Original Article

Extraction and Saponification of Vegetable Oils: Implication for Science Process Skill Acquisition

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ABSTRACT

In this work, four vegetable oils were extracted and saponified. The oils are groundnut, palm, coconut and palm kernel oils. Various methods of extraction were reviewed and suitable ones adopted for extraction of the named oils. Palm oil was used to produce bar soap, palm kernel oil for the production of toilet soap, groundnut oil for the manufacture of medicated soap and coconut oil for the production of liquid bath [fruit bath]. Coconut and palm kernel oil were found to be of higher saponification values. On the other hand, groundnut and palm oil were more suitable for edible products like margarine. Indeed, the extractions, analysis and synthesis recorded in this work satisfy what was needed by every science educator for the re-orientation of the students in the procedures of synthesis, analysis and general experimental works. The science process skills emphasized at various stages of this work would guide and motivate the science teacher towards the use of the laboratory for scientific investigations, experimentations and practical oriented lessons. From this research work, students can acquire the following science process skills observation, measuring, controlling variables. Classifying, inferring, predicting/hypothesizing, manipulating techniques, number relation, and experimenting not only in the laboratory but in their everyday life. Palm oil was used to produce bar soap, palm kernel, kernel oil for production of toilet soap, grand nut oil for manufacture of medicated soap and coconut oil for the manufacture of liquid bath (liquid soap for batting)

Keywords: Extraction, saponification, science process, skill acquisition, vegetable oils

Introduction

Science teaching is expected to be an experimental experience. One of the principles of science education is to train science teachers who can apply the science process skill which include observing, measuring, experimenting, inferring and interpreting data in developing the scientific and mental skills of the learner. In order to achieve these goals and objectives of science education, various chemical processes and strategies have been employed by science educators in the recent past. Some of the strategies include: field trip, classroom demonstration, hands-on-actives and play-way.

All these notwithstanding, research have indicated that school science teaching is theoretical,

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extremely didactic and teacher-directed, instead of being experimentally based (Akusoba, 2000). The problems contributing to this state of affairs were analysed among other factors to include superficial experimental teaching of science and inadequacy of basic laboratory infrastructure and technical support personnel (Ajayalemi, 2000). As a result of students lack of ability to relate scientific activities to science process skills, it becomes necessary to illustrate implication of science process skills to chemical process of extraction and saponification of selected vegetable oils.

This research work is limited to four oils namely coconut, groundnut, palm and palm kernel oils. The importance of these vegetable oils can never be over emphasized; coconut oil is used in the manufacturing of tooth paste, lip gloss, shaving cream, eczema and stretch mark relief. It is good for cooking and as wound healing. Groundnut oil is a good oil for cooking as it helped to promote good heart, healthy skin, and lowering cholesterol content in the body. It prevents digestive disorder and it is also used for body massage. Palm kernel oil is very important as it contains vitamin K, it is zero cholesterol, it improves hair growth and provide naturally soft skin. Palm oil is extremely useful for cooking because it improves energy level, vision and support healthy pregnancy as it contains vitamin A and E.

Extraction of Palm Oil

Palm oil was extracted through the local boiling, pounding and pressing method. The skill of manipulative technique, observing qualities, measuring quantities, inference, predicting and experimenting was demonstrated. About 20kg of palm fruits were boiled for about one hour. The fruits were then emptied into a big mortar and pounded. The pounded fruits were poured into a big bowel and the nut separated manually. On completion, the fruits were transferred into a big saucepan for frying. After, the fruits were transferred into a hydraulic press, which compressed the pounded fruits to release the palm oil.

This oil was used to produce bar soap, materials used were;

1. Caustic soda [NaOH]
2. Sulphuric acid H_2SO_4
3. Water H_2O
4. Sodium Silicate Na_2SiO_3
5. Perfume
6. Color

Procedures for the Production

5g of caustic soda was dissolved in 1 litre of water for 24 hours. The following day 1 litre of palm oil was added and the solution was turned very well using a wooden stick, 5g of Sodium Silicate was also added and the resulting solution mixed appropraitly.10g sulphuric acid was added and the solution turned, followed by addition of perfume and colour to desired test. The semi-liquid soap was then poured into the researcher-made mould to set.

Extraction of Palm Kernel Oil

About 10kg of palm kernel were crushed by mechanical means. The crushed kernels (palm kernel flakes) were subject to physical or non-solvent extractor and oil released was bright yellow in colour. Process skills of classifying and manipulative techniques, observing qualities, measuring quantity, inference, predicting and experimenting were used. Palm kernel oil was used to produce toilet soap.

Materials Involved **are:**

1. Caustic soda[NaOH]
2.Sodium Silicate[$NaSi_2O_3$].
3. Sulphuric Acid H_2SO_4
4. Glicyceri
5. Glycol
6. Perfume
7. Hardener
8. Colour

Procedure for the Production

The following steps were involved

1. 5g caustic soda was dissolved in 1 litre of water for 24hours.
2. 1 litre of palm kernel oil was added and the solution turned very well.
3. 5g of sodium was also added and the solution mixed appropriately.
4. 10g of sulphuric acid was added and turned.
5. 3g of cicylil and 3g of cilcycol was also added and turned very well.
6. Perfume and colour was also added to desired taste.

