PROCEEDINGS BOOK
12th ICEEE–2021
"Global Environmental Development & Sustainability: Research, Engineering & Management"
November 18 – 19, 2021 RKK – Óbuda University, Budapest, Hungary
ISBN: 978-963-449-256-6 www.iceee.hu

IMPACT OF WASTE ON THE ENVIRONMENT STUDY OF POLLUTANTS STATISTIC AND SOLUTIONS: CITY OF CONSTANTINE, NORTH-EAST OF ALGERIA

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Abstract: *Daily human activity poses many problems for the environment because of the waste it leaves, the study conducted on solid and liquid household waste located in the city of Constantine, Northeastern Algeria. Regardless of a manufacturer or consumer, especially in the absence of dissuasive laws for such abuses. A solid and liquid sampling was carried out on the waters and sediments of the main wadi Rhummelwhich crosses the city of Constantine from the South to the North, the hydrochemical results show an increase in the rate of heavy polluting metals from upstream to downstream, Pb 0.15 mg/l, Cr 1 mg/l, Ni 0.80 mg/l. These metals are also revealed by X-ray diffractometric analyses. The spread of heavy metals in water poses a major threat to people's lives, requiring a quick and effective solution. The statistical analysis showed in El-Khroub and Ali Mendjli the two main municipalities are the most waste-producing district, while Ben Badis comes in last place. In 2019, total waste received at the Technical burying center of Bougharb 32623.37m^3 and 1533.62 T/month for inert waste where it receives about 700 tons of waste. The daily discharge and treatment of this waste in the Technical burying center of Bougharb lead to many nuisances for the environment. This wide dispersion of waste represents a major threat to citizens and requires strict decisions and a rapid solution to stop and eliminate these pollutants.*

Key words: *Waste, CET, pollution, Environment, wadi Rhumel.*

INTRODUCTION

Our planet is dying, day by day this planet is dying because of human waste. Different types of wastes are spreading terribly in the world due to unconscious behavior of people, whether they are consumers or manufacturers. Waste constitutes a major direct or indirect threat to human life and living beings. Algeria, like the rest of the countries in the world, suffers a lot from pollution due to the indiscriminate dumping of waste and the lack of awareness, especially in the big cities. The pollution makes a major threat to all living organisms without exception. In last years, Algeria has experienced a significant increase in population and factories, which has a negative impact on the environment, especially with the lack of awareness and the lack of waste disposal centers. Several studies have been done on the risk of pollution where many works have proven that when pollution is important, the number of species decreases as well as their recovery rate as in [1, 2 and 3]. Using of remote sensing by using high and medium resolution images and GIS [4] and

statistical PCA analysis [5] help in the analysis of water pollution. In order to contribute to the fight against pollution, the aims of this work are to establish a study on the waste that is collected in the city of Constantine to know the source of some heavy metals' pollutant, type and causes of propagation of this waste, study its consequences on the environment and society in this city.

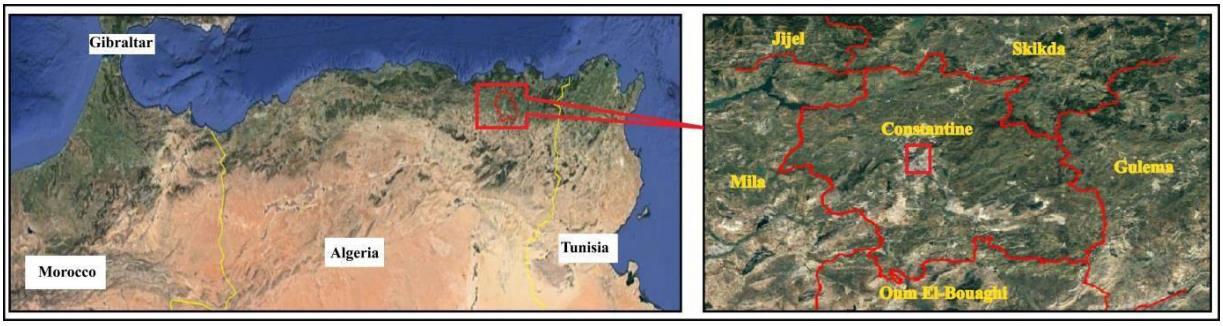

Figure 117. Location of the studied area in Constantine city (google earth 2020).

MATERIALS AND METHODS

This study, conduct field studies where we made a complete census of the waste of the city of Constantine years 2019 received at the level of the technical cent of burial of Boughareb where we took solid and liquid samples on the discharge of Wadi Rhumel. Where it passes on the downstream points until the upstream of which one passes by SETP El Hama, El Mania, club of lawyers towards Ain Smara. For solid samples numbered plastic bags were used and then placed in the bags and sealed. Liquid samples are placed in 4 plastic bottles 1500 ml. The treatment of the solid samples is done at the level of the laboratory of physical and chemical research of the University of Mentouri Brothers where these samples are studied by the DRX. The analysis of the liquid samples is done at the level of hydrogeological laboratories of the faculty of earth science where the physical-chemical analyses were done with the volumetric method.

