Management of Industrial Waste in Kabylia, Algeria: Case of Electro-Industry (Ei) And The National Company of Electro-Appliances (ENIEM)

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Abstract: There are many questions about the definition of waste, but the most relevant one is: at what stage does an object become waste? since the problem of waste is becoming more and more acute. In order to answer this question, we took interest in the industrial activity of EI. of AZAZGA and ENIEM. of Oued Aissi which generate various wastes (solid, liquid, and gaseous) as well as their different modes of treatment.

These industrial companies, which produce engines, transformers and generators at EI level and household appliances at ENIEM level, are certified ISO14001. They try to minimize the release of waste into the environment as much as possible using the most appropriate means (neutralization plant, treatment plant, waste treatment at source, recycling and even incineration sometimes), but this seems insufficient so as not to pollute.

***Key words*:** waste, industrial company, treatment, ISO, Algeria.

I. INTRODUCTION

The industrial revolution, population growth, economic development, and the changing way of life of societies have led to the production of waste that is as variable as it is complex, which has posed a new problem concerning the impact of waste on the environment (BALLET, 2005).

A waste is a substance that cannot be used or recovered by the person who produced it, but it can be a raw material or by-product. As a result, the concept of waste is not very precise; it depends on current technologies and the structure of the economy, but the objective is to reduce the amount of effluents and waste produced by human activities and to make them as harmless as possible through their management under the best conditions (NGO AND REGENT, 2012).

According to MARCOUX et *al.* (2010), waste prevention remains a majority objective, by prioritizing treatment methods through waste management, which is a tool made available to industrial companies, especially since the regulations relating to the latter have become increasingly developed and demanding in terms of respect for the environment.

Indeed, the integration of ecology and economy into the activities of industrial companies has been the subject of several theoretical and practical reflections that have shown that environmental threats and social requirements oblige any company to adopt ecological behaviors that will increase its long-term value (KABONGO, 2005), especially since the world of waste is very technical and requires a good knowledge of the field in order to better manage it and not to repeat the mistakes of the past (TRISTAN, 2018).

In Algeria, industrial companies are making great efforts in the environmental field, especially since its production industry remains a major factor in economic growth and competitiveness, which recognizes a reduction in pollution and optimal use of energy resources in the context of sustainable development (BOUMBAR and DJILI, 2017).

In order to highlight the efforts of these Algerian industrial companies, we have carried out a study in the field of ecosystem protection and respect for the environment in the context of sustainable development, whose objective is to assess the state of waste management within the company of manufacturing transformers and electric motors, called Electro-Industries (EI) and the National Company of Household Appliances Industries (ENIEM), located in Kabylia (wilaya of Tizi-Ouzou).

II. MATERIALS AND METHODS

In Algeria, it is in the North that industrial potential and its sources of industrial pollution are located. Our choice fell in the wilaya of Tizi-Ouzou (located 100 km east of Algiers), on the Eléctro-Industies d'Azazga (EI), specialized in the manufacture and marketing of engines, transformers and generators, as well as the National Company of Household Appliances Industries (ENIEM.) which ensures the assembly and marketing of household appliances (stoves, refrigerators, bath heaters, air conditioners, ...).

Our study was based on the collection of analytical data on waste generated by these companies between 2012 and 2022. To do this, we first identified the different types of waste, their classification, quantification and treatment methods until their disposal.

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III. Results and Discussion

The diagnosis of the management of waste generated by EI and ENIEM between 2012 and 2021 synthesizes the quantitative and qualitative balance of the different types of waste by gathering all the information related to each category: industrial waste (special: DS or special hazardous: DSD) household and similar waste (DMA), ... as well as their treatment methods (incineration, storage, etc.).

1. Evolution of the quantities of waste generated by EI and ENIEM

A. Solid waste

The annual quantities of solid waste generated by EI and ENIEM over ten (10) years are illustrated in Figures 1 and 2.

