IMPACTS CAUSED BY SUBSTANCES PRESENT IN ELECTRONIC WASTE IN YOUR CONTACT WITH WATER

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Abstract

Sought to investigate the relationship of water contamination with chemicals such as mercury, lead, arsenic and cadmium found in electrical and electronic equipment. A look at Brazil, in this study, we examined the presence of these substances in drinking water and its proximity to the urban area where it was thrown. Remember that the raw material in the manufacture of electronic equipment, such as computer and video display, generate approximately 22 kg of chemicals. During the study, it was observed that in place of drinking water there was evidence of contamination and that can be associated with the proximity of such electronic equipment.

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INTRODUCTION

Water is a vital resource for humanity and for the manufacture of electronic equipment. Be a transverse component of all social, economic and environmental activities. Electronic equipment, is today an icon for the development of an entire society. Both are a necessary condition, limiting or facilitator for any development. But, when water and electronic waste are combined and become a threat to the human environment, it becomes a basis for a conflict (Allsopp, 2006).

The main metropolitan areas of Brazil face growing problems of water pollution. Coastal cities such as Santos, Recife and Manaus suffer from the effects of food rivers, lakes and oceans contaminated by possible residential, industrial sewage and now waste electrical and electronic equipment. In 2000, only 35% of the wastewater collected was treated.

The South, Southeast, North and Northeast Brazil experience water scarcity due to overexploitation they were and misuse of water resources surface, largely attributed to strong pollution from sewage, leaking landfills and industrial waste.

The Brazil has one of the largest water reserves in the world, concentrating about of 25% of the surface fresh water available on the planet. But the contrast in the distribution is also huge: the northern region, 7% of the population, has 68% of water in the country, while the Northeast with 29% of the population owns 3%, and the Southeast, with 43% of the population, has 6% (CETESB, 2008).

Contamination of groundwater by contact with the electronic waste is a matter of great importance and in Brazil becomes paramount for insertion of 12,305/2010 Law governing the fate and those responsible for the circulation of this residue.

For a presentation in this research, the possibility of occurrence of these accidents is related to technological innovation, which in Brazil is recent and has not yet created a population environmental education in the promotion of new ideas to the responsibility of the citizen in the conduct and delivery of your electronic waste to appropriate locations.

During the enontradas in the samples were toxic metals including lead in quantities up to 100 times above background levels. But the researchers did not identify such results elsewhere in the River, that discarded such evidence only would be happening at a point in the River, what was mischaracterized as beginning of this metal. Other chemicals such as phthalates, some of which are known to interfere with sexual reproduction, were found in most of the samples tested. A sample also contained a high level of chlorinated dioxins, known to promote cancer.

Thus, the conduct of research was proposed for a query in the five regions of Brazil: North, Northeast, South and Southeast, pointing out places and issues highlighted as cause for concern by the fact of his contact with the water, which make the process of public management required.

The process of public management of impacted areas found in the search, requires deep understanding of the hydrogeological conditions. And the form found in the contaminant material, which can be easily compared to countries like Ghana which is a poor region and that cannot be compared to anywhere from Brazil, but which may be considered disturbing. This reason that made this necessary research for a correct assessment of the risk that this impact can bring to the site, to then carry out the implementation of appropriate remediation technologies.

To predict the risks of water pollution at the sites surveyed and for recovery strategies of areas already contaminated, some actions are being developed, and that in a future still far should take effect. To carry out research on electronic waste and its contact with the water, we're trying to find out if the public authorities are monitoring possible contamination with heavy metals such as lead (cause damage to the nervous system and blood type (where it is used: Computer, phone, television)), mercury (cause brain damage and liver. (Where it is used: fluorescent lamps, barometers and Thermometers)), cadmium (cause poisoning, damage to the bones, kidneys and lungs. Where it is used: Computer, old tube monitors, laptop batteries). And arsenic (cause skin diseases, affect the nervous system and can cause lung cancer. Where it is used: cell) that are heavy metals present in the junk e-mail and which are highly prejudiciai. (ISN, 2016).

Thus, to identify solutions for water contaminated with electronic waste, we are corroborating correlations with the research produced in 2010 by the University of the United Nations, based in Tokyo, under the responsibility of Professor Eric Williams, who has been warning since 2001 the predator Of chemicals Side of computers when their harmful effects (SANTOS, 2016).