STATISTICAL ANALYSIS AND GRAPHICAL PRESENTATION

During the year 2019, the technical landfill cent received two types of waste: inert waste from the landfill of Ali Mendjli where the average value of this waste reached 1087.44 T/day and 32623.37 m^3/month. The month of February recorded the highest value of this type of waste with a total of 66110.35 m^3, while July came last with a total of 18454.5 m^3 (Fig.2 A). The second type of waste received in the technical landfill cent is the household waste where the average value of this waste was 51.12 T/day and 1533.62 T /month. The highest value of this type of waste recorded in the month of March while the lowest value recorded in the month of June (Fig.2 B). During the year 2019, the commune of El-Khroub recorded the highest valueof dumped waste with an average of 58358.9 T followed by the commune of Constantine with an average value of 42820.75 T, while the commune of Ibn Badis came at the last place with an average value of2677.5 T (Fig.2 C)

RESULTS AND DISCUSSION

Physical-Chemical Analyses

Chemical analyses were carried out according to Algerian standards of temperature, conductivity and concentration of chemical elements in the water. From these analyses we notice that the temperature is about 13.7-13.9°. The conductivity varies between 1748µS/cm and 1882µS/cm where the highest values recorded on the on the wadi Rhumel due to a high amount of dissolved salts coming from the domestic discharges of the agglomeration of Ain Smara. In all cases the temperature and conductivity do not exceed the standards.

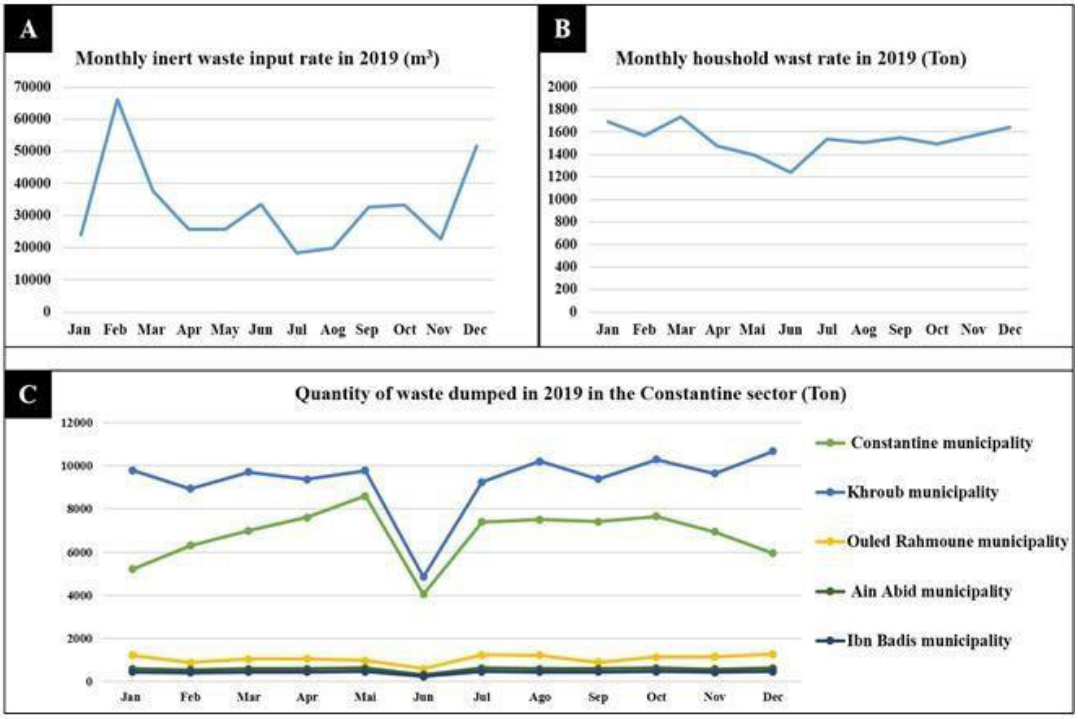

Figure 2. type and quantity of waste in 2019 in the city of Constantin. A/ Monthly inert input rate in 2019 (m^3); B/ Monthly household waste rate in 2019 (Tone); C/ Quantity of waste dumped in 2019 in the Constantin sector (Tone).

