 5: Drying of sanitary water deposits

| Time of drying (h) | Weight of sludge after drying (g) | Quantity of water removed after drying (%) |
|---|---|---|
| 144h15 min | 141.13 | 92.94 |

Fig.6. : Sludge

Fig.7. : Drying of sludge ue

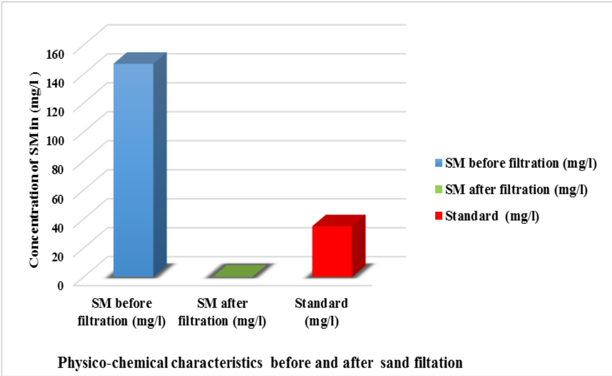


Fig. 8 : Concentration of SM before and after sand filtration

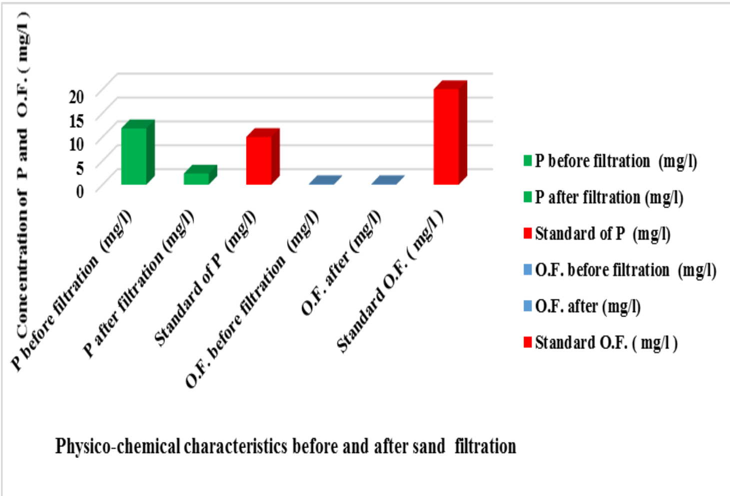


Fig. 9 : Total phosphorus analyses. and Oils and fats before and after sand filtration

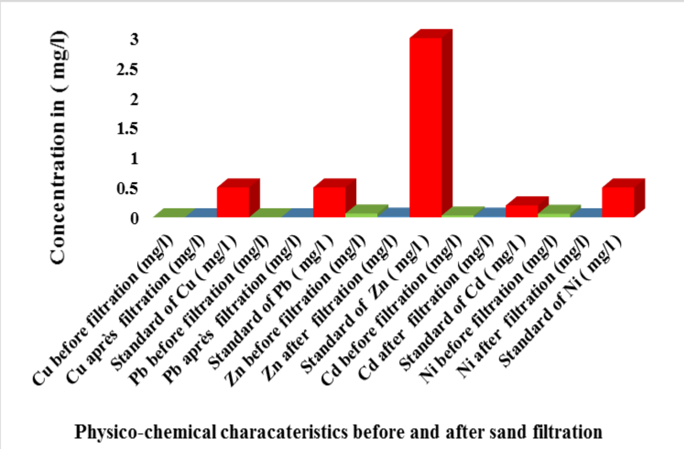


Fig.10 : Analysis of heavy metals before and after sand filtration

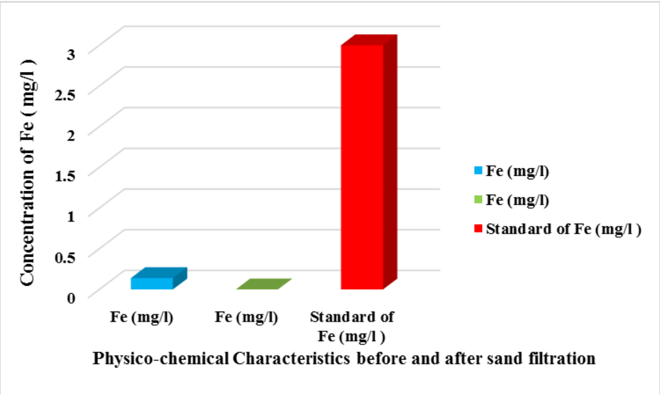


Fig. 11 : Analysis of Fe before and after sand filtration

*D. Analysis result of oily and sanitary sludge*

The different results of the various analyses and tests are summarized in the tables below

