



The production of ecological soap as a generating theme for the study of organic chemical reactions

A produção de sabão ecológico como tema gerador para o estudo das reações químicas orgânicas

LIMA, Magno de⁽¹⁾; SOARES, Mikael Fabrício de Farias⁽²⁾; SANTOS, Geovana Gonzaga⁽³⁾; SILVA, Rafael Reis⁽⁴⁾; ROCHA, Marcos Oliveira⁽⁵⁾, SANTOS, Aldenir Feitosa dos⁽⁶⁾

⁽¹⁾ 0009-0005-3278-1723; State University of Alagoas (*Universidade Estadual de Alagoas*). Arapiraca, AL, Brazil. Email: magno.lima@alunos.uneal.edu.br.

⁽²⁾ 0009-0009-7047-6438; State University of Alagoas (*Universidade Estadual de Alagoas*). Arapiraca, AL, Brazil. Email: mikael.soares@alunos.uneal.edu.br.

⁽³⁾ 0009-0009-8134-5302; State University of Alagoas (*Universidade Estadual de Alagoas*). Arapiraca, AL, Brazil. Email: geovanagonzaga33@gmail.com

⁽⁴⁾ 0009-0006-4803-5706; State University of Alagoas (*Universidade Estadual de Alagoas*). Arapiraca, AL, Brazil. Email: wesley.reis.2021@alunos.uneal.edu.br.

⁽⁵⁾ 0000-0002-5421-0690; Federal Institute of Alagoas (*Instituto Federal de Alagoas*). Arapiraca, AL, Brazil. Email: marcos.rocha@ifal.edu.br.

⁽⁶⁾ 0000-0001-6049-9446; State University of Alagoas (*Universidade Estadual de Alagoas*). Arapiraca, AL, Brazil. Email: aldenir.santos@uneal.edu.br.

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ABSTRACT

The generating theme covers several issues and problems experienced by the community. Using the generating theme, soap, to teach Chemistry, comes as an additional tool to the teaching of Organic Chemistry, because, alternatively, it is possible to teach respective contents, valuing the scientific and social contexts and taking care of the environment. This work aimed to build scientific knowledge through the chemical reactions involved in the soap production process, providing students with a better understanding of chemical reactions, through the saponification reaction, which was worked on in a theoretical and practical way. This is an exploratory research, with a qualitative approach. This work was carried out between the months of July and October 2023, with 64 students belonging to two classes of the 2nd and 3rd years of high school/technical, the students previous knowledge was analyzed and it was observed that the students did not have an understanding of the content of chemical reactions, after the explanations and the application of the practical class, the students were able to understand each stage of the saponification reaction and how chemistry occurs in the experiment and in their daily lives. The data collection instrument was based on the observation of the researchers during the development of the practical class. Through the data collection instrument, it was possible to observe that 95% of the students approved the practical class, which shows how much the insertion of generating themes in the teaching methodologies of Chemistry contributes to the teaching and learning process of the student.

RESUMO

O tema gerador abrange diversos assuntos e problemas vividos pela comunidade. Utilizar o tema gerador, sabão, para ensinar Química, vem como uma ferramenta a mais ao ensino de Química Orgânica, pois, de forma alternativa pode-se ensinar respectivos conteúdos valorizando os contextos científicos e sociais e cuidando do meio ambiente. Este trabalho teve como objetivo construir conhecimentos científicos através das reações químicas envolvidas no processo de produção de sabão, proporcionando aos estudantes uma melhor compreensão sobre as reações químicas, por meio da reação de saponificação, a qual foi trabalhada de forma teórica e prática. Trata-se de uma pesquisa exploratória, com abordagem qualitativa. Este trabalho foi realizado entre os meses de julho a outubro de 2023, com 64 estudantes pertencentes a duas turmas do 2^o e 3^o anos do ensino médio/técnico, foram analisados os conhecimentos prévios dos estudantes e observado que os alunos não tinham um entendimento do conteúdo de reações químicas, após as explicações e a aplicação da aula prática, os alunos conseguiram compreender cada etapa da reação de saponificação e como a química ocorre no experimento e no seu cotidiano. O instrumento de coleta de dados partiu da observação dos pesquisadores durante o desenvolvimento da aula prática. Através do instrumento de coleta de dados foi possível observar que 95% dos alunos aprovaram a aula prática, isso mostra o quanto a inserção de temas geradores nas metodologias de ensino de Química contribui no processo de ensino e aprendizagem do educando.

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Introduction

The teaching of Chemistry is still often approached in a strictly traditional way in the classroom, being marked by its dull and decontextualized character, making students question the importance of this Science in their lives, since the contents are not worked based on the reality of the students (Alves, 2016).

By questioning whether the teaching-learning process is consistent with the student's reality, Freire (1987) warns us to seek an investigative methodology focused on the use of Generating Themes, or thematic investigation, which involves the search for knowledge and the relationship between man and the world he lives in (Santos *et al.*, 2022).

The generating theme covers several issues and problems experienced by the surrounding community. It involves more than just a problem, but involves an analysis, an apprehension of reality, a dialogue with the students in order to know their perceptions and visions of reality. The use of generating themes in the teaching of Chemistry, especially in Organic Chemistry, has become an essential tool for the teaching-learning process because Chemistry is an experimental science (Both, 2018; Barreto, 2016).

Due to the fact that Organic Chemistry exhibits a gigantic variety of compounds, its study requires great subjectivities and spatial intelligence (Neto & Lima, 2020). For Goodwin (2019), the study of Organic Chemistry enables an abundant territory for the exercise and mastery of the role of illustrative representations in scientific explanation.

Marcondes *et al.* (2015) also consider that Organic Chemistry:

It deals with the classification of the types of chains, classification of the types of carbons, classification of the types of bonds, classification of the types of hydrocarbons, classification of the types of isomery, rules for naming compounds, rules for writing the molecular, structural and trace formulas of organic compounds, etc. [...] Often students spend an entire year training the application of numerous rules to classify, name and formulate organic compounds with very few moments of reflection on content that is actually relevant to citizenship or to the development of the ability to interpret the physical world present in their daily lives and in the media.

The study of Organic Chemistry in basic education needs to provide conditions for students to be able to understand in an improved way, the life of part of the materials that surround them daily (Valentim, 2017).

In this context, the use of generating themes in Organic Chemistry can contribute to students identifying the relationship between theory and practice. The generating theme, ecological soap, helps in the teaching of Organic Chemistry, because, alternatively, it is possible

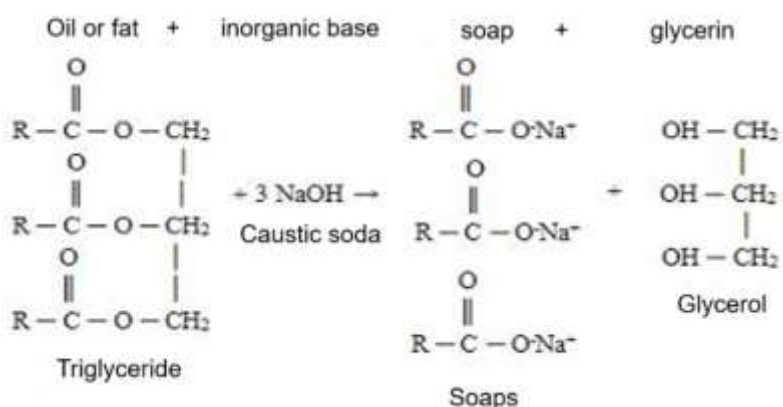
to show the respective contents valuing the scientific and social contexts and taking care of the environment (Conama, 2005).

Soap is an organic salt, its molecule has at least one bond with a typically ionic characteristic, thus making it polar. The polarity, as well as the length of the chain, causes the soap to dissolve into polar and nonpolar substances, and even both simultaneously. It is this characteristic that enables the soap to have a cleaning action (Zago Neto & Del Pino, 2019).

Soap is produced through a chemical reaction between a fatty acid (fats and vegetable or animal oils) with a basic material. Usually, the base used is sodium hydroxide (NaOH), popularly known as caustic soda. When the fat is heated in the presence of sodium hydroxide, a chemical reaction called saponification takes place (Figure 1) (Peruzzo & Canto, 2018). The saponification reaction, in addition to producing soap, also produces glycerol, an organic compound belonging to the group of alcohols.

Figure 1.

Saponification Reaction.



Source: Canto (2016).

