

## **ENVIRONMENTAL EDUCATION AS PRACTICAL TOOL IN ENVIRONMENT MANAGEMENT OF TROPICAL SOLAR SALTWORKS - BRAZILIAN EXPERIENCE**

**R. de M. ROCHA<sup>1</sup>, D.F.S. COSTA<sup>1</sup>, M.A. LUCENA FILHO<sup>1</sup> and F.A.M.SANTOS<sup>1</sup>**

<sup>1</sup> Universidade Federal do Rio Grande do Norte, Semi-arid Ecology Laboratory  
Rua Joaquim Gregório, s.n. Penedo. CEP. 59.300-000. Caicó. Rio Grande do Norte (Brazil)  
E-mail: [renatocaico@yahoo.com.br](mailto:renatocaico@yahoo.com.br)

### **EXTENDED ABSTRACT**

Along of the Brazilian coast line, only in the northern coast of the state of the Rio Grande do Norte (Brazil) are located the greatest companies of salt of the country, mainly in the borders of their estuaries. The saltworks that are located in that stretch of the Brazilian coast are responsible by 95% for the marine salt produced and exported in the country. The salt industry of the Rio Grande do Norte goes through a gradual process of modernization, demanding a more competitive product in the international market, mainly in purity and quality grade; further on, the preoccupation today is to obtain a product that is fruit of a suitable environmental management and with respect to the environmental norms. Describing their civil servants to understand better the operation of the ecosystem hypersaline in which they are inserted, the salt companies located in to the borders of the estuary of the River Apodi/Mossoró (Brazil), invested in the training in environmental education for all leaders and civil servants. The trainings realized in each saltwork presented two different methodologies, composed by expositive classes and practical exercises. Those courses are developed next to the chosen public of leaders and technicians, and also with civil servants of the salt. During the exhibitions, the following contents in the practical exercises are boarded related topics with theory about the hyper saline environments (salt work like ecosystem; ecosystem of mangrove, etc.); and in the practical exercises, the diverse organisms would be exhibited that compose the saline ecosystem, surrounding the knowledge about the ecology of the hypersaline environments. Like practical result of the works, about 90% (near 3,000 civil servants and leaders) were in that course of the salt works located in the borders of the Apodi/Mossoró estuary own practically all personnel enabled of the knowledge and experiences about the environmental questions that surround the ecosystem hyper saline, the mangrove swamps, the estuary where the salt works are located. During and after the accomplishment of the courses, employees did now know the importance ecological that this ecosystem represents so much for the estuary as well as for the production of the salt.

**KEYWORDS:** viability, management and salt works.

### **1. INTRODUCTION**

Along of the Brazilian coast line, only in the northern coast of the state of the Rio Grande do Norte (Brazil) are located the greatest salt companies of the country, mainly in the borders of their estuaries. The saltworks that are located in that stretch of the Brazilian coast are responsible by 95% for the marine salt produced and exported in the country, directly influencing the local and regional economies through the generation of employment and tax payment.

The location of saltworks along the estuaries of major rivers in the coast is due to environmental factors, such as semi-arid climate with high temperatures (> 28 ° C), low rainfall

(<800 mm / year) and high rates of evaporation, in association with the availability of water in the estuary.

However, the salt industry of Rio Grande do Norte has been going through a gradual process of modernization (ROCHA, 2005), requiring an increasingly competitive product in international market, particularly in relation to its degree of purity and quality; in addition, the concern today is to obtain a product which is the result of an appropriate environmental management and in according to environmental standards (ANDRADE *et. al.*, 1995).

Associated with this fact, the worsening of environmental problems has changed the environmental framework in business, generating an increasing level of requirements (DONAIRE, 1994). The new environmental awareness, which appeared in the midst of cultural changes that occur in the 1960s and 1970s, has increased and situated the environmental protection as one of the most fundamental principles of modern society (DIAS, 1992; JACOBI, 2003).

Regarding the reasons shown above, it is also worth emphasizing according to Donaire *op. cit.*, which refers to the fact that the current environment in which the company operates has witnessed the emergence of new roles to be played and understood as a result of changes in values and ideologies of our society.

Thus, modern firm activities (saltworks, for example), in addition to the economical productive concerns, including issues of social nature, involving from the medical and social assistance, pollution control, environmental monitoring, among others. Thus, as Sato & Carvalho (2005) and Sato & Santos (2002) highlight, society along with the environmental monitoring body has required a more appropriate and responsible position by companies, in order to minimize the socio-environmental impacts resulting from the operation.