Research has found some of its harmful effects of the computer when its disposal in inappropriate place. Other authors, such as Sung-Woo Chung in his paper "Promoting the 3Rs in Developing Countries: Lessons from the Japanese Experience" (CHUNG AND SUZUKI, 2008) argue that low labor costs are one of the main interests of sending developed countries to the China and other Asian and African countries (KUEHR AND WILLIAMS, 2003).

While working computers and cell phones may have a new life for garbage pickers in Brazil, the population throws away and with that, they create pollution when due to the high levels of toxic chemicals they contain. That is why this work comes to the meeting of presenting a document that shows the need for global recycling and with this to prevent the electronic waste from increasingly appearing in rivers and thereby contaminating it.

In this way, the work intends to identify from reliable university tests, critical information and to inform water management authorities that toxic substances such as mercury, arsenic, lead, cadmium were found at levels above levels Of human consumption.

IDENTIFICATION OF CONTAMINATED AREAS

The identification of the contaminated areas is made up of a sequence of observations and contacts with researchers in Brazil that have identified areas with the presence of clean water and they were being contaminated by the presence of waste electronics. These regions were, the southeastern (Santos-SP), (Vitoria-ES), North (Manaus-AM), (Palmas-PR), the northeast (Recife-PE), (Fortaleza-CE), (Salvador-BA), South (Porto Alegre-RS). In Brazil, the resolution CONAMA nº. 420/2009 lays down guidelines for the environmental management of chemicals contaminated areas as a result of anthropogenic activities (CONAMA, 2009). The following standards ABNT set out the methodology for the management of impacted areas: NBR 15515-1 preliminary assessment (ABNT, 2011a), NBR 15515-2

Confirmatory Assessment (ABNT, 2011b), NBR-3 15515 detailed investigation (ABNT, 2013a) and NBR 16209 risk assessment (ABNT, 2013b).

OBJECTIVE

The purpose of this article was to identify the presence of electronics waste in the Brazilian regions with water contamination and present possible scenarios of risk (after the contamination) and their corresponding emergency measures. For this, a case study was carried out in Brazilian regions with information published in some news scenario (with images of the region) and in touch with researchers interested in the subject.

METHODOLOGY

As a way of presenting this case study on the probable contamination by lead, mercury, cadmium and arsenic in the waters of the rivers considered ideal today in Brazil, and in this case who determines all portability Standards throughout the national territory is 2914 Ordinance of the Ministry of health. This Ordinance recommends that the pH value of water intended for human consumption and supplied by public supply network is in the range between 6.0 to 9.5.

In this way and as a case study, in the North, South, Southeast and Northeast, by virtue of its strong electronics consumption. From these regions, sought to verify that the community would be throwing away your electronics equipment in rivers near the cities in which they took advantage of the water for human consumption. Data were collected for these samples in these four regions. With this Ph analyses were made of water, as the electrical and electronic waste searched for being an important chemical pollutant, interfere with the pH of the water, and may make it more acidic or Basic, causing the death of several aquatic organisms, adapted to a situation of balance of pH. In addition, they affect the salinity of the water, changing the permeability of the membranes that surround the cells of marine animals, and can cause death of these organisms or from them cause problem in humans.

LOCATIONS OF CONTAMINATION

These regions were, the southeastern (Santos-SP), (Vitoria-ES), North (Manaus-AM), (Palmas-PR), the northeast (Recife-PE), (Fortaleza-CE), (Salvador-BA), South (Porto Alegre-RS)Região sudeste

The Baixada Santista has been target of pollution generated by industrialization and the growth of the population. Volunteers remove CRT tv of mangrove in Santos. In the area there is already strong evidence of contamination by consumer electronics devices. The Oceanographic Institute of the University of São Paulo (IOUSP) conducted a study that makes the lifting of the level of contamination by metals in the estuary of Saints through the sedimentary column observation using the US EPA 3050B (EPA, 2012). Research has shown that the accumulation of these metals in sediments shows water contamination that is used by the population for human

consumption. Figure 1 shows volunteers pulling tv CRT contaminated River.

Figure 1: remove the CRT tv rio in Baixada Santista
Source: Instituto eco cleaners, 2017

In the great victory of the Holy Spirit, computer monitors are dropped in the middle of the street by residents. The Material was left in the garden of a central Avenue.