*a) Determining the rate of waste oils*

Calculation of the oil concentration in the sludge with: Equation N° 1

The mass of the 1.22 g filter paper is already tare on the scale when measuring sludge as shown in tables ( 7-8 ).

*Sanitary sludge :*

Oil content (%) = ((5-4.82) ÷ 5) × 100 = 3.6%

*Oily sludge :*

Oil content (%) = ((5-3.65) ÷ 5) × 100 = 27%

Table 6 : Change in oil content in sludge

| | Sanitary sludge | Oily sludge |
|---|---|---|
| Oil rate (%) | 3.6 % | 27 % |

*b) Hydrocarbon content*

Table 7 : Change in hydrocarbon content in sludge

| | Sanitary sludge | Oily sludge |
|---|---|---|
| Hydrocarbon content (mg / l) | < 0.1 mg / l | 21.75 mg / l |

Our oily sludge of CPS contains a quarter of its mass in used oil and a large quantity of hydrocarbons which are important sources of pollution since the used oil and the hydrocarbons are toxic and carcinogenic products on the one hand, and on the other hand a mine of energy due to their great calorific value.

*c) Phosphorus and total nitrogen content*

Table 8 : Variation of phosphorus content and total nitrogen in sludge

| Type of Sanitary sludge | Sanitary sludge | Oily sludge |
|---|---|---|
| Phosphorus content (mg / l) | 21.73 mg / l | 3.108 mg / l |
| Total nitrogen content (mg / l) | 28.95 mg / l | 2.31 mg / l |


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The sanitary sludge is very rich in phosphorus and nitrogen nutrients which are essential for the development of the flora which favors its valorisation in agriculture.

*d) Determination of metallic elements*

The heavy metal masses in the oily and sanitary sludge are summarized in the following table of results in mg / l as shown in tables ( 9-11 ) :

Table 9 : Quantification of metallic elements in oily and sanitary sludge in mg / l

| Elements | Cu | Zn | Fe | Ni | Pb | Cd |
|---|---|---|---|---|---|---|
| Sanitary sludge of WWTP ( mg/l ) | 0.8545 | 0.672 | 2,8312 | 0.2367 | 0.1362 | 0.00161 |
| Oily sludge of CPS ( mg/L ) | 1.214 | 1.30 | 4.04 | 0.5367 | 0.3565 | 0.00931 |

In Algeria there are no regulations that set the limit values for sludge parameters from wastewater treatment plants, the only regulation that exists is the AFNOR U44041 standard, developed for France in application of the European directive n ° 86-278 of June 12, 1986 anyway it is a norm which concerns the inputs of sludge intended for the spreading and in practice, it constitutes the only reference for sludge ;

The values given by the atomic absorption spectrophotometry of the laboratory GL1 / Z are expressed in mg / l) the norm AFNOR gives us values in mg / kg of dry matter DM that is why we must convert them in mg / kg of dry matter DM of the following way:

To prepare the treated water we dissolved 1 g of sludge in 100 ml of final solution in 1 liter of dry matter solution and we calculate the amount of these elements in 1kg of dry sludge with the following formula:

EQUATION N °2 :

Value in mg / kg of DM = X * 100/1000

Table 10 : Quantification of metallic elements in sanitary sludge in mg / kg

| Elements | Cu | Zn | Fe | Ni | Pb | Cd |
|---|---|---|---|---|---|---|
| Sanitary sludge of WWTP ( mg/kg ) | 85.45 | 67.2 | 283.12 | 23.67 | 13.62 | 0.161 |
| Norm in agriculture in ( mg / kg ) | 1 000 | 3 000 | / | 200 | 800 | 20 |