Donaire *op. cit.* emphasizes the fact that the environmental concern has won a significant focus among the many demands required by the society which affect the business. Nagagata (2006) states that this concern has required the companies a new positioning in their integration with the environment.

This research aims at evaluating the implementation of modules in environmental education in staff of salt-works located in the estuary of Apodi/Mossoró river, state of Rio Grande do Norte (Brazil). As a foundation for the actions carried out throughout the work, started from the premise that would require the workers' skills of saline in order to show them how they fit and how it makes the functioning of a hyper saline ecosystem. This need would have support in the growing demand for trained professionals to work in salt companies.

Practices relating to environmental education in Brazil solar salines had as precursor forensic actions of State Public Ministry (Prosecutor for the Environment, Mossoró-RN). These actions were taken on an adjustment of practice by some companies, but then the vast majority of salt companies that region of the state joined the program to see its potential to add an "environmental value" to the marine salt produced. From the legal requirements of actions in this new axis of surveillance and environmental control of companies, environmental education courses in hyper saline environments began to appear on the pre-requisite list of the state environmental agency (IDEMA) to issue the license to operate any company for salt production.

In this sense, Environmental Education training were carried out for all salt companies' managers and employees located on the estuary of the Rio Apodi/Mossoró, seeking a strategy of action that allow create more effective and rational attitudes short and long-term in dealing of local and regional environmental problems.

## 2. MATERIAL AND METHODS

The estuary of Apodi/Mossoró river is located on the northern coast of the state of Rio Grande do Norte - Brazil, in the municipalities of Grossos, Areia Branca and Mossoró, between latitudes 4 ° 56'53 "S and 5 ° 09'30" S and longitudes 37 ° 09 "36" W and 37 ° 17 '43 "W (see Figure 01).

Two methodologies are developed in training at each salt work, in which the first part of the course consists of lecture classes with multimedia projector and white board, and the second part developed through practical lessons with the use of binocular microscopes and magnifying lenses.

These courses are developed with a target audience composed of managers and technicians with complete degree and or incomplete university study, along with other employees of saline, which usually have a complete or incomplete elementary and high school.

During the exhibition in lectures, the following content are addressed:

- ✓ ecology of hypersaline environments
- ✓ Saltwork as ecosystems
- ✓ Potential environmental problems involved in the production of salt
- ✓ Ecosystems adjacent to saltworks(mangrove, savanna steppe, flooded, etc.).
- ✓ Environmental monitoring of the estuary.

Moreover, during the lectures students are encouraged to consider the environmental quality of their work, as well as to reflect on what the environmental problems that they witness and what actions could be taken to avoid them.

In practical classes (with binocular microscopes and magnifying lenses) are exposed to various agencies that comprise the ecosystem of saline in the state Rio Grande do Norte, involving knowledge about the ecology of the environment, such as:

- ✓ Planktonic Community (phytoplankton and zooplankton)
- ✓ Water filtration process carried out by microcrustaceans *Artemia* spp.(Crustacea: Branchiopoda: Anostraca)
- ✓ *Artemia* spp cyst occurrence and form.
- ✓ Analysis of different sodium NaCl crystals produced in saline.

## 3. RESULTS AND DISCUSSION

As a practical result of work, 90% of salt located on the banks of the Apodi-Mossoró estuary have trained almost all staff with knowledge and experiences on environmental issues involving the hypersaline ecosystem, mangrove, estuarine, and the estuary where saltworks are inserted. Practically, about 3.000 employees and managers already experienced this kind of course, receiving theoretical-practical guidelines on hypersaline environments and associated ecosystems (mangrove, for example).

The importance of these results is reflected in the statement by Donaire (1994), regarding the fact that the first industries emerged at a time when environmental issues were not relevant, because of reduced levels of production and comparatively lower and little concentrated populations.

The author points out those environmental requirements were few and smoke from chimneys was synonymous with progress, proudly announced in the propaganda of various industries.

Both during and after the courses, a concern is evident in relation to natural resources, especially the environment of mangrove, by knowing now the importance of ecological environment that represents both the estuary and to the production of salt. From the training,

areas of mangroves have been preserved with the aid of its own employees, especially in regard to the use and extraction of natural resources of this environment.

Throughout the courses, several concerns of employees are emerging, particularly with respect to three themes: environmental control in the company's internal and external area, need for utmost vigilance with respect to the waste generation in industrial practices and processes, as well as integration of environmental control between the administration management and staff.