The values of calcium (Ca^{2+}) are between 144.28 mg/l and 165.13 mg/l, these values do not exceed the standards. The source of calcium is mainly the carbonate rocks; it also comes from the gypsum contained in the clayey rocks. The magnesium (Mg^{2+}) values do not exceed 63.18 mg/l, these values are the result of the dissolution of dolomites and gypsiferous soils by water. The water in the study area is very hard, with total hardness values ranging from 55°F to 64.4°F. The values of sodium (Na^{+}) are between 110.7 mg/l and 140.76 mg/l, sodium ions are the result of the alteration of silicate minerals in clays or of industrial and domestic wastewater discharges. Chlorides (Cl^{-}) have several sources: alteration of silicate minerals, evaporation or from chemical fertilizers and industrial discharges. The values of sodium (Na^{+}) are between 110.7 mg/l and 140.76 mg/l, sodium ions are the result of the alteration of silicate minerals in clays or of industrial and domestic wastewater discharges. Chlorides (Cl^{-}) have several sources: alteration of silicate minerals, evaporation or from chemical fertilizers and industrial discharges. The values of chlorides are between 184.6 mg/l and 202.35 mg/l. Sulphate (SO_4^{-2}) comes from the alteration of evaporitic rocks, organic matter or chemical fertilizers and industrial waste. Its values vary between 288 mg/l and 404 mg/l. Bicarbonate is found in carbonate soils. For the waters of our study area, the concentrations of bicarbonate range from 297.68 mg/l and 353.8 mg/l. The metallic elements Zinc (Zn) and Copper (Cu) are found in trace amounts where the high value does not exceed 0.9 mg/l for Zn and 0.7 mg/l for copper (Table 1). the hydrochemical results show an increase in the rate of heavy polluting metals from upstream to downstream, Pb 0.15 mg/l, Cr 1 mg/l, Ni 0.80 mg/l The results show a strong values of previous elements except bicarbonate are recorded at the level of the lawyer's club which is downstream of the agglomeration of Ain Smara. From these results, it is concluded that the high proportion of these elements is due to the industrial discharges of Ain Smara. We also note from the calculation of the content of Wadi Rhumel water in biodegradable organic matter that these waters are too polluted where the origin of this pollution can be domestic and industrial since it is downstream of the agglomerations.

Table 1. Results of physical-chemical analyses

		STEP El Hama	El Mania	Towards Ain Smara	Lawyer's club
Temperature °C		13.8	13.7	13.9	13.9
Conductivity µS/cm		1778	1748	1884	1882
Total hardness me/l		11.28	11	12.8	12.88
Ca^{2+}	me/l	7.21	7.41	7.53	8.25
	mg/l	144.2	148.2	150.6	165
Mg^{2+}	me/l	4.06	3.58	5.26	4.62
	mg/l	48.78	43.2	63.18	55.84
Na^{+}	me/l	6.12	5.98	4.79	6.12
	mg/l	140.76	137.54	110.07	140.53
HCO^{-3}	me/l	5.8	5.24	4.9	4.88
	mg/l	353.8	319.64	298.9	297.68
SO^{-2}	me/l	6	6.54	7.25	8.41
	mg/l	288	314	350	404
Cl^{-}	me/l	5.6	5.2	5.4	5.7
	mg/l	198.8	184.6	195.7	202.35
Zn	mg/l	0.07	0.07	0.08	0.09
Cu	mg/l	0.006	0.006	0.006	0.007
DBO_5	cm	10	20	15	10
Pb	mg/l	0.1	0.15	0.08	0.09
Cr	mg/l	0.9	1.0	0.8	0.85
Ni	mg/l	0.70	0.80	0.65	0.70

esults of XRD Analyses

Five representative samples were subjected to XRD, the analyses of these were carried out in the laboratories; Mentouri Brothers University. These five samples were analyzed by using XRD and the diffractogrammes specters. The analyis was done by a software Match 3 (evaluation version) which is used to determine the x-origin that puts the values of each peak and is represented by a value of 2θ. After the various calculations of the important lines in each spectrum, these are stripped using ASTM (American Society for Testing Minerals) files, using the list of minerals encountered in evaporitic deposits. The X-ray results confirmed that the samples taken on the edges of Wadi Rhumel downstream to upstream contained large amounts of quartz and calcite, and also confirmed the deposition of pollutants, which are heavy metals, on the soil of Wadi Rhumel which is represented by Chromium, Zinc, Lead, Arsenic and copper. (Figure 3)

The presence of some metals with low concentration like Zinc and copper does not mean they are is a sign of pollution [10, 11]. These concentrations are the result of urban effluents [12]. As for the water of Oued Rhumel, the of these high concentrations of heavy metals is the industrial discharges of Ain Smara.