Table 11: Quantification of metallic elements in oily sludge in mg / kg

| Elements | Cu | Zn | Fe | Ni | Pb | Cd |
|---|---|---|---|---|---|---|
| Oily sludge of CPS ( mg/kg ) | 121.4 | 130 | 404 | 53.76 | 35.65 | 0.931 |
| Norm in agriculture in ( mg / kg ) | 1 000 | 3 000 | / | 200 | 800 | 20 |


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The chemical analysis of traces of heavy metals in the oil sludge of CPS and the sanitary sludge of WWTP, shows us well The predominance of three metallic elements with elevation of concentration are: copper (Cu), iron (Fe) as well as zinc (Zn) succeed by low concentration of nickel (Ni) and lead (Pb) and finally the presence of cadmium (Cd) in the form of a trace; but the concentration of these metal elements remain below the AFNOR standard which concerns the valuation of sludge in agriculture.

*e) Thermal treatment of CPS oily sludge*

The energetic recovery of oily mud is accompanied by a production of heat recovered in the form of steam or electricity and the residues of the incineration called "ash" which becomes another source of pollution if it is not eliminated c that is why we have suggested that it be valued as an addition in the manufacture of building materials.

*f) Calcination of the oily sludge at 500 ° C*

At the level of the RA1 / Z refinery laboratory, the oily CPS sludge was calcined in an oven at 500 ° C for 2 hours in figures ( 12-17 ).

Fig.12 : Put the oily sludge of CPS

Fig.13: Oily mud of CPS in the oven calcined at 500 ° C

Then, using a worm mortar the ash was crushed to prepare it in the various analyzes (see Photo IV.27) this operation makes it possible to homogenize the material taken.

Fig.14 : Ash of oily mud

□ The ash powder will be used for:

- Chemical composition of oily sludge
- X-rays diffraction analysis (XRD);
- Fourier transform Infrared (FTIR) analysis;
- Analysis of scanning electron microscopy (SEM).
- Determination of heavy metals by the atomic absorption spectrophotometry method.

*E. Analysis result of the oily sludge (GL1 / Z) dries at 500 ° C*

*a) Determining the rate of waste oils*


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Calculation of oil concentration in sludge with in figures ( 15-17 ) :
Equation N$^{o.}$ 2 :

The mass of the 1.22 g filter paper is already tare on the scale when measuring sludge.

Oil content (%) = ((5-4.8) ÷ 5) × 100 = 4%

Fig.15 : Used oil level in oily mud

Fig.16 : Oil content of CPS oily sludge

Fig.17 : Oil content of WWTP sanitary sludge

*F.* Techniques and characterization of sludge

*a) Chemical composition of drying oily sludge ( XRF )*

The importance of this analysis is to determine the nature of the oily mud, the results obtained are described in the following in table 12 and fig.18:

Table 12 : The chemical composition of oily sludge

| Chemical composition | Percentage % |
|---|---|
| Fat | 30,6 |
| Ashes | 15,2 |
| Humidity | 6,9 |
| Hydrocarbons | 17,3 |
| Heat output | 7000 Kcal/kg |

The chemical composition of the oily sludge produced at the EL FETH laboratory level shows us that, in addition to containing used oils, it also contains a high level of fat and hydrocarbons from the refining of oil hence its high calorific value, and a source of pollution for the soil that is why the refinery of Arzew can neither the landfill nor the used in the Agriculture.

*b) X-rays diffraction ( XRD )*

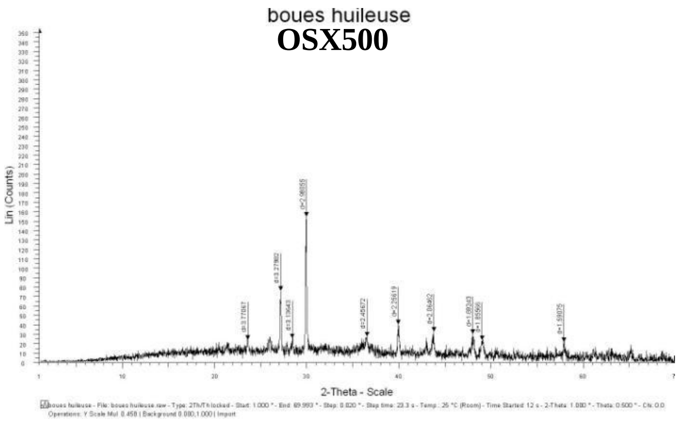


Fig.18 : Diffractogram of oily sludge dries at 500 ° C

• The peak at 2θ ° = 23.2 ° with the interarticular distance d = 3.77 corresponds to the opal-A ($SiO_2$ $nH_2O$) [18].

