

Electronics Industry and Ecosystems Deterioration in Mexicali City

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Abstract:-The electronics industry is very important in the world economy, because is one of more dynamic activities, due to a great quantity and different electronic products manufactured and used in a lot quotidian operations. This type of industry has strongly attracted attention to the environmental authorities in the recent 10 years, due to the deterioration that causes to the ecosystems. The electronics industry generates a lot liquid chemical waste, which are thrown into soils and aquifers that are close to companies. The interest of the relation of environmental problems and the electronics industry has manifested with more frequency, from 20 years ago, especially in countries that regulate strictly to care the ecosystems, being some countries of Europe, United States and Japan. The lack of control in certain liquid wastes from activities of the electronics industry, that are discharged into areas next to companies or by the drainage systems has caused a great deterioration of the ecosystems. This occurs with some companies installed in the Mexicali city dedicated to manufacture electronic products. This city is located in the northwest of Mexico that is a border city with the United States of America (USA), where some soils and aquifers are been damaged for some years. This has negative effects in the population too, by the generation and proliferation of respiratory diseases (RD), being a beginning of some environmental and health crisis, particularly in areas adjacent to these companies. This study examined the environmental problems of electronics industry in Mexicali, being principally in the winter periods. The analysis was made based in two steps, being the first to evaluate the pollution of soil and water levels with the principal climatic factors as relative humidity (RH) and temperature variations around two companies of the electronics sector to be correlated with the RD levels. The second step was to analyze the pH of soil and water, around the three companies evaluated in this city and to elaborate an evaluation of soils with the Scanning Electron Microscopy (SEM) technique to know their level of deterioration. The study was made from 2011 to 2012.

Index Terms--Ecosystems deterioration, electronics industry, liquid waste, respiratory diseases.

I. INTRODUCTION

The electronics industry is often considered as low pollution emission, according to the laws of environmental regulation in the indoors of this type of companies. This activity is classified according to the pollutant emissions generated during the manufacturing process. From this perspective, the industry is perceived as slightly pollutant; where in the United States annually generates 1.6 % of the hazardous waste total [1], according to the emission reflected from the Toxic Release Inventory (TRI). From the view the final product is conceived not as a contaminant particularly compared with other industries that produce an environmentally crisis, such as the iron and steel industry, chemicals and

petrochemicals companies, pulp and paper manufacturing processes and others [2]. In Mexico are a lot companies of the electronics sector, that are been installed in industrial parks of the most important cities as the Mexico city, Guadalajara and Monterrey and in some most popular border cities with the USA as is Mexicali, Tijuana, Nogales, Cd. Juarez and Reynosa. In Mexicali, the major percentage of the companies (75%) is from electronics industry, or is dedicated to the manufacture of electronics products. In this city around the companies of the electronics sector, are presented deteriorated soils and an increase of RD in people. This is because it does not take into account the speed at which expands the liquids waste dumped in areas next to these companies. The effect in the environmental of electronics industry is supervised in a very limited way, regardless of the great damage to the ecosystems in any city of the world [3] and in special in Mexicali. The increase of environmental problems caused by electronic industry of Mexicali is considered as an important aspect in the deterioration of the ecosystem of this zone of Mexico, by the advancement of the technology and standards for this type of companies. This, is known by the fact that in some nearby areas to more than half of these companies, originate variations in the ecosystems as in soils, water canals, aquifers and in the air quality of this city. The environmental regulations and the limited supervision in this topic with international and national laws regulate the level of demand of the electronic products, but environmental problems still appear regularly in Mexicali, caused by electronics industry. This analysis provides some elements for an environmental and industrial policy in Mexico, especially in the northwest of Mexico where is located Mexicali, to consider the great care of the ecosystems.