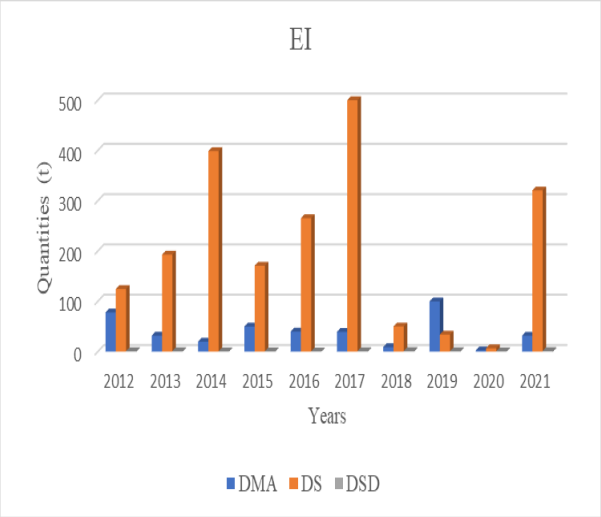

Fig. 1: Evolution of the quantities of solid waste generated by EI between 2012 and 2021.

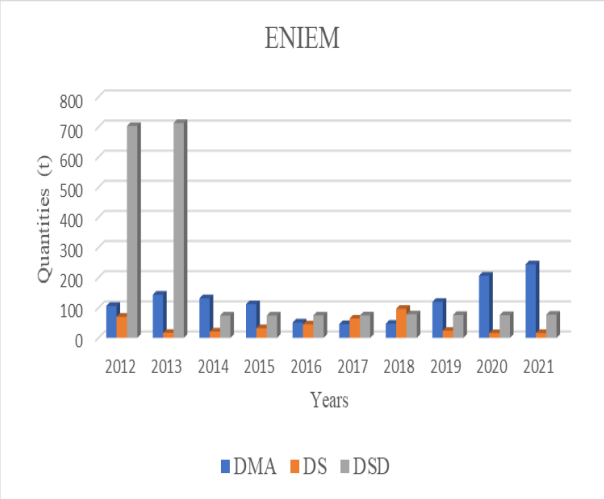

Fig. 2: Evolution of the quantities of solid waste generated by ENIEM between 2012 and 2021.

The solid waste produced by EI and ENIEM is varied (household and similar waste: DMA, special waste: DS, special hazardous waste: DSD) with variable annual quantities, which diversifies their treatment methods, ranging from storage to recovery (metal and ceramic waste, plastic waste and wood, etc.), or even incineration (paper, cardboard and wiping cloths).

B. Liquid effluents

The qualitative characterization of industrial effluents of the final channel after neutralization with EI and ENIEM is expressed by physico-chemical analyses of certain parameters such as pH, temperatures, total phosphorus, DCO, total chromium, total nickel, total zinc and iron. The results of these analyses are illustrated in Table 1 and Figure 3 and compared to Algerian regulatory standards governed by Executive Decree No. 06-141 of 19 April 2006 defining the limit values for the discharge of industrial liquid effluents.

TABLE I: Final industrial release results at EI (2022).

Parameters	Units	Resultats	Limit values
Temperature	°C	29	30
pH	/	8.22	6.5 – 8.5
MES	Mg/l	94	35
DCO		180	120
Phenol value		<0.1	0.3
Total hydrocarbons		<5	10
Cadmium		<0.03	0.2
Copper		<0.1	0.5
Nickel		<0.2	0.5
Lead		<0.2	0.5
Zinc		<0.03	3

The results of the physicochemical parameters measured for the final industrial release of AR reveal that the majority of parameters mainly heavy metals (Cr, Zn, Pb, Ni, Cd, Cu) comply with Algerian standards and an average temperature of 29 ° C depending on the season, while suspended solids (MES) and chemical oxygen demand (DCO) as well as that the pH exceeds this standard because of chemical pollutants which originate from the poor quality of the raw materials used and the failure of the paint booths at the transformer unit and neutralization station during our sampling period.