7. Hardener was carefully added then the semi-liquid soap was poured into the researcher-made mold to set.

Extraction of Coconut Oil

This was done by solvent extraction method. The solvent for this extraction was warm water. About 10 heads of coconut, with masses ranging from2-4kg each were used. This gave about 10kg of coconut meat. This was washed, sliced and grounded by mechanical means. Here, the skills and of number relations and manipulative technique, observing, measuring quantities, predicting/hypothesizing and experimenting were involved. After grinding, sieving was done manually with a sieve and warm water to extract the coconut milk which contains the oil.

The milk was then placed over flame, followed by evaporation. Evaporation was completed when large quantity of the oil deposits was found separated on the top of water and oil was then decanted. This was directed by the skills of manipulative.

Coconut oil was used to produce fruit bath (liquid soap).

Materials Involved are:

- Texapon
- Glycol
- SLS
- Glyceril
- Sodium chloride
- Perfume
- Formaline
- Pearsiny
- Colour

Procedure for the Production

The following steps were involved;

1. 20g of texapon was dissolved with 10g of sodium chloride.
2. 8g of SLS was dissolved with water in a separate container. Step 1 and 2 were mixed together.
3. 4g Glyceril was also added and turned very well.
4. 4g Glycol was also added and the solutions mixed very well
5. ¼ litre of cocnut oil was added and turned.
6. Formaline was added as a preservative and mixed very well.
7. Perfume and colour was added to desired test.
8. Pearishing was lastly added to enhance the quality of the soap.

Extraction of Groundnut Oil

Frying method of extraction was used. Process skill of manipulative technique, observing qualities, measuring quantities, predicting, inferring and experimenting was dominant. About 20 cups of groundnut was grounded, mixed with warm water and rolled into little balls of about ½ - 1cm diameter. These were fried in a sauce pan. Heating was highly regulated as the groundnut balls release the oil. By careful observation and inference, the process was considered completed when the balls turn dark brown. Groundnut oil was used to produce medicated soap.

Materials Involved were as follows:

- Caustic soda
- Sulphuric acid
- Sodium silicate
- Phenol
- Glicyceril
- Menthol
- Perfume
- Colour
- Hardener

Procedure used:

The following steps were involved in the manufacture of the medicated soap.

1. 1g of caustic soda was dissolved in 1 litre of water.
2. 1 litre of groundnut oil was added and the solution mixed very well.
3. 5g of sodium silicate was also added and mixed.
4. 10g of sulphuric acid was added also and mixed.
5. 3g of Glicyceril was added and mixed.
6. 5g of Phenol as antiseptic was added, also and mixed.
7. 1g of Menthol was added and turned very well so as to have homogeneous mixture.
8. Perfume and colour was added to desired taste
9. Hardener was added, then the semi-liquid soap was poured into small plastic container to set.

Differences between the Different Oils from the Experiment

It was observed that palm kernel oil and coconut oil were of high saponification value, this means that those two oils are very good in the production of soap because their soap lather easily and foam better than the soaps produced using palm oil and groundnut oil. On the other hand, coconut oil is better used for the production of liquid soap because it cannot solidify with caustic soda as the oil is just like parafine oil. Thus, coconut oil cannot be used in the manufacture of solid soap. Groundnut oil and palm oil are best suitable for edible products like margarine and for cooking. Soap manufactured using groundnut oil is not purely solid but semi solid and those produced using palm oil are pure solid but does not lather very well.

Implication of this Work for Science Process Skills Acquisition

Science process skills are that skills that lie under scientific thinking and decision making. Thus, it is important for a science curricular to be rationalized in such a way that it brings in science process skills. Arslan and Tertemize (2004) articulated the science process skills as the developer of science responsibility in pupil's learning that enables easy learning in classes and that supplies the pupils to be active and structure their knowledge, based on this definition, it may be suggested that the science process skills involve means and methods to reach scientific information and thus allow the pupils to think scientifically. Tan and temiz (2003) approached the science process skills as observation, classification, quantification, correlating number and space, forecasting, data recording, data usage and modelling, data interpretation and making inference, determining variables, changing and controlling variables, hypothesizing and testing and experimentation skills.

Indeed, from the initial stage of this work, scientific approach was used, starting from collecting of materials and experimenting. No experiment could take place without involving one or more science process skills at various stages (NERC 2002, STAN 2008). As a result, the implication for the acquisition of these skills by the science teachers and students cannot be over emphasized as it is needed for proper application to ensure high experimental objectivity and validity of outcome. This was supported by Opong (2003) who suggested that anybody who wants science should first acquire these skills which are used to search for scientific knowledge.

For proper laboratory work, the teacher is expected to have a sound knowledge of the science process skills. This is to enable him maintain a leadership role during laboratory or experimental work with the students. There should be enough use of adequate lesson plan, provision of relevant learning experiences and ensured purposeful intended learning outcome.

Conclusion and Recommendations

This work clarified the ambiguous state of the various oils in quality, composition and use. The various methods of extraction were reviewed. The chosen method of extraction of the oils and saponification procedures are current and economical. These oils are all good for saponification, groundnut and palm oils are considered better for edible products. The experimental procedure and reports on the need for practical science teacher remain a source of inspiration and a challenge to the teacher.

Based on this therefore, the researcher recommends the following:

- Since the science process are indispensable in every science activity, there is need for every science teacher to acquaint themselves with the science process skills.
- The science process skills should be integrated into the secondary school curriculum activities.
- Professional quizzes and seminars should be organized for the science students to educate them on laboratory procedures and science process skills, and free leaflets on the above subject should be issued free of charge.
- The government and educational institutions should organize seminars and workshops for practicing science teachers on industrial/laboratory procedures and the importance of science process skills.

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