CONCLUSIONS AND RECOMMENDATIONS

The current situation in the city of Constantine requires efforts from everyone to reduce the spread of waste where waste is terribly widespread in Constantine. The proportion of waste increases in the denselypopulated areas where the commune of El-Khroub and Constantine is recorded the highest values of waste. Temperature, conductivity and chemical elements (Ca^{2+}, Mg^{2+}, Na^{+} CL^{-}; HCO^{-3} and SO4-2) have highvalues especially in the Lawyers' Club due to industrial discharges from Ain Smara. The metallic elements (Zn and Cu) are found in traces. The analyses of the samples by XRD confirmed the pollution of the waters of Wadi Rhumel where the values of quartz and calcite are very high. These analyses also showed high

proportions of many heavy metals (Zinc, Lead, Chromium, and Arsenic). For this reason, the state must develop quick solutions to reduce the spread of waste by establishing strict laws, recruiting all means and raising awareness to fight against this pollution. The solid waste can be eliminated by recycling it. The discharges of Ain Smara must be filtered in order to remove or decrease the concentration of elements.

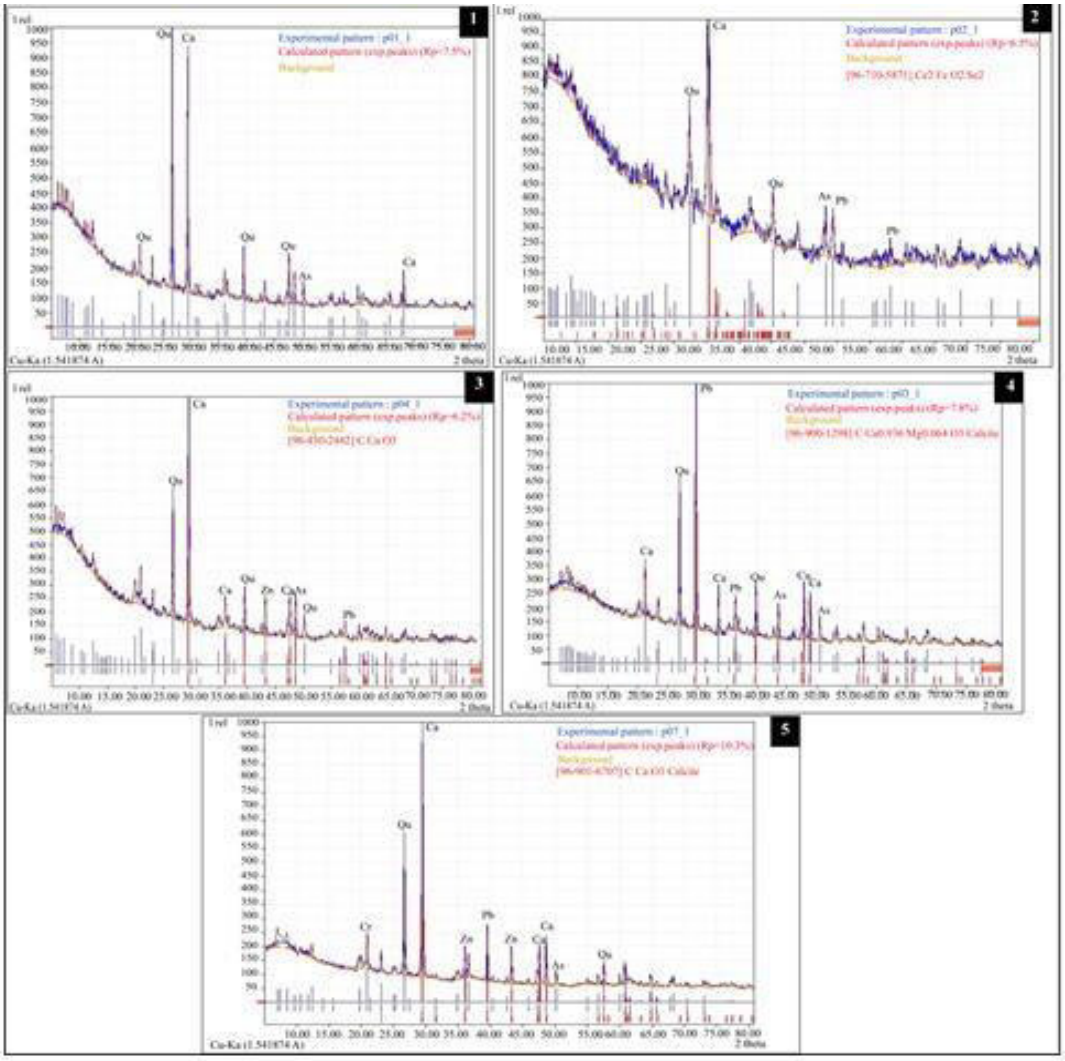

Figure 3. DRX spectra of samples taken from Owed Rhumel. 1/ samples of STEP el Hamma; 2/ samples of El Mania; 3/ samples from lawyers' club; 5/ samples of Ain Smara; 5/ samples of Lixivia. (Qu) quartz; (Ca) calcite; (Zn) Zinc; (Pb) Lead; (Cr) Chromium; (As) Arsenic; (Cu) Copper

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