Many people produce soap at home and the manufacture of soap supports some families, in addition to avoiding environmental impacts. According to Alberici and Pontes (2015), the manufacture of homemade soap minimizes the amount of frying oil, which is discarded irregularly in the environment. Because soap is a product that is present in the lives of students, and because its manufacture involves simple chemical processes, it can be inserted in Chemistry teaching methodologies (Oliveira, 2019).

In this context, the objective of this work was to build scientific knowledge through the chemical reactions involved in the soap production process, providing students with a better understanding of chemical reactions, through the saponification reaction.

Methodology

Type of research

The present study is characterized as applied research, since it seeks to generate knowledge about organic reactions through the reuse of vegetable oil.

Research location

The research was carried out at the Federal Institute of Alagoas (*Instituto Federal de Alagoas*) - Arapiraca Campus, with 64 students belonging to two classes of the 2nd and 3rd year of high school/technical education.

Procedures

The work was carried out in 4 stages.

Stage 1:

Four classes were taught to the classes on the content of chemical reactions. During the classes, the students previous knowledge was investigated through a questionnaire, as well as a correlation of the content with their daily lives. Soon after, a relationship was made between the content of chemical reactions and the production of ecological soap and the importance of reusing materials that are used at home and that most of the time the destination is garbage. An explanation of the content of chemical reactions was made, as well as the relationship of this content with the production of ecological soap. In addition, a practical class was held with the students, which made it possible to work on the content worked in the theoretical class.

Stage 2:

The students were asked to collect all the frying oil from their residence, which would possibly be discarded in the environment. This stage lasted 2 months and plastic bottles were used for storage.

Stage 3:

The production of ecological soap was carried out, together with the students. The procedure for the production of ecological soap is described below:

First, the caustic soda was dissolved in 500 ml of cold water with the help of a bucket with a capacity of 20 liters; soon after, the lye solution and 1 liter of frying oil were slowly added; this solution was stirred during the period of 30 minutes; sequentially the flavoring essence was added; then, the solution was poured into a plastic container with a lid and left to rest for a period of 24 hours; finally unmold (Teixeira, 2017).

In this practice, the students were instructed never to use aluminum utensils, because caustic soda reacts with metal, they were instructed to always use thick plastic utensils and to be very careful. It must be understood that in order for safety standards to be correctly applied,

it is necessary to understand that each laboratory has individual characteristics. Effective quality control, standardization of technical activities and equipment are factors that must also be taken into account (Del Pino & Kruger, 2019).

Stage 4:

In stage 4, data collection was carried out through the application of a questionnaire, with objective questions, based on the practical class and the preparation of ecological soap, which were related to the evaluation and awareness of the proper use of used cooking oil.

Analysis and presentation of data

The data were analyzed as a percentage and displayed in the form of graphs.

Results

This work was carried out between the months of July and October 2023, with 64 students belonging to two classes of the 2nd and 3rd years of the technical course in electronics at the Federal Institute of Alagoas (*Instituto Federal de Alagoas - Ifal*) - Campus Arapiraca. The students collected 12 liters of used vegetable oil, which would probably be discarded and would harm the environment.

Figure 2 shows the soap production process and figure 3 the soap produced by scholarship students of the Institutional Program of Scholarships for Initiation to Teaching (*Programa Institucional de Bolsas de Iniciação à Docência - PIBID*) - of the Chemistry Degree course, together with Ifal students.

Figure 2.

Making soap from cooking oil.



Source: Survey data (2024).

Figure 3.

Soap made from cooking oil.



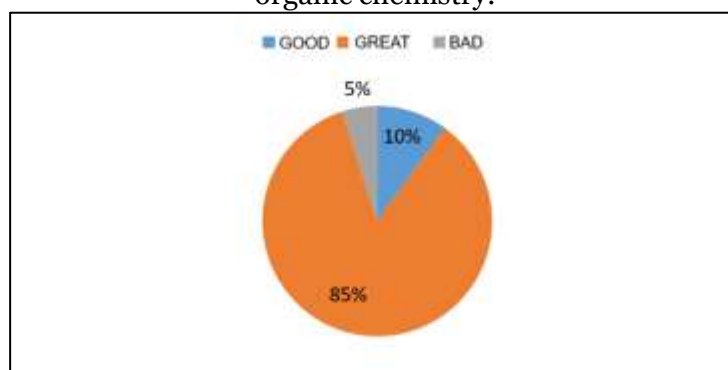
Source: Survey data (2024).

The production of soap aroused interest in the discipline in students, opening possibilities for discussions and investigations that contribute to the enrichment of knowledge based on the student's previous knowledge.

After the practical class, the students answered a questionnaire in order to analyze how they evaluated the practical class of soap production and if they agree that soap production helps to understand the content of chemical reactions. 64 students answered the form and the results are shown in Graphs 1 and 2.

Graph 1.

Students opinion on the contribution of soap to the acquisition of knowledge about organic chemistry.



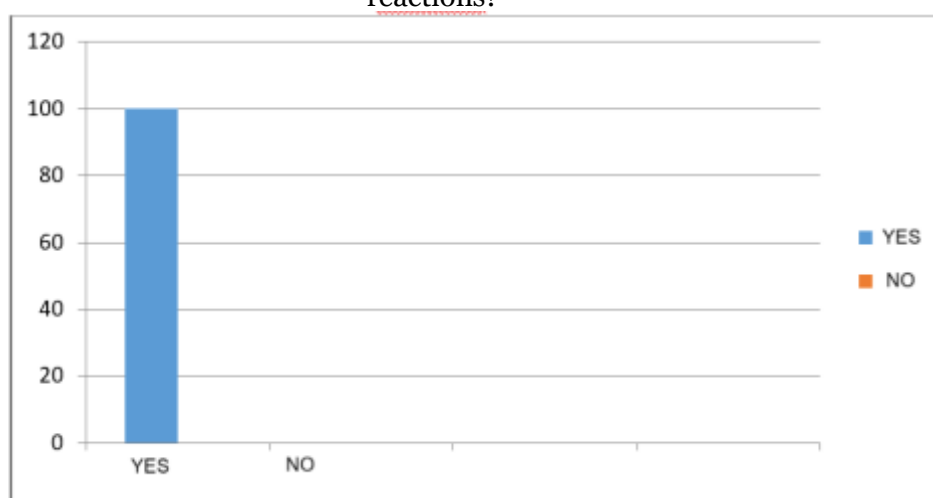
Source: Survey data (2024).

It can be observed in graph 1 that 85% of the students evaluated the practical class of soap production as excellent; 10% of the students pointed it out as good and 5% of the students did not like the class applied.

According to the literature, in the realization of teaching workshops, a more human appreciation is put into practice, in which the teacher needs to be attentive at all times, so that he can identify in each student the concern in wanting to do and commit to the activity and should not classify or compare the actions and results of the students (Vieira & Volquind, 2020).

Graph 2.

Do you agree that soap production helps to understand the content of chemical reactions?



Source: Survey data (2024).

As can be seen in graph 2, all students stated that the production of soap served to have a good understanding of the content of chemical reactions, in relation to the reuse of frying oil for the production of ecological soap (Silva *et al.*, 2024). According to Neto and Del Pino (2016), environmental awareness is a fundamental resource for the transformation of behavior in relation to the environment. To raise awareness is to seek to achieve a predisposition of the community to change its attitudes.

Conclusions

All the activities carried out during the development of this project had the active participation of the students. They were interested in carrying out the proposed tasks and sensitized to the environmental issue involved in the improper disposal of cooking oil in the environment.

According to the results obtained in this work, it can be observed that it is possible to make soap from waste oils, since the recycling of used cooking oil is a viable process, both in economic and environmental terms.

It was also possible to conclude that with the use of soaps developed in practical activity it can provoke a certain curiosity in the students in relation to the content of chemical reaction, based on the formation reaction during the formation of soap through the frying oil.

The students were more curious about the mentioned discipline, since involving the content of chemical reactions, part of organic chemistry is also inserted. As a future suggestion, a more in-depth analysis in order to arouse the student's interest in the discipline and also improve their concepts about the content and the teaching and learning process by the students.