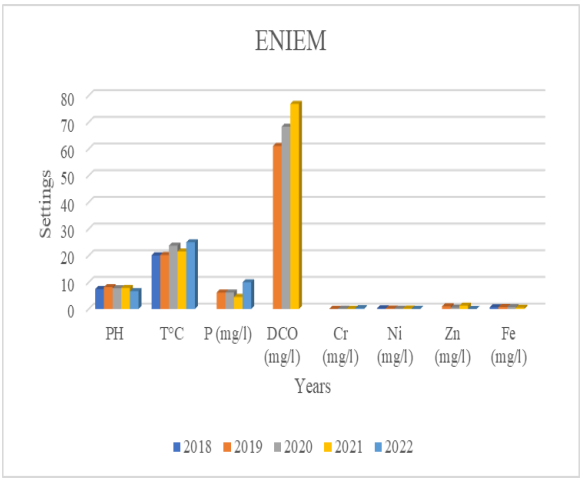

Fig. 3**:** Evaluation of physicochemical parameters of the final release at ENIEM (2018-2022)

The quantitative and qualitative evaluation of the various physico-chemical parameters measured in the ENIEM analysis laboratory demonstrates results in accordance with Algerian standards (pH, T°C, DCO, P, Cr, Ni, Zn).

1.3. Gaseous effluents

The production units at EI as well as ENIEM emit polluting gases, they are due to the production and use of various chemicals such as oils and surface treatment activities. These atmospheric pollutants are not treated although they can have impacts on the biotope and biocenosis.

IV. Discussion

Waste management is a current problem and an essential issue for our future and that of the planet in view of the quantities produced. Indeed, waste generates various types of pollution, which degrade the environment, but the management of this waste in a responsible and respectful manner is the responsibility of any industrial company for a healthy environment (CHRISTELLE, 2015). This waste management requires the competitiveness of companies, which has become their major concern with the binding evolution of environmental legislation, in order to find them the most appropriate methods of sorting, collection, treatment and disposal and to control their movements (BELGAID and MACHER, 2016). This is the example of ENIEM certified ISO 14001 thanks to its environmental policy for strict ecological management, which consists of managing all these different types of waste.

This waste is both a risk and a resource to be eliminated without precautions, it risks not only degrading the landscape but also polluting the environment and exposing man to nuisance and dangers, some of which can be very serious (DESACHY, 2001). The poor management of the waste produced contributes to the degradation of natural environments and the loss of biodiversity (RAMADE, 2012).

It is important to note that Executive Decree No. 06-141 of April 19th, 2006 stipulates that any installation must be maintained in such a way so as to reduce discharges into the enironment. For this, ENIEM and EI have installed a neutralization plant for the treatment of their liquid effluents, knowing that these facilities generate large quantities of toxic sludge, which are stored within these companies by paying huge taxes following the application of the polluter payer principle pending a definitive solution to this problem. Nevertheless, the results obtained comply with Algerian standards, which is confirmed by the results of LEMBROUK and CHALLAL (2010), AISSAOUI and BERKAINE (2015), BEN MEHREZ and LOUELH (2015), HOCINE and AMEUR (2016), LEMBROUK and SADOUDI (2016 and 2018), GHEZLI and BELARIF (2017) and GATER and FERHANI (2019), which confirms the proper functioning of the neutralization station of these companies and the good control of the neutralization process.

V. Conclusion

The waste of the IS and the ENIEM are numerous (solids, liquids and gases), that is why their treatment methods are varied ranging from storage (metal and ceramic waste, plastic and wood waste, ...), to recovery by approved waste pickers (example of oils recovered by NAFTAL) or even incineration (paper and cardboard and wiping cloths), while organic waste from the canteen is collected by the APC.

Although the waste management methods of these companies comply with Algerian regulations, in particular Law No. 01-19 of 12 December 2001 on waste management, control and disposal, they suffer from the problem of waste storage, which obliges them not to comply with storage standards, where most of their industrial waste identified (resin, paint, sludge, ...) are stored in inappropriate premises, which creates a source of serious contamination, in the short, medium and long term.

Therefore, this study must be well followed in order to establish an adequate platform for the ecological and sustainable management of waste, in particular industrial waste, as well as for proper storage.

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