• The peak at 2θ ° = 27 ° With the interarticular distance d = 3.27 corresponds to quartz ($SiO_2$) [19].

• the peak at 2θ ° = 27 ° With the interarticular distance d = 3.27 corresponds for lepidocrocite (γ -FeOOH) [20].

• The peak at 2θ ° = 28.5 ° With the interarticular distance d = 3.13 corresponds to the diopside ($CaMgSi_2O_6$) [18].
[18] B.Y. lmaz, M,Ediz ,the use of raw and calcined diatomite in cement & concrete composites 30,202-21 ,2008.

• the peak at 2θ ° = 28.5 ° with the interarticular distane d = 3.13 corresponds to opal-A ($SiO_2nH_2O$) [18].

• the peak at 2θ ° = 30 ° with the interarticular distance d = 2.98 corresponds to calcite ($CaCO_3$) [18,19].

• the peak at 2θ ° = 36.5 ° With the interarticular distance d = 2.45 corresponds for Kaolinite ($Al_2Si_2O_5(OH)_4$) (ASTM N°=5-490 ) .
• the peak at 2θ ° = 40 ° With the interarticular distance d = 2.25 corresponds to For hematite ($\alpha$-$Fe_2O_3$) ( ASTM N°=8-98) .
• the peak at 2θ = 40 ° with the interarticular distance d = 2.25 corresponds to quartz ($SiO_2$) [19].
• the peak at 2θ ° = 43.5 ° with the interarticular distance d = 2.06 corresponds to the opal-A ($SiO_2nH_2O$) [19].
• the peak at 2θ ° = 48 ° with the interarticular distance d = 1.89 corresponds to quartz ($SiO_2$) [19].

• the peak at 2θ ° = 49 ° with the interarticular distance d = 1.85 corresponds to quartz ($SiO_2$) [19].

• the peak at 2θ ° = 58 ° with the interarticular distance d = 1.59 corresponds to quartz ($SiO_2$) [19].

According to the diffractorgram of oily sludge dried at 500 ° C. The phase identification has shown that there are two dominant phases of crystalline structure, calcium carbonate ($CaCO_3$) and silicon oxide ($SiO_2$).

