

Indigenous Process of Coconut Oil Extraction: An Effective Way of Teaching and Learning Separation Techniques in Basic Science

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Abstract:- The need to infuse the indigenous educational practices into the modern scientific practices to enhance science education as well as promoting entrepreneurship education in our basic science classroom cannot be underscored. This paper examines indigenous coconut oil extraction process as a way of teaching and learning separation techniques in basic science classrooms. The practical approaches involved in traditional coconut oil extraction and how it can be used to teach filtration, decantation, evaporation and sedimentation as the main separation techniques in Junior Secondary School (JSS) 3 basic science and technology was well addressed in the paper. In addition, the paper shows how improvisation through indigenous educational practices can be incorporated into the modern scientific practices to inculcate in the learners acquisition of scientific process skills required for technological advancement and sustainable development in line with the revised basic science and technology curriculum.

Keywords:- *Indigenous knowledge, basic science, coconut oil, extraction, separation Techniques.*

I. INTRODUCTION

The indigenous education refers to the system of education that predominates in most of the societies all over the globe before the advent of western education. It is the local knowledge that is unique to a given culture and acquired by local people through the accumulation of experiences, informal experiments, and intimate understanding of the environment in a given culture (Chikaire, Osuagwu, Ihenacho, Oguegbuchulam, Ejiogu-Okereke & Obi, 2012). Indigenous knowledge constitutes the core of community development process such as agriculture, preservation of food, collection and storage of water, animal husbandry and ethnic veterinary medicine. Furthermore, every society whether literate or non-literate has its own unique ways of training her youths (Abah, Mashebe & Denuga, 2015).

McClallum (2012) and Khupe (2014) opined that indigenous knowledge can be meaningfully integrated into western science curriculum to create rich learning experience for our learners. Proper integration of indigenous knowledge system into science teaching activities will greatly assist science teachers and learners to make extensive use of hands-on activities, investigative laboratory activities, open-ended questions, inquiry-oriented

discussion, co-operative learning and in fact performance assessments as pedagogical tools. Within each of these knowledge systems is a body of complementary knowledge and skills which, if appropriately applied and leverage, can serve and strengthen the quality of education experiences for indigenous students (Kaino, 2013). Therefore, cultural background of learners is imperative to planning and teaching science in order to promote acquisition of hands-on and minds-on practical activities. This will make science learning child-centred since most of what they learn through socialization take place within their immediate environment.

The indigenous coconut oil extraction process is one of the indigenous educational practices among coastal communities in Nigeria. Coconut oil is one of the edible oil growing in popularity as a nutritional supplements and functional food in emerging functional food market (Marina, Che Man & Amin, 2009). It is suitable for human consumption in its natural state without refining. The extraction of coconut oil processes harbour some scientific practices of separation techniques which can be used to teach separation of mixtures in JSS 3 basic science and technology classrooms.

Basic science and technology is a fundamental subject that was introduced into the junior school curriculum to serve as bedrock of all science subjects and to provide students with a unified and interrelated perspective on fundamental ideas, concepts and principles in biology, chemistry, physics and other allied subjects (Ajewole, 2010; Erinsho, 2008; Hamzat & Mohammed, 2003).

In selecting the contents of basic science, three major issues shaping the development of nations worldwide and influencing the world of knowledge today were identified. These are globalization, information and communication technology (ICT) and the entrepreneurship education. The thematic approach to content organization was adopted in order to achieve a holistic presentation of basic science concepts and skills to learners. The topics in each theme are spirally sequenced, from simple to complex cutting across the 9-years of basic schooling to sustain the interest of learners and promote meaningful learning and skill development (Nigeria education Research and Development Council (NERDC), 2012). In addition, the curriculum is focused on promoting guided inquiry and activity-based methods of teaching and learning using locally sourced materials in order to enhance students' learning by doing and skills development (Saibu, Shittu, Alaka & Olude, 2017).

Therefore, the teaching of separation techniques in basic science classrooms using the indigenous coconut oil extraction process will help learners develop learning by doing as well as their cognitive and affective skills. Learners will also be exposed to African indigenous knowledge system as a way to apply scientific and technological knowledge and skills to meet contemporary societal needs in terms of education, science and technology, agriculture, health care delivery, biodiversity and national resource management, ecological knowledge, natural disaster management and sustainable development for efficient societal transformation.

II. AN OVERVIEW OF SEPARATION TECHNIQUES

Separation technique is a topic in Basic Science which is taught at JSS 3 level (NERDC, 2012). It involves the separation of components of a mixture of two or more different substances physically combined together and that each constituent of a mixture still retains its individual properties (Effiong & Nkwo, 2012). A method of separation is also any mass transfer process that contains a mixture of substances into two or more distinct product mixtures, at least one of which is enriched in one or more of the mixture's constituents.

Separations are carried out based on differences in chemical properties, or physical properties such as size, shape, mass, density, or chemical affinity between the constituents of a mixture, and are often classified according

to the particular differences they use to achieve the separation. In the case, no single difference can be used to accomplish a desired separation; multiple processes will often be performed in combination to achieve the desired end. Separation makes it possible to study the properties of each individual component separately and use it.

