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RESEARCH ARTICLE OPEN ACCESS

SCIENCE / CHEMICAL TEACHING THROUGH ALTERNATIVE MATERIAL MEDIA: CHARACTERIZATION OF RICE HUSK ASH

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ABSTRACT

This paper aims to present material for Science / Chemistry teaching through the characterization of rice husk ash. The rice husk ash has a significant amount of silica and potassium in its composition and in this perspective, the importance of working with these residual materials is highlighted, given its facilityfor obtaining and adapting to the didactic content of project-related subjects by aggregating technology and environmental issues. The batches of rice husk ash obtained from the company have in their composition only beneficial elements without the presence of toxic elements, making it possible to use them in the methodological experimentation proposal. In order to be able to use the residues of the rice husk ashes safely as alternative materials for the teaching of Science / Chemistry, physical-chemical, analyses were carried out in Scanning Electron Microscopy and Atomic Absorption of mass. Through the results presented, the content approach of the Science / Chemistry disciplineshas become possible with the use of alternative materials, the ease of obtaining and the low cost constitutes a differential that makes it possible to approach experimentation.

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INTRODUÇÃO

Global energy demands have tripled since 1950 and are expected to increase by around 50% by 2020. For reasons of sustainability, the energy matrix in use today needs to change, as statistical data shows, around 84% of commercial energy consumed worldwide is originated from non-renewable sources. Most of this consumption (81%) comes from fossil fuels (oil), which are the main causes of global warming and the greenhouse effect. The use of clean and renewable energies is extremely importantleveraging vectors for the success of sustainable development. To this end we describe simple learning systems that can be used in the classroom are of vital importance (Rubner, Ashton J, 2019). Based on this problem, which is the lack of studies on new science teaching methodologies and in the case of chemistry, the study proposes the characterization of rice husk ash residue from a thermoelectric plant and later use for science / chemistry teaching in a participatory process. Since our motivation was promoting sustainable development with students from a University, encouraging them to reflect, and thus contribute to the construction of student knowledge initiatives, through the Potentially Significant Teaching Unit - UEPS, which has already been used in science teaching (Moreira, M. A, 2012). Meaningful learning is a process by which new information relates to students' prior knowledge from their experiences, which he calls subunits. Thus, meaningful learning occurs when the new knowledge is anchored in previous knowledge. The broader and more meaningful the learning, the more differentiated the sub-subsectors of significant, modern learning argues, the introduction of this methodology in teaching through the taxonomy of significant learning advanced by Fink (2013) is used as a framework to discuss the results. But for the elaboration of the Potentially Significant Teaching Unit, learning must be significant and critical (Moreira, 2011). Meaningful learning is used to assess laboratory learning and to investigate the affective, cognitive and psychomotor domains of the student's learning experience (George-Williams*et al*, 2019). Thus, showing the versatility of works proposed with the use of theory. To understand the theory, it is necessary to experience it. About 80% of the students were able to relate the practice to examples from their daily lives, with a better understanding of what is being studied. The practice articulated to the theory makes a lot of difference for contextualized teaching, where students can perceive the importance of the contents taught, providing greater clarity so that they can really interpret, seek the student's active participation in solving problematic situations. Working with experimentation means creating an environment conducive to research, where the student is an active part of the construction of learning, investigate, analyze, create hypotheses, discuss and work in groups, involving him in the search for conclusions that support his theory (Guimarães, 2009). This methodology makes teaching really active, involving students in the direct manipulation of materials and in carrying out experiments where they can modify, test and interpret them (Moraes, Ramos, 1988). The use of alternative materials in teaching chemistry brings important contributions to learning. The use of alternative materials in the teaching of chemistry brings important contributions to learning that is easy to acquire and / or inexpensive is not new in educational institutions. When using alternative methods, the teacher will be collaborating in a direction where students can observe the importance of the subject making it fun and interesting, arousing interest and encouraging more meaningful learning. Alternative materials are resources found in everyday life that can be used as teaching tools, whose main characteristics are the fact that they are low cost and easy to acquire. These materials can be used as support tools in the teaching-learning process, supporting the theorization of some fundamental concepts in a practical and experimental way without losing sight of the importance of the scientific basis of the taught content. The act of interacting with alternative materials, activates the ability to develop skills and competences, allowing the expansion of knowledge and bringing Science closer to the student's learning needs. According to Neto (2007) Silicon (Si) is not considered an essential nutrient for the plants development, but some crops such as wheat, corn and beans show increased productivity with the increase of Si availability in the soil. RHA is already being used empirically, by family farmers, as correction and soil conditioner (ISLABÃO, 2013).Rice husks are already used by rice mills as fuel in wood-burning furnaces. The substitution of bark in relation to firewood is justified by the great availability, reduced cost and also by the calorific power of rice husk, which is 3730 kcal kg-1, comparable to black wattle (4550 kcal kg-1) and eucalyptus (4525 kcal kg-1) (QUIRINO*et al*., 2005), but lower than charcoal that has values around 7500 kcal kg-1 (VALE*et al*., 2002).