Figure 2: Monitors played on the streets of Victoria
Source: TV Gazeta, 2016

Figure 3: Electronics thrown in the river Source
Source: TV Gazeta, 2016

It turns out that the garbage pickers end up leaving these electronics on the bed of the rio Santa Maria da Vitoria, which supplies half of the population of the great victory.Região Sul

In Figure 4, is shown on a problem that's been happening throughout Brazil in urban locales. Here we found in the River in an urban area, buildings and visible habits and objectionable, the population of the city of Paraná playing electronic equipment in a river that runs behind their homes. The most serious is that this river leaves the water for human consumption of these inhabitants.

Figure 4: the people throw away electronics in the river that supplies.
Source: Brazil Agency

Northern Region

Residents of stilts of Manaus live exposed to polluted streams. It is common to see from computer monitors to refrigerators and electronic equipment. The worst and that children, out of curiosity, end up swimming and ingesting the liquid of this river to catch some of these equipment found in river (Figura 5).

Figure 5: polluted river on stilts of Manaus.
Source: Brazil Agency

Northeast Region

The Capibaribe River (Figure 6 and Figure 7) supplies Capibaribe supplies the region of the city of Recife. With the advancement of technology and the demand for new equipment, the population has encountered as a solution, throw on the bed of the river their computer equipment. But, I think you're also fridge, air conditioning, and other consumer electronics.

Figure 6: Capibaribe River polluted.
Source: SIREE 2016

Figure 7: Capibaribe River polluted.
Source: TV Pernambuco, Northeast

In Salvador (Figure 8 and Figure 9), the population still uninformed, play the electronics on the street and not realize that these equipments are being deposited in rivers that bathe the region and which serves as a supply for human consumption.

Figure 8: Population throws away electronics
Source: TV Bahia

Figure 9: is coming in rivers
Source: TV Bahia

INITIAL RESULTS AND DISCUSSION

During the investigation of our research, the researchers in the North, Northeast, South and Southeast, declared that tests the pH of water would be essential because it could affect the metabolism of several aquatic species and human. So we note that the resolution CONAMA 357 establishes that for the protection of aquatic life and human, the pH should be between 6 and 9.

In this way, with the results of the pH, we'd be agreeing with the authors of the test the pH of water surveyed regions, because we understand that changes in pH can also be obtained from the effect of chemicals that are toxic to aquatic organisms and humans, such as heavy metals.

To this end, all samples were made from metal extraction laid down in the sediment samples using three methods: ultrasound-assisted extraction, digestion in digester and block digestion in microwave oven. Quantification of metals was done by Atomic absorption spectrometry, flame or by Electrothermal Atomization in graphite furnace. The three methods of opening of samples used were efficient, but digestion in microwave oven stood out in all cases.

The variations of the cadmium concentrations (maximum concentration = 0.01 mg/L), lead (maximum concentration = 0.033 mg/L), mercury (maximum concentration = 0.02 mg/L) and arsenic (maximum concentration = 0.033 mg/L) were used from collecting points and their averages along the Rivers surveyed, disclosed in table 01, indicate that the values are below the figures presented and amended by resolution 410/430/2009 and 2011 Resolution of the National Council on the environment (CNMA) establishing maximum concentrations classified water sweet.

According to the researchers, the values in mg/L Total cadmium, located in the regions surveyed, reported that concentrations have changed as a result of which these sites suffer water impoundment, which makes the environment-covered area and may have been the decantation of the heavy metals in the bottom of the dam. And also by the influence in February where high rainfall, contributing with arable land leaching that probably lead residues of pesticides used on crops, because it is an agricultural area. But consider that the results were positive and that the rivers surveyed are still with values within national standards for human consumption.

Cadmium is a metal found in nature associated with sulfites of ores of zinc, copper and lead. The metal cadmium is used primarily as anti-corrosion galvanized steel; cadmium sulfide and as pigment in plastics selenite and cadmium compounds in the manufacture of batteries and nickel-cadmium rechargeable batteries, electronic components and nuclear reactors (RAVI, 2005), cadmium and lead is standard in

monitors. The fish, the lethal doses of these elements, in General, vary from 0.1 to 0.4 mg L^{-1}, although, in experimental conditions, some resist even 10 mg L^{-1}. (CETESB, 2008)

The index of water quality for protection of aquatic life introduced a similar behavior across all monthly tests developed by researchers in two periods (drought and rainy), varying the quality of "regular" to "bad". According to the data obtained, of the four studied regions that got worse in tests was the river Capiberibe in the Northeast with ph value on average indicating 5.7.

Although there is no evidence of high contamination by heavy metals in this river, the literature demonstrates that there is a risk of metals, even at sublethal concentrations, affect aquatic ecosystems.

Based on the evaluation of water quality and the concentration of ions applied to this body, it is recommended that water be deployed a Waste management program at the Federal University of Pernambuco that seek to provide, efficiently, the handling and disposal of chemical waste generated, especially in laboratory activities.

Furthermore, it is concluded that the results of this work could contribute to the stock grant management, collaborating in the construction of a system to support decision making on pollution control in this environment.

However, warn that society needs to seek a solution on environmental education for the disposal of electrical and electronic equipment. The surveyed assessed that in 2015 were removed the equivalent of a ton of consumer electronics equipment in the sum of the regions surveyed, which becomes an environmental impact because these devices contain toxic residue that causes many harms to human.

Were also observed in the research that people are not being monitored or even polite to not play your electronics equipment in rivers, and not a campaign of receiving of this equipment. The Brazil will arrive in 2017 with 48 million tons of junk mail, according to UN figures.

Table 1: evaluations carried out in rivers in the Southeast, North, Northeast and South.

Parsed parameter	COLLECTING DATA				
		SOUTHEAST REGION	NORTHERN REGION	NORTHEAST REGION	SOUTHERN REGION
	COLLECTION POINT	16/01/2015 TO 13/12/2016	21/02/2015 TO 15/01/2016	23/01/2015 TO 12/01/2016	16/01/2015 TO 18/01/2016
	TIME	8:00 hours	8:00 hours	8:00 hours	8:00 hours
		Average of the 12 months	Average of the 12 months	Average of the 12 months	Average of the 12 months
Total cadmium	mg Cd/L	0,002	0,002	0,09	0,001
Total lead	mg Pb/L	0,002	0,002	0,012	0,001
Total mercury	mg Hg/L	< 0,0001	< 0,0001	< 0,0001	< 0,0001
Total Arsenic	mg As/L	<0,001	<0,001	<0,001	<0,001
PH	-	7,1	7,2	6,8	7,4

Source: tests performed at the University Provided of Bahia (Northeast region); Tests conducted at the Lusíada University Center (Southeast region); Tests conducted at the Catholic University of Pernambuco (Northeast region); Tests conducted at the Federal University of Amazonas (Northern region); Tests conducted at the Pontifical Catholic University of Paraná (South region).

For the evaluations of the hydrogen potential (PH) were used in all measures the Digital PH meter with electrode, PH-model 710 (INSTRUTHERM)

According to Santos (2016), it demonstrates that the amount of electronic waste produced each year in Brazil is significantly higher than the projections considered in other countries. The Brazil generates a million tons of electronic waste and that in 2013 was in the order of 918,000 tons. The projection for 2020 is in the order of 1.09 million tons. For 2016 and 2017 1 increase around 1.2 million tons.

It is worth mentioning that the law 12,305/2010 (BRAZIL, 2016) establishes guidelines for the correct disposal of electronic waste. This discard is well defined between the most important instruments in article 8, identifies him as: solid waste plans; the annual declaratory system of solid waste; the sector agreements; the National System of information on the management of solid waste (SINIR); the national registry of operators of hazardous waste; Reverse logistics systems and Selective collection.

Brazilian laws begin their reflections on the environmental impacts in the late 1970 's and early 1980, as AB States ' Know (1998), when referencing one of the first works of the World Bank in 1974, hinting at one of the points for environmental impact studies. Titled "Environment, Health, and human ecologic considerations in economic development projects", this study became guidelines manual in the identification, detection, measurement and control of adverse environmental effects.

Born from that study, a general survey of the environment, health, human and ecological impact relating to project development in sectors such as agriculture, industry, energy and urban development, including water supply, sanitation and transportation. This information could allow individuals and institutions involved in economic development, recognize potential problems at the beginning of projects when directed to the environment.

From the 12,305/2010 Law (BRAZIL, 2010), members of the society have been raising awareness of the harmful effects of such waste, due to amount of dangerous elements, as highlighted in annex 7. Because, while playing the electronic waste in landfills not controlled, the toxic metals can contaminate the soil and reach the water table, interfering in the springs, triggering another problem, namely: If the water is used for irrigation and human supply, livestock, civil society members can contract diseases, since they are manufactured with toxic substances and pollutants , and heavy metals, as presented in annex 2. And the chemicals that make up the specifically computers like: Mercury, cadmium, arsenic, copper, lead and aluminum, cause problems with contamination if badly stored and/or discarded. A study of the Faculdade de Medicina da USP identified abnormal rates of metals such as lead and cadmium in blood of scavengers.

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