II. RISKS OF ENVIRONMENTAL PROBLEMS IN THE POPULATIONS

The modernization of cities and towns has contributed to the deterioration of ecosystems, generating a destabilization of society that sometimes causes some ecological crisis in populations [8]. This has contributed to creation of environments that impair the quality of aquifers and soils principally, due to the dumped of liquid waste of electronics industry, without a care in the right environment. Also, health problems can be caused to exposition of chemical substances discharged, with [9]. Another important factor is the disappearance of some species of plants that produce oxygen (O₂, vital to humans), animals that break the food chain and microorganisms and bacteria which function decay decaying matter in water, air and soil [10]. This is an

unwanted part of sustainable development, being an important factor that will continue on the road to an uncertain future for new generations to leave and could cause a breakdown of society and the origin of new diseases, economic decline and these uncontrollable social problems.

III. CLIMATIC FACTORS

Climate is composed of several parameters, where the relative humidity (RH) and temperature are the most important in change of weather and have a negative effect in deterioration of soils [8]. These climatic factors are measured with specialized equipments, which consist of a hygrometer and thermometer that send the information of values to a PC to be evaluated. The information is organized in hourly, daily, weekly, monthly, seasonally and yearly periods, to be correlated to other parameters. Scientists that analyze the AC, consider that the grade of deterioration of soils can be originated by drastic changes in the humidity and temperature in certain times of the year [7].

IV. METHODS

This study examined environmental problems of electronics industry in Mexicali, being principally in the winter periods.

1. Analysis of deterioration of soils. This step was made with images of photographs where are observed chemical substances discharged in soils, showing the major concentration of sulfurs.

2. SEM evaluation. SEM analysis represents the evaluation of surfaces with microphotographies at surface levels indicating deterioration grade of soils. With this evaluation, was determining chemical agents that are discharged in soils.

V. RESULTS

The lack or environmental awareness in people of some companies, causes some ecosystems deterioration and then can disappears some species of animals and plants and can originates the climate change. All chemicals dumped by industries, are going to aquatic and soils of ecosystems and these can be directly, as seen in the images of this study, and indirectly, which companies or industries throw their waste to the ground, where in the rainy seasons the chemical substances are thrown very far from companies. There are permissible limits worldwide that refer to the concentrations of substances discharged by electronics industry, where most people can be exposed without adverse health effects. However, it is recognized that, given the variability of individual susceptibility, a percentage of the population in a city such as Mexicali, you may experience mild discomfort to certain substances or at or below the threshold limit concentrations and even, to a lesser degree, may be affected by a worsening of previous conditions or the occurrence of an occupational disease.

A. Analysis of pH levels in soils and aquifers

Evaluation of pH in underground aquifers, lakes, rivers and canals near of the companies evaluated, was made. The pH levels indicate the grade of acidity or alkalinity. Depending of the range, being 0 being 0 to 6 as acidity level 7, as without acidity and alkalinity and 8 to 14 as alkalinity. Table 1 shows the average pH levels in surface water near of the industrial plants analyzed.

Table 1. PH levels in soils near of the two companies evaluated (2011-2012)

COMPANIES	Company 1				Company 2			
	100 ^a	250	500	1000	100 ^a	250	500	1000
2011								
Spring	4.9	5.2	5.6	6.2	5.8	3.7	8.2	8.8
Summer	5.5	5.4	5.8	6.3	5.2	5.3	9.4	8.7
Autumn	5.7	5.3	5.7	6.5	3.4	7.1	9.5	8.5
Winter	5.1	5.3	5.7	6.1	5.6	5.4	3.4	4.7
2012								
Spring	4.7	5.1	5.7	6.0	7.8	5.6	5.0	7.7
Summer	5.0	5.0	5.6	5.6	5.7	9.1	8.2	8.2
Autumn	5.0	5.0	5.6	5.6	5.7	9.1	8.2	8.2
Winter	5.0	5.0	5.6	5.6	5.7	9.1	8.2	8.2

^a Distance in meters around two industrial plants

evaluated to determine the pH levels..

B. SEM analysis

An evaluation of SEM shows the sections of the mechanisms of the soil deteriorated causing uniform corrosion (UC) and pitting corrosion (PC) in some zones near of the electronics industry evaluated. This is observed in Figures 1 and 2 with the soils with humidity in the summer and winter seasons.

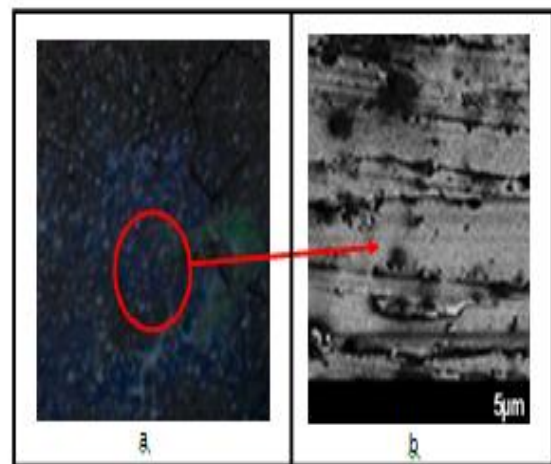


Fig 1 Microanalysis of ecosystem deterioration next to an electronic industry in Mexicali in summer season in 2012 in company 1.

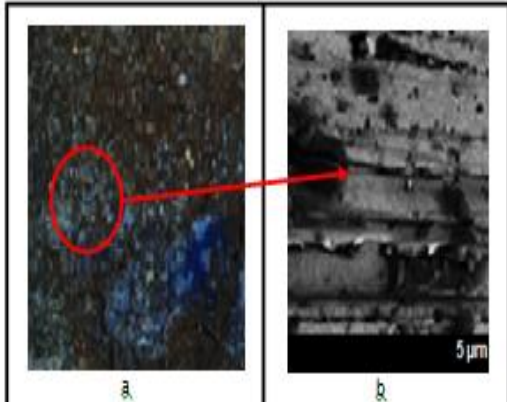


Fig 2 Microanalysis of ecosystem deterioration next to an electronic industry in Mexicali in summer season in 2012 in company 1

VI. CONCLUSIONS

The lack of control of solid and liquid wastes from industrial plants, and in domestic and commercial activities are important elements in the climate change, that every day feel its consequences with natural disasters such as drought, frost, earthquakes and drastic changes of climatic and environmental damage our environment. There have been a wide variety of environmental impact studies with significant results that support the lack of awareness of environmental care and will generate an important source of sustainability of human life, animals and plants. Still, they continue to have problems with this analysis environment and informs the community and government authorities and other sectors, it is necessary to consider care for our environment, and prevent some types of natural disasters that are the cause of great human and economic losses. This study shows how it is necessary to control landfill companies, where the authorities and society play an important role in the care and preservation of ecosystems, to avoid environmental problem situations. This leads to the awareness of personnel involved in the use of chemicals, even with great control contemplated by the companies, it appears that continue to discharge such substances that do so much damage to society and the environment. One proposal was to design and fabricated an automatic system that has the ability to detect when chemicals that damage ecosystems and create diseases, mainly respiratory rate affects both wing world population to be thrown. This automatic system is in the period of design and will be fabricated early next year. With this automatic system will be improve the care of the ecosystems to Mexicali and other regions.

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AUTHOR'S PROFILE



Dr. Gustavo Lopez Badilla, was born in Santa Ana, Sonora, with studies in Electronics Engineering from 1989 to 1994 in the Faculty of Engineering of the Universidad Autonoma de Baja California, a Masters in Systems Engineering from 1998 to 2002 and a Ph.D. from 2005 to 2008 at the Institute Engineering of the Universidad Autonoma de Baja California and Postdoctorate Center of Nanoscience and Nanotechnology at the Autonomous University of Mexico in Ensenada from 2009 to 2010. The areas of expertise are in Electronics Engineering, Computing, Biomedical, Industrial and Environmental Chemistry and Nutrition. With five years in industrial engineering. Member of the National System of Researchers (SNI) level Candidate, Research and Academic with twelve years experience in areas of environment, corrosion, materials and surface analysis and over 30 scientific and popular articles, conference participation since 2006 in engineering, materials, nutrition and health, with participation in three books with chapters and two complete books. Research has been on people and companies with engineering approaches, technology and health in organic and inorganic chemistry and physical chemistry of materials with specialized equipment and



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