MATERIALS AND METHODS

The present research is of an applied nature, to the extent that it has constructed a model for using the concepts developed. Applied research is characterized by its practical interest, that the results are applied or used immediately in solving problems that occur in reality. (Turrioni, Mello; 2012). As for the objectives, normative research is primarily interested in developing strategies and actions to improve the teaching of a theme, to find an optimal solution in order to obtain new problem definitions or to compare various strategies related to a specific problem. (Bertrand, Fransoo, 2002). As for the way to approach the problem, it is classified as combined research, and the researcher combined aspects of quantitative and qualitative research in some stages (Turrioni, Mello; 2012). Quantitative, when it is translated the information into numbers to analyze and classify it, and qualitative, for interpreting and giving meaning to the information obtained. In relation to the technical procedures used, it encompassed aspects of bibliographic, documentary research and survey of experiments in the educational institution around the studied problem (GIL, 2002). The rice husk ash was provided by a thermoelectric company and the experimental procedures relevant to this work were carried out in the second semester of 2018 at the University's Laboratory. The following equipment was used for the chemical evaluation of granulated rice husk ash: Photocolorimeter, Atomic Absorption Spectrophotometer and Scanning Electron Microscope with coupled EDS (SEM + EDS) to take the readings. In addition, it was analyzed for the physical characterization of the raw material, humidity, hardness and size, aiming at the development and use of the RHA for its granulation and subsequent incorporation into the soil for the production of the corn crop, among others, and reducing the environmental impact of residual rice husk biomass and being the most sensible alternative to dispose of this residue. The ball mill milling process is widely used by several researchers, and results in varying average diameters. A ball mill was used, with a porcelain jug, 27 cm in diameter, powered by a 35 rpm engine. The load was 5000 g of balls (with a diameter of 15 mm to 20 mm) for 800 g of rice husk ash and a grinding time of 60 minutes. In the construction of UEPS we thoughton a participatory process promoting sustainable development with students from the university's Agronomic Engineering course, encouraging reflection, improving the quality of life, thus contributing to the construction of environmentally correct initiatives through the Potentially Meaningful Teaching Units - UEPS,(MOREIRA, 2011).

Potentially significant teaching unit: University education is undergoing conceptual changes, one of them is the way of presenting certain content to students. Usually students copy and try to memorize it to use immediately during the test or for some proposed activity, but over time these concepts can no longer succeed be accessed, mainly in professional life, different from the high school student, whose main motivation is the ENEM (National High School Exam) and the entrance exam. One of the teaching methodologies can be UEPS, the student will be accompanied throughout the teaching process, the teacher will try to make the student understand the content and not just run to use it once, and then forget. For Ausubel (2003), the information already mastered by the student is a significant factor that will influence his learning, having a certain mastery over a certain topic the student will be able to develop new learnings, facilitating the understanding of new concepts. However, it is not enough for the teacher to be willing to develop a didactic sequence, based on a Potentially Meaningful Teaching Unit, the student also needs to be willing to develop his knowledge, being participative, critical and questioning. Thus, you will have a better use of the content to be studied.