Various separation techniques that are employed in separating mixtures of substances are evaporation, filtration, crystallization, decantation, simple distillation, fractional distillation, chromatography, centrifugation, separation funnel magnetic separation among others (Ababio, 2013). In this context, only the techniques applicable to coconut oil extraction will be examined.

III. PROCESSES INVOLVED IN LOCAL EXTRACTION OF COCONUT OIL

Coconut oil is extracted locally from fresh and mature kernel of the coconut by natural and mechanical means without undertaken chemical treatment and refining procedures therefore, retaining the sensory and functional characteristics of fresh coconut (Mansor, Che Man, Shuhaimi, Abdul Afiq, & Nurul, 2012). This method is called the 'Hot Process' and it has been traditionally used by our forefathers. There is no machinery involved, only simple every day kitchen tools and vessels. Also, no preservatives or additives are added to it. It is coconut oil in its purest form.

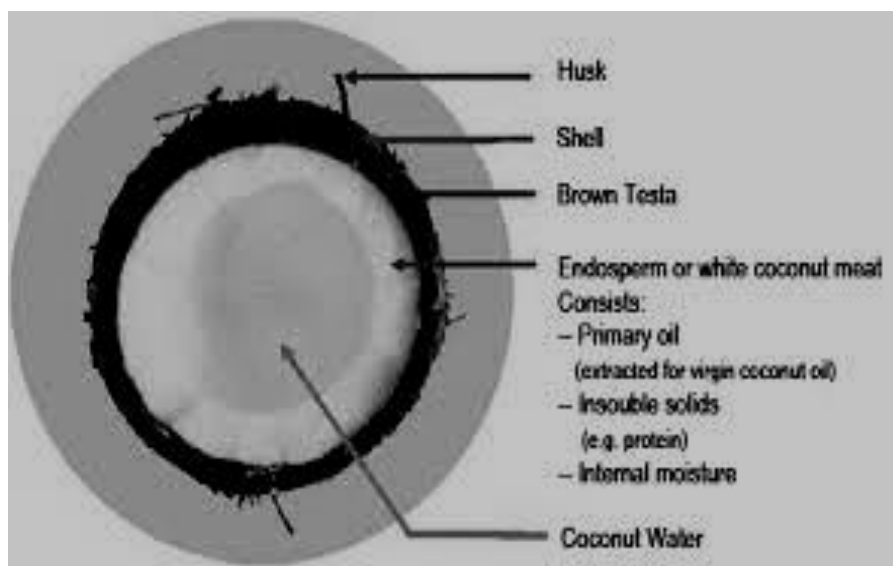


Fig. 1: The coconut fruit. Retrieved on October 22, 2017, from <https://www.feedipedi.org/List of coconut fruits>.

According to Antoniraj (2016) ten ways to extract coconut oil locally from scratch are:

- Collect coconuts: 9 to 10 coconuts will give you 3 liters of coconut milk, from which you can extract approximately 150 grams of coconut oil. 3 to 4 coconuts will give you 1 litre of coconut milk, from which 50 grams of oil can be extracted.
- Remove the husk
- Crack open the coconut: A blunt object like hammer or small axe can be used for breaking the coconut
- Remove and collect coconut meat from the shell using chopping board for cutting the coconut flesh/meat
- Crate/ground the coconut meat using a blender.
- Extract coconut milk by kneading and mixing
- Make a fire place
- Boil the coconut milk
- Extract oil from boiled coconut milk
- Separate pure oil

More so, Sunitha (2017) identified the following steps of local coconut oil extraction.

- Step 1: Extract the flesh from the coconut. Once you have collected the flesh from all the coconuts, grate it.
- Step 2: Extract the coconut milk from the flesh by squeezing it with your hands in a muslin cloth. Keep a bowl below the cloth to collect the liquid. You can add very little hot water to it to make it easy to handle and squeeze out all the milk.
- Step 3: Once the coconut milk has been extracted, sieve it using a muslin cloth to remove any impurities.
- Step 4: Place the coconut milk in a brass vessel and put it on fire. Let it cook for 2 to 3 hours, but make sure the heat is kept low.
- Step 5: Keep stirring it every now and then till the milk becomes brownish in colour. However, be careful that it doesn't burn as coconut milk has a very delicate texture.
- Step 6: Once the milk becomes concentrated, remove it from the fire and let it cool down. Place the cooled thickened milk in a muslin cloth and squeeze out the oil. Collect it in a bowl and then store it in a can or a plastic bottle.

IV. TEACHING AND LEARNING SEPARATION TECHNIQUES USING LOCAL COCONUT OIL EXTRACTION PROCESSES

The extraction of coconut oil processes elucidated above can be applied to teach and learn filtration, decantation, sedimentation and evaporation techniques of separation of mixtures in basic science classrooms. Consider the following extraction process and corresponding separation techniques.

- The grated and grounded coconut meat seed is collected in a clean Muslin cloth or sometime, well meshed or knitted local basket, water added, and mixed, kneaