Chemistry and environmental education in relevant disposal of batteries

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ABSTRACT

The solid wastes generated by urban agglomerations, associated with the exaggerated consumption in combination with industrial activities that have a great impact on the environment, are a matter of concern for scientists, non-governmental organizations and part of the conscious population that seek to find alternative development that allows preservation and recovery, with a view to human sustainability. This study was conducted to inform and sensitize the students of the second high school series of a School located in the city of Barra de Santa Rosa, Paraíba, Brazil, about the inappropriate disposal of batteries and the problems that can bring to health Human health and its environmental impacts. To carry out this intervention, the chemist scholars worked on guidelines, research, sustainable actions and a lot of creativity. They were made together with the students containers collecting piles from plastic bottles, where each student built his own. A visit as well as questionnaire was also made to the cellular technicians of the city in order to make a survey about the disposal of their batteries. One cannot fail to emphasize the importance of the contextualization of the teaching concepts with daily facts, as in the case described, the content of electrochemistry with the theme generator batteries. When commitment is made and new methodologies are sought, students do not have to learn in a forced and decorated way, but rather have fun and gradually evolve.

Keywords: Recycling, environment, chemistry teaching.

INTRODUCTION

The waste generated by urban agglomerations, associated with the exaggerated consumption in combination with industrial activities that have a great impact on the environment, are a matter of concern for scientists, non-governmental organizations and part of the conscious population that seek to find alternative development that allows preservation and recovery, with a view to human sustainability (Santos et al., 2017). It is through the relationship between environmental education and chemistry teaching that there can be the integration of knowledge and abilities, allowing the generation coherent community activities, since it is the role of the educator and the school to guide and inform, not only to develop the understanding of scientific, technological and social aspects related to waste, but to allow the citizen to critically reflect on the role as co-responsible for the generation and solution of environmental problems (Araújo and Santos, 2018; Cheung, 2011). Considering also that there is difficulty of this contextualization in the teaching model in the public schools, especially in the teaching of Chemistry, because there are little concern about the degradation of the environment, due to the lack of a policy of awareness in which it can involve every Faculty and student of the school. The relationship between chemistry teaching and the garbage is given by learning about the different materials, their occurrences, processes of obtaining them and their applications, allowing the drawing of parallels between the social and economic development of modern man (Marques et al., 2007). All this demonstrates the importance of learning chemistry.

At present, human being no longer lives without technology, that is, without using portable electrical devices.
such as toys, games, clocks, flashlights, power tools, electronic organizers, shavers, cameras, camcorders, cell phones, and computers, whose life are limited and discarded. When disposed of in landfills or landfills, they release toxic components that contaminate the soil, water table and water courses, affecting fauna and flora, and man through food chain. When disposed of in landfills, it can contaminate the slurry and its burning is also not a good practice because its components that are toxic remain in the ashes and can volatilize, thus contaminating the atmosphere.

Ever since the last decade, there has been a huge proliferation of portable electronic devices, such as: toys, games, watches, flashlights, power tools, electronic organizers, shavers, cameras, camcorders, cell phones, computers, stereos, measurement and calibration, medical equipment, etc. At the same time, the demand for increasingly smaller, lighter and better-performing batteries and batteries has skyrocketed. Consequently, a wide variety of batteries are currently on the market to meet the myriad requirements (Afonso et al., 2003). Understanding the principles of operation of this wide variety of batteries is an arduous task and often requires deep and multidisciplinary knowledge as many of these electrochemical systems employ advanced technology. In spite of this, it is intended to address here, in the simplest possible way, the operation of the batteries that most often appear in our daily lives.

Some of the batteries available in the market contain toxic materials, and many countries, such as Brazil, have been concerned about the effects on human health and the environment that these electrochemical systems present (Matsumbara et al., 2007). The metals cadmium, lead, copper, manganese, nickel and other chemical components that produce the energy of the batteries that are discarded improperly, when in contact with the nature, are highly toxic, causing stomach diseases, anemias and cerebral changes that can lead to death. Human beings, animal and plant life suffer from the contamination of improperly discarded batteries. In contact with the body, these metals end up attracting two essential elements of the body: proteins and enzymes. Eventually, they join some of them, preventing them from working - which can lead to death. Heavy metals also bind to cell walls, making it difficult to transport nutrients. Some complications that they cause are changes in the lungs, liver and kidneys. For example, cadmium causes inflammation and paralysis, while lead causes paralysis in the hands and disturbances in vision, and mercury loss of vision, weakens brain functions and coma (Lima and Merçon, 2011).

The problem is serious because people still today give unloaded batteries to small children to play with, where they can put them directly in the mouth and also, the collectors in the dump come in contact with these chemical elements constantly without any protection. Animals drink from this contaminated water and plants irrigated with water from contaminated groundwater (Leite et al., 2010).