A very important moment is found at the beginning of each meeting, as it is where the content of the previous class is resumed, taking time to clarify doubts from the previous meeting, remembering that the content needs to be understood and not decorated by the student. The steps for the elaboration of a potentially significant Didactic Sequence will be discussed, aiming to expand the possibilities of occurrence of Significant Learning in the development of activities. There are eight steps proposed by Moreira (2011) for the elaboration of a UEPS:

1. Define the specific topic to be addressed, identifying its aspects to be studied as well as what content can be used.
2. Create / propose situations, discussion, questionnaire, concept map, mind map, problem situation, etc. with that the student will be able to show what he already knows, so the teacher will be able to work as a student something to develop his knowledge from that.
3. Propose problem situations, with an introductory level taking into account what the student already knows, in these problem situations we can have the help of other types of materials such as games and software, making the class even more attractive, with greater student participation.
4. Once the initial situations are worked out, present the knowledge to be taught / learned, starting with more general, inclusive aspects, giving an initial view of the whole, of what is most important in the teaching unit, and then exemplifying, addressing

specific aspects; the teaching strategy can be, for example, a brief oral presentation followed by collaborative activity in small groups which, in turn, must be followed by presentation or discussion activity in a large group;

5. In continuity, resume the more general aspects of the content of the teaching unit, in a new presentation, but at a higher level of complexity in relation to the first presentation; problem situations must be proposed at increasing levels of complexity; give new examples, highlight similarities and differences in relation to situations and examples already worked on, that is, promote integrative reconciliation.
6. Concluding the unit, proceed with the process of progressive differentiation, returning to the most relevant characteristics of the content in question, but from an integrating perspective, that is, seeking integrative reconciliation, and in this part they must be proposed and worked on at higher levels of complexity in in relation to previous situations; these situations must be resolved in collaborative activities and then presented and / or discussed in a large group, always with the mediation of the teacher;
7. The assessment of learning through UEPS must be made throughout its implementation, recording everything that can be considered evidence of significant learning of the content worked;
8. UEPS will only be considered successful if the assessment of student performance provides evidence of significant learning. Meaningful learning is progressive, the mastery of a conceptual field is progressive; therefore, the emphasis on evidence, not final behavior.

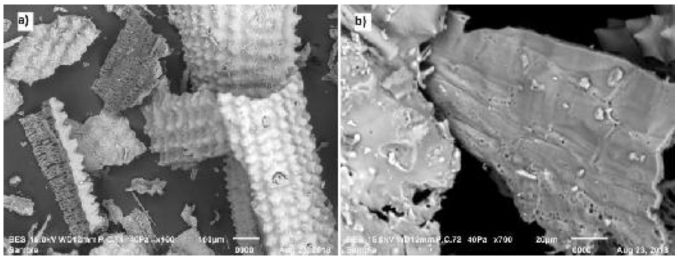
RESULTS AND DISCUSSIONS

From the rice husk ash obtained by the thermoelectric plant, tests were carried out to produce granules of rice husk ash, using a disc (machine), which was adjusted to meet the needs during the formation of the granules. The RHA granule consists of a mixture of RHA with cassava starch and glycerol. For the granule mass, a natural binder based on cassava starch and glycerol was used, according to the desired composition of each granule and within the conditions of size, swelling and humidity, once ready, these granules were taken to the oven for drying the same. The results of two batches of rice husk ash obtained from a thermoelectric rice industry have a black color with a texture like a powder, highlighting that the batch of the second ash obtained is finer compared to the first, as shown in Figure 1.

Source: Authors

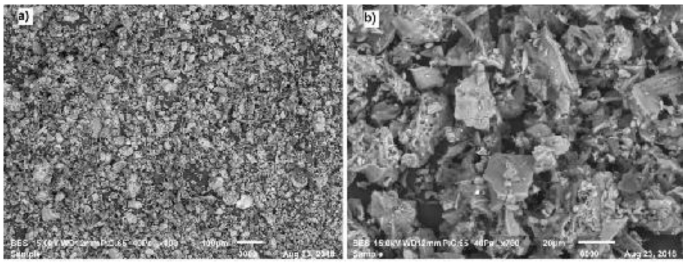
Figure 1. The left of the first batch of RHA and the right of the second batch of RHA

The RHA material from the first batch was passed through a simple 2.4 mm sieve to remove the coarser material (as shown in the first micronized ash) and then subjected the ash to a mechanical grinding process in a ball-mill. The residual RHA used in this work went through a grinding process. The result of ball mill ash grinding in the first batch was a very fine material. The vast majority of RHA grains produced by milling are 40 µm in size, with 60% of the particles having a diameter less than 25 µm. About 15% of the rice husk ash particles are less than 3 µm in diameter. According to Dellaet al. (2001), this can be a problem for the safety of workers involved in a process that uses RHA as a raw material, since the deposition of these particles can cause the silicosis disease that compromises the airways (DELLAet al ., 2001). SEM analyzes of the first and second batch of rice husk ash prove important amounts of silica and potassium. However, the images in figure 2 of the SEM show significant differences in the structures of the first and second rice husk ash. The first ash has well-defined lamellar structures, while the second ash has very fine structures without a defined characterization, possibly because it was very micronized.