*c) Fourier transform infrared spectroscopy ( FTIR )*

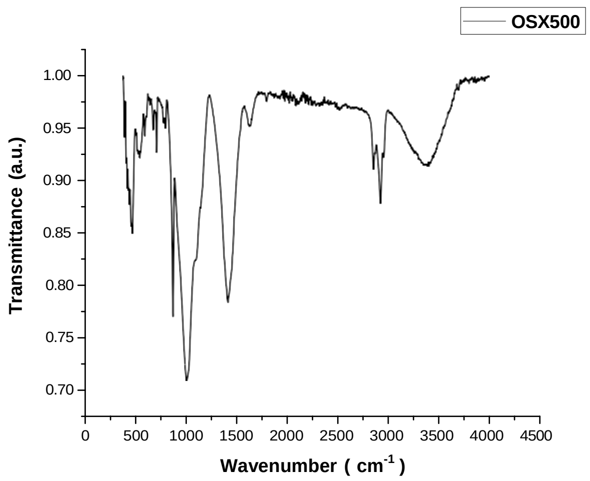


Fig.19 : spectrum of oily sludge dried at 500 ° C

According to the spectrum we have different bands to explain in fig.19 :
The two absorption bands at 200 cm -1 and 1350 cm $^{-1}$ in particular represent the families Halides (C-I, C-Br, C-Cl, C-F) ( ASTM N°=5-490).
• The 469.84 cm$^{-1}$ absorption plug corresponds to C-F vibrations ( ASTM N°=5-490).
• The 543.87 cm$^{-1}$ absorption plug corresponds to C-I vibrations ( ASTM N°=5-490).
• The two absorption drains at 711.81 cm$^{-1}$ and 676.88 cm$^{-1}$ correspond to the C-Cl and C-Br vibrations ( ASTM N°=5-490).
• The 797.46 cm$^{-1}$ absorption plug corresponds to C-Cl vibrations ( ASTM N°=5-490) .
• The 1007.15 cm$^{-1}$ absorption plug corresponds to the C-C and C-F vibrations . ( ASTM N°=11-654).
The two absorption bands at 1370 cm$^{-1}$ and 3000 cm$^{-1}$ correspond to alkanes and alkenes ( ASTM N°=11-654) .
• The absorption bung at 1415.63 cm$^{-1}$ corresponds to C-H vibrations ( ASTM N°=11-654).
• The absorption bung at 1627.80 cm$^{-1}$ corresponds to the vibrations C=C and C=N and N-H.
• The 1797.33 cm$^{-1}$ absorption plug corresponds to C=O covalent carbonate vibrations ( ASTM N°=11-654)..
• The 2852.51 cm$^{-1}$ absorption plug corresponds to the C-H vibrations ( ASTM N°=11-654).
• The 2922.09 cm$^{-1}$ absorption plug corresponds to C-H vibrations ( ASTM N°=11-654)..
Generally it is hydrocarbons of long carbon chain from $C_{11}$ to $C_{30}$ ( ASTM N°=11-654).
The two broad absorption bands at 2500 cm$^{-1}$ and 3300 cm$^{-1}$ correspond to the carboxylic acids ( ASTM N°=11-654) .
• The absorption plug at 3355.06 cm$^{-1}$ corresponds to the O-H vibrations of the carboxylic acid R-COOH ( ASTM N°=11-654).
According to the spectrum of dry oily sludge at 500 ° C indicates the presence of halides which are probably the


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additives that go into the production of finished oils, the persistence of heavy hydrocarbons and the formation at low amounts (traces) of acids carboxylic because of the different chemicals use.

*d) Scanning electron microscopy*

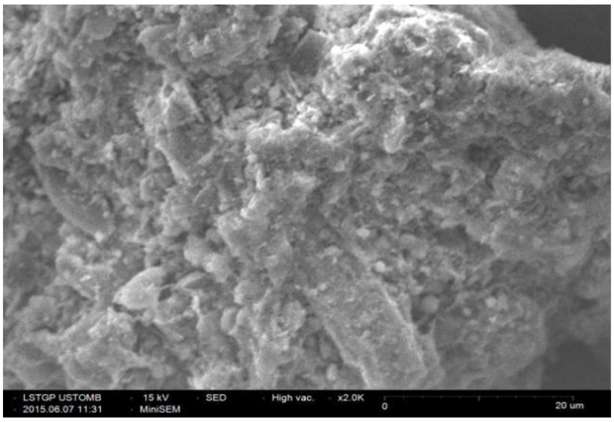


Fig.20.: SEM observation of the sludge of the WWTP at T = 500 ° C

The fig.20 represents the scanning electron microscopy (SEM) observation of the CPS oil sludge at temperature T = 500 ° C. we note that the sludge structure of CPS at T = 500 ° C is homogeneous and in the form of fibers as shown in fig.20.

*e) Determination of metallic elements*

The heavy metal masses in the oily sludge dried at 500 ° C are summarized in the following table 13:

Table 13 : Quantification of metallic elements in dry oily sludge at 500 ° C

| Elements | Cu | Zn | Fe | Ni | Pb | Cd |
|---|---|---|---|---|---|---|
| Oily sludge dries at 500 ° C in mg / l | 1.2237 | 1.06 | 4 | 0.564 | 0.349 | 0.0065 |
| Dry oily mud at 500 ° C in mg / kg | 122.37 | 106 | 400 | 56.4 | 34.9 | 0.65 |
| Norm in agriculture in mg / kg | 1 000 | 3 000 | / | 200 | 800 | 20 |

The chemical analysis of traces of heavy metals of dry oily Sludge at 500 ° C, shows us that it contains in majority of its composition the following metals: copper, iron and zinc which have not disappeared under the effect of the heat but which remain inferior to the norm AFNOR which concerns the valuation of the sludge in agricultures.