Environmentally sustainable educational practices indicate pedagogical proposals focused on the criticality and emancipation of subjects, with a view to changing behavior and attitudes, to the development of social organization and collective participation (Sousa et al., 2015; Lima et al., 2016). Taking advantage of situations of environmental impacts aiming at the dynamic, interdisciplinary and contextualized teaching-learning process can be a way for the teacher to awaken in students the awareness of the importance of chemistry (and also of regional studies) and lead them to construct concepts that are significant for improvement of their quality of life, regardless of the socioeconomic situation (Silva et al., 2016; Santos et al., 2016).

Following this line of thought, this study aims to inform and sensitize the students of the second high school series of a State School of Primary and Secondary Education, located in the city of Barra de Santa Rosa, Paraíba, Brazil, on the inappropriate disposal of batteries, and the problems it can bring to human health and environmental impacts.

**METHODOLOGY**

This study was developed in the State School of Primary and Secondary Education José Luiz Neto, located in the city of Barra de Santa Rosa, Paraíba, Brazil, in years 2016 and 2017. The target audience of the study were students of the second year classes of regular high school. The objective of the study was to inform, raise awareness and propose to the students actions so that we could collect as many batteries as possible, which in turn would be thrown into the common trash in their houses.

Initially, a questionnaire was administered to the students of the classes with the purpose of investigating their previous knowledge about the generating theme. Subsequently, seminars on batteries, their environmental impact and a brief introduction to electrochemistry were given (Santos et al., 2016). The same questionnaire was applied again to compare the degree of evolution of the learning of the class after the classes. After the resumption of the content and withdrawing of all doubts, it was proposed for the students the making of containers to collect and store batteries, known as "Eat-batteries". In the same line of thinking about recycling, all the students took plastic bottles into the classroom, where they deposited the batteries an they found in their homes, in the homes of friends, neighbors and so on. Students were free to use their creativity in making containers.

The material for the production was divided into what each one would take to adorn his/her "Eat-batteries". Another intervention was to visit the main cell phone technician in the city, who receives many batteries of discharged cell phones daily. A questionnaire was applied to him, seeking to know how he discards discharged...
batteries, which in turn were commercialized and delivered in his trade. He also sought to guide on some issues that he did not know about.

RESULTS AND DISCUSSION

With the purpose of informing and sensitizing these students of the State School of Primary and Secondary Education José Luiz Neto, in the city of Barra de Santa Rosa, following the perspective that the initial investigation of students’ prior knowledge is a determining factor in the teaching process and learning, a questionnaire was applied with objective questions related to the theme. In the application of the first questionnaire, it was observed in the results of the students’ responses that, their vast majority did not know how and where to properly dispose of batteries. Moreover, most of them did not know what heavy metals were, if they were harmful, what was contained inside a pile, and where to return them when discharged. Interventions were carried out through seminars on the subject, and in the application of the same questionnaire, a significant evolution of the concepts was verified with the analysis of their answers in comparison with the first questionnaire. Thereafter, the collecting containers of batteries, the “Eat-batteries” were designed. The students were creative, efficient, motivated, and more aware than previously, as shown in Figure 1.

All the students in the classes worked hard and each of them took home his/her battery collector - “Eat-batteries”. In the last project action that brought in batteries from home, family, neighbors and those to be thrown into the environment or common trash, all students were able to collect a good amount of batteries, about 200, though few. All the batteries were stored in the containers constructed, in the laboratory of the school, where later they will be sent to the correct treatment. The important thing is that, in addition to the knowledge acquired by the students about the problem, it is possible to reduce the risk of contamination by these batteries that would be discarded in the environment, since the city does not present a collection point for these toxic materials. This guaranteed quality of life for ourselves and the people around us.

A visit was made to the cell phone maintenance technician in the city and we asked them some questions related to battery management. After he responded with a lot of education, some doubts were clarified and he warned about the need for some information that he, as a seller of cell phone batteries, should know for safety and correct disposal.

CONCLUSIONS

At the time of the preparation and the collection of the batteries, the objective of the work was reached, which is to ensure proper discarding of the toxic materials in the environment in which we live. The students were
conscientious and motivated about the correct disposal, and as such, participated effectively in making "Eat-batteries", being very productive in all. The present study will help students acquire knowledge on proper disposal of batteries or exhausted battery and also be environmentally conscious in life, alerting people around them. One cannot fail to emphasize the importance of the contextualization of teaching concept with daily facts, as in the case described. Example includes the content of electrochemistry with the theme generator batteries. When commitment is made and new methodologies are sought, students do not have to learn in a forced and decorated way, but rather have fun and gradually evolve.

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REFERENCES


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