Source: Authors

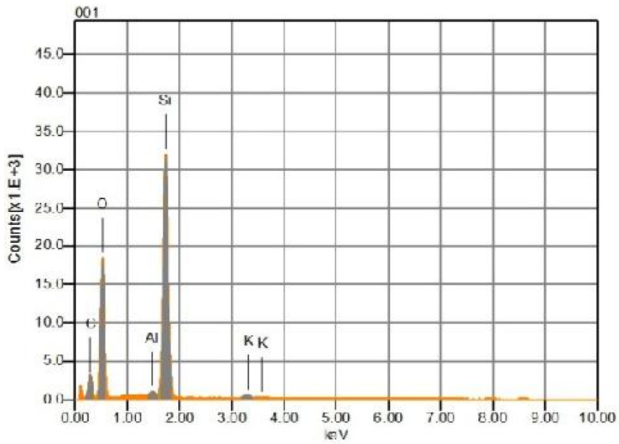
Figure 2. Images produced by Scanning Electron Microscopy (SEM) of samples of rice husk ash from the first batch without the screening and grinding process



Source: Authors

Figure 3. Images produced by Scanning Electron Microscopy (SEM) of samples from the second batch of RHA in its composition enlarged (a) 100 times and (b) 700 times

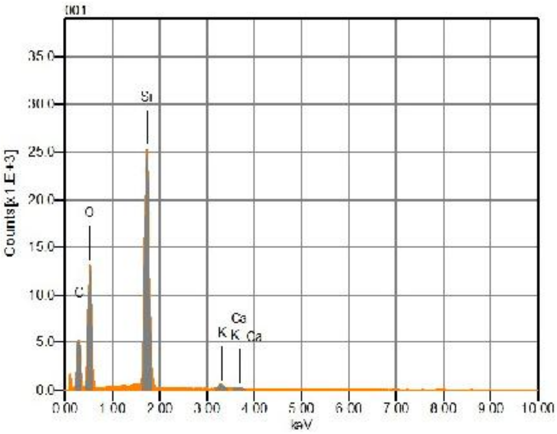
Then, Scanning Electron Microscopy (SEM) in the form of Ray Spectroscopy performed a scan over the total area of Figures 4 and 5, which has a magnification of 700 times, to check the substances that make up these samples.



Source: Authors

Figure 4. Analysis of the components of a sample of the first micronized ash in Scanning Electron Microscopy (SEM) in the form of ray spectroscopy with a magnification of 700 times

In view of Figures 4 and 5, it was observed that the RHA of the second batch has in its composition a small amount of 0.25 g of calcium (Ca) necessary for the soil. However, the first batch of rice husk ash contains 79.05 g of silica in its composition, while the second batch of RHA, because it is more micronized, presented a smaller amount of 69.41 g of silica. The samples of rice husk ash were analyzed in DR-X. These analyzes resulted in diffractograms that indicated the quantity of each component present in the samples. With these diffractograms, the silica is not amorphous, but crystalline. These peaks represent the elements present in the sample. In this case, silicon dioxide. The percentages of cristobalite (87%), tridymite (9.5%) and quartz (3.5%) indicate a high purity of SiO_2 in the samples. Because they are allotropic structures, the presence of these forms can be altered, changing the procedure performed during heating to high temperatures. Quartz is more stable at room temperature. Tridimite and acristobalite are formed by testing at high temperatures.