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REFERENCES

- Alves, I. W.; Araújo, L. E. (2016). Reciclagem de óleo de cozinha na transformação de sabão em pedra. *Caderno PDE*, v. 2.
- Alberici, R. M.; Pontes, F. F. F. (2015). Reciclagem de óleo comestível usado através da fabricação de sabão. Espírito Santo do Pinhal: Engenharia Ambiental - Centro Regional Universitário de Espírito Santo do Pinhal, v.1, n.1, p.073 -076.
- Both, L. A. (2018). Química Orgânica no Ensino Médio: na sala de aula e nos livros didáticos. Dissertação (Mestrado em Educação). Universidade Federal de Mato Grosso - UFMT.
- BRASIL. (2013). Ministério da Educação - MEC. Diretrizes curriculares nacionais do ensino médio. Brasília-DF.
- BRASIL. (2019). Parâmetros curriculares nacionais para o ensino médio. Brasília – DF.
- Chassot, A. I. (2019). Química no cotidiano: pressupostos teóricos para a elaboração de material didático alternativo. In: *Espaços da Escola*, Ijuí: Unijuí, 3(10).
- CONAMA (2005). Conselho Nacional do Meio Ambiente. Resolução nº 357. Diário Oficial da República Federativa do Brasil. Brasília, DF.
- Del Pino, J.C.; Krüger, V. (2019). Segurança no laboratório. CECIRS.
- Freire, P. (1987). *Pedagogia do oprimido*. 17. ed. Rio de Janeiro: Paz e Terra, 1987.

- Goodwin, W. (2019). How do Structural Formulas Embody the Theory of Organic Chemistry? *The British Journal for the Philosophy of Science*, Oxford, n. 61, p. 621– 633.
- Lima, J. O. G. (2012). Perspectivas de novas metodologias no Ensino de Química. *Revista Espaço Acadêmico*, Londrina, v. 12, n. 136.
- Marcondes, M. E. R.; Silva, A. E. L.; Torralbo, D.; Akahoshi, L. H.; Carmo, M. P.; Suart, R. C.; Martorano, S. A.; Souza, F. L. (2022). Oficinas Temáticas no Ensino Público visando a Formação Continuada de Professores. São Paulo: Imprensa Oficial do Estado de São Paulo.
- Mortimer, E. F.; Miranda, L. C. (1995). Transformações: concepções de estudantes sobre reações químicas. *Química Nova na Escola*, São Paulo, n. 2, p. 23-26.
- Neto, O. G. Z.; Pino, J. C. D. (2016). *Trabalhando a química dos sabões e detergentes*. Porto Alegre: Universidade Federal do Rio Grande do Sul – UFRGS.
- Peruzzo, F.M.; Canto, E.L. (2021). *Química na abordagem do cotidiano*. 7. ed. São Paulo: Editora Moderna, 2021.
- Vieira, E.; Volquind, L. (2019). *Oficinas de Ensino: o quê, por quê? Como?* 4. ed. Porto Alegre: Edipucrs.
- Neto, O. G. Z.; Pino, J. C. D. (2020). *Trabalhando a química dos sabões e detergentes*. Porto Alegre: Universidade Federal do Rio Grande do Sul - UFRGS.
- Oliveira, R. D. V. L.; Queiroz, G. R. P. C. (2016). O cotidiano, o contextualizado e a Educação em Direitos Humanos: A escolha de um caminho para uma Educação cidadã cosmopolita. In: R. D. V. L. Oliveira; G. R. P. C. Queiroz (org.). *Tecendo diálogos sobre direitos humanos na educação em ciências*. SP: Editora Livraria da Física, p. 63–98.
- Silva, C. L. W. (2013). *Óleo de cozinha usado como ferramenta de educação ambiental para alunos do ensino médio*. 55p. Monografia (Especialização em Educação Ambiental) - Universidade Federal de Santa Maria UFSM - RS.
- Santos, K. M. S. et al. (2021). Avaliando Métricas em Química Verde de Experimentos Adaptados para a Degradação do Corante Amarelo de Tartrazina para Aulas no Ensino Médio. *Revista Química Nova na Escola*, 43(3), 411-417.
- Silva, C. S.; Barbosa, L. S.; Ferreira, N. A.; Borges, C. R.; Pires, D. A. T. Oficina de produção de sabão com óleo usado de cozinha: conscientização ambiental no interior de Goiás. *Revista Tecnia*. 1(1), 119-130.
- Teixeira, A.C. (2017). Educação ambiental: caminho para a sustentabilidade. *Revista brasileira de educação ambiental*. n. 2, p.23 – 31. Brasília - DF.
- Valentim, J. A. (2017). *Extração de óleos essenciais por arraste a vapor: sequência didática para proporcionar aprendizagem de conceitos de Química*. Dissertação (Mestrado em Ensino de Ciências Naturais). Universidade Federal do Mato Grosso - UFMT.