During the dialogue-space carried out in the theoretical part, most of the environmental concerns addressed by companies' employees concerns to the pollution control in the disposal places of saline. Despite this fact, are talked all necessary actions to be taken by employees and managers of these companies, so that the disposal of the bitter "can be done without damage to the environment.

Many activities from the training should highlight, such as joint efforts for removal of garbage and rubble from the salt works and the surrounding environments (mangrove, savanna, meadow, etc.). Also, it is worth noting the implementation of projects of (re) planting mangroves in certain places, aiming at filling empty spaces, thereby avoiding excessive intake of exogenous material and sediment into the estuary.

Moreover, during the practical part of the course, real situations are arisen so that students explain their operation and environmental problems that this practice can lead (disposal of sewage, garbage within the company, etc.). These facts are analyzed once observation of the same by employees provide useful information for companies interested in solving environmental issues in a practical and quick way.

It is worth mentioning the fact that during and after the training, the environmental issue is now considered necessary for the success of the company. It is clear that the environmental quality achieved when, aggregated sea salt produced in saltworks, this is likely to turn into new opportunities for profit and growth. Saltwork companies analyzed promptly captured the market trend in aggregating environmental quality to the final product. After the training, this fact is increasingly taken into in management decisions into consideration of each company.

Even in companies where the environmental issue was already being developed since beginning the training, environmental protection is no longer a function solely of production to become also a function of government. Included in the organizational structure, interfering in the strategic planning and will be an important activity in the organization of the company, whether is in the development of routine activities, either in the discussion of alternative scenarios and the consequent analysis of its evolution, generating policies, goals and action plans.

These results suggest the need for expansion of activities in environmental education in business. These staff (leaders or not), in which environmental control is integrated into the productive practices and processes, rather than being an activity of controlling pollution and going to be a production function.

#### **4. CONCLUSION**

Based on the above shown, it can be said that an immediate response in the companies they acquire an environmental awareness is the change from a basic principle with regard to this issue. This principle will be the prevention of pollution and or environmental degradation, involving since the selection of raw materials and throughout the productive process.

From completion of courses in environmental education with the staff of saltworks located on the banks of the estuary of the Apodi / Mossoró river, is expected to be offered a change of paradigm on the way to think about the industrial development of salt industry in the state of Rio Grande do Norte. This change is reflected in a new way of producing marine salt in business in harmony with the surrounding ecosystems and thinking in the ecology of this hypersaline environment.

According to the results, it is concluded that the challenge is, above all, to make an environmental education in a critical and innovative way in two levels: formal and non-formal. Thus, as described by Nagagata (2006), environmental education should be above all a political act geared toward social transformation. Its approach should seek a perspective that relates to man, nature and universe.

## REFERENCES

1. ANDRADE L., SOARES G., PINTO V., 1995. *Oficinas Ecológicas: uma proposta de mudanças*. 2 ed. Petrópolis, RJ: Vozes.
2. DIAS G.F., 1992. *Educação Ambiental: princípios e práticas*. São Paulo: Gaia.
3. DONAIRE D., 1994. Considerações sobre a influência da variável ambiental nas empresas, *Revista de Administração de empresas*, São Paulo, v. 34, n. 02, p. 68 – 77.
4. \_\_\_\_\_. 1994. *Atividades Interdisciplinares de Educação Ambiental - manual do professor*. São Paulo/SP: GLOBAL.
5. JACOBI P., 2003. Educação ambiental, cidadania e sustentabilidade. *Cad. Pesquisa*. Universidade de São Paulo, n. 118, p. 189-206.
6. NAGAGATA E., 2006. A importância da educação ambiental como ferramenta adicional a programas de conservação. In: ROCHA, C.F.D.; BERGALLO, H.G.; SLUYS, M.V.; ALVES, M.A. S. *Biologia da conservação – essências*. São Carlos/SP: RiMa, p. 563-585.
7. ROCHA A.P.B. 2005. Expansão urbana de Mossoró/RN (período de 1980 a 2004): geografia, dinâmica e reestruturação do território. *Dissertação de mestrado em Geografia*. Universidade Federal do Rio Grande do Norte, Natal/RN.
8. SATO M., CARVALHO I., 2005. *Educação Ambiental: pesquisa e desafios*. Porto Alegre/RS: ArtMed.
9. SATO M., SANTOS J.E., 2002. Tendências nas pesquisas em Educação Ambiental. In: NOAL, F.; BARCELOS, V. (Org.) *Educação Ambiental e cidadania*. Santa Cruz do Sul: eDUNISC.