Source: Authors

Figure 5. Analysis of the components of a sample of the second ash in Scanning Electron Microscopy (SEM) in the form of Ray Spectroscopy with magnification of 700 times

In view of the results presented, the granules from the second batch of rice husk ash (without sieving and grinding) do not present the desired hardness for application in agriculture. Since the granule must withstand pressure of 2.3 kg according to the literature and the granule was considered fragile because it can be crushed with your fingers. This granule of the second rice husk ash was unsatisfactory for its use in agriculture, unlike the granule (from the first rice husk ash) which supported 3.32 kg and remained intact when it was pressed by the fingers. The lots of rice husk ash obtained from the company, have in their composition only beneficial elements without the presence of toxic elements, enabling their use in the methodological proposal of experimentation. However, there is a need to characterize the rice husk ash provided by the company, which manages the RHA residue. It is considered important that the rice husk ash to be granulated first passes through a simple 2.4 mm sieve and subsequently grinds the coarsest material in a ball mill for 60 minutes.

Conclusion

The present article had as a methodological proposal the experimentation in order to make the teaching of Science / Chemistry more pleasant, contextualized and interesting for the student. In order to be able to safely use the residues of rice husk ash alternative materials for teaching Science / Chemistry, physical-chemical analyzes of rice husk ash were performed in Scanning Electron Microscopy and Atomic Absorption of mass. Through the results presented, it can be attested that the granules of rice husk ash have in their composition only beneficial elements without the presence of toxic elements, enabling their use in the methodological proposal of experimentation. The approach to the contents of the Science / Chemistry subjects, as well as others, became possible with the use of alternative materials, whose ease of obtaining and low cost constitutes a differential that makes it possible to approach experimentation even in institutions with few resources. and spaces.

REFERÊNCIAS

Cardoso, S. P.; Colinvaux, D. Explorando a Motivação para EstudarQuímica. Rev. Química Nova, São Paulo, v. 2, n. 23, p. 401-404, 2000.

Ertrand, J. W. M.; Fransoo, J. C. Operations management research methodologies using quantitative modeling. International Journal of Operations & Production Management, v. 22, n. 2, p. 241-264, 2002.

Foletto, E. L.; Hoffmann, R.; Hoffmann, R. S.; Portugal JR., U. L.; JAHN, S. L. Aplicabilidade das cinzas da casca de arroz. Rev.Química Nova, São Paulo, 28, 2005.

Gil, A. C. Como elaborar projetos de pesquisa. 4. ed. São Paulo: Atlas, 2002. Hoffmann, R.; Jahn, S.L.; Bavaresco, M.; SARTORI, T.C. “Aproveitamento da cinza produzida na combustão da casca de arroz: estado da arte.” 2007. Disponível em: <http://www.ufsm.br/cenergia/arte_final.pdf>. Acesso em: maio de 2012.

Hoffmann, Ronaldo. “Método avaliativo da geração regionalizada de energia, em potências Inferiores a 1 MWe, a partir da gestão dos resíduos de biomassa – O caso da casca de arroz”. Tese de doutorado Promec/Ufrgs, Porto Alegre, 195, 1999.

Irga-Instituto Rio Grandense Do Arroz–Safra 2016/2017. Produção Histórica. Disponível em: <http://www.irga.rs.gov.br/ upload/20170724112804 produco_rs_historica.pdf> Acessado em: 25 de Janeiro de 2019.

Moreira, M. A. (2012a). ¿Al final, qué es aprendizaje significativo? Revista Qurriculum, 25; marzo 2012, pp. 29-56. Disponível em: http://www.lume.ufrgs.br/handle/10183/96956.

Moreira, M. A. Aprendizagem Significativa: a teoria e textos complementares. São Paulo. Editora livraria da Física, 2011.

Pretz, Ricardo. “Potencial bioenergético do setor arrozeiro do Rio Grande do Sul: uma abordagem termelétrica”, Tese de Doutorado, Promec/UFRGS, Porto Alegre - RS, 78, 2001.

Quirino, W. F.; Vale, A. T.; Andrade, A. P. A.; Abreu, V. L. S.; Azevedo, A. C. S. Poder calorífico da madeira e de materiais ligno-celulóticos. Revista da Madeira, 89:100-106, 2005.

Rubner, Isabel; Berry, Ashton J.; Grofe, Theodor; Oetken, Marco. Journal of Chemical Education, v96 n2 p248-255 Feb 2019.

Vale, A. T.; Abreu, V. L. S.; Gonçalez, J. C.; Costa, A. F. Estimativa do poder calorífico superior do carvão vegetal de madeiras de Eucalyptusgrandis em função do teor de carbono fixo e do teor de materiais voláteis. Revista Brasil Florestal, 73:47-52, 2002.

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