## VI. CONCLUSION

From our experiments on the three drying pilots containing three different materials selected on the basis of their large adsorption capacities which are respectively: sand. sawdust. and molecular sieve. Sand has been found to be the most suitable material for drying and filtration of GL1 / Z complex sanitary water deposits which are characterized by their overly liquid structure. And sand has also been found. gravel and gravel not only retain organic matter but also heavy metals. and the total phosphorus.Or the filtered water of the sludge needs to be recycled because we could not carry out all the analyzes concerning the parameters of pollution like the ammonium ion for lack of materials.

Our study is part of a sustainable development, recyclable materials and protection of natural receiving environments in order to minimize or eliminate waste such as treated solid urban effluents (sludge) from the wastewater treatment plant. de-oilers (CPS) of the GL1 / Z complex with a view to an agronomic valorisation for the sanitary and energetic sludge for the oily sludge.

In a first step we characterized the residual sludge of the GL1 / Z complex; the results of the analyses showed that the sanitary sludge contains the essential nutrients for the soil as part of the overall crop fertilization program. The important nutrients in the sanitary sludge are nitrogen, phosphorus and potassium; other macro and micronutrients may also be present.

The concentrations of heavy metals cadmium (Cd), chromium (Cr), copper (Cu), nickel (Ni), lead (Pb) and zinc (Zn) are below the required standards.

The oily sludge according to the results obtained, contains a very high rate of used oils contributing to its valorization as a substitute fuel in the furnaces of cement plants or blast furnaces foundries, the principle is to promote the energetic power of the material. organic dried sludge because its calorific value is very high, ready that of methane. The use of alternative fuels makes it possible to diversify energy resources and reduce costs.

On the one hand In the ovens, the organic components will be exposed to a heat of 2000 ° C and will be burned integrally, while the mineral components will undergo a chemical


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transformation which will integrate with the clinker without altering the excellent quality of this one.

The use of sludge ash as an additive to cement clinker in order to minimize the increasing amount of waste in coordination with existing industries in the national territory using the least expensive processes.

Finally, we can say that our sludge recovery study completely eliminates this waste in an ecologically and economically exemplary industrial process. It is the most environmentally and economically the tightest way to address the problem of sludge and ash disposal.

## ANNEXE

Table 14 : Limit values for industrial liquid effluent discharges Joradp. April 2006

| N° | | UNITE | VALEURS LIMITES | TOLERANCES AUX VALEURS LIMITES ANCIENNES INSTALLATIONS |
|---|---|---|---|---|
| 1 | Température | °C | 30 | 30 |
| 2 | pH | - | 6.5 - 8.5 | 6.5 - 8.5 |
| 3 | MES | mg/l | 35 | 40 |
| 4 | Azote Kjeldahl | " | 30 | 40 |
| 5 | Phosphore total | " | 10 | 15 |
| 6 | DCO | " | 120 | 130 |
| 7 | DBO5 | " | 35 | 40 |
| 8 | Aluminium | " | 3 | 5 |
| 9 | Substances toxiques | " | 0.005 | 0.01 |
| 10 | Cyanures | " | 0.1 | 0.15 |
| 11 | Fluor et | " | 15 | 20 |
| 12 | Indice de phénols | " | 0.3 | 0.5 |
| 13 | Hydrocarbures | " | 10 | 15 |
| 14 | Huiles et graisses | " | 20 | 30 |
| 15 | Cadmium | " | 0.2 | 0.25 |
| 16 | Cuivre total | " | 0.5 | 1 |
| 17 | Mercure total | " | 0.01 | 0.05 |
| 18 | Plomb total | " | 0.5 | 0.75 |
| 19 | Chrome Total | " | 0.5 | 0.75 |
| 20 | Etain total | " | 2 | 2.5 |
| 21 | Manganèse | " | 1 | 1.5 |
| 22 | Nickel total | " | 0.5 | 0.75 |
| 23 | Zinc total | " | 3 | 5 |
| 24 | Fer | " | 3 | 5 |
| 25 | Composés organiques | " | 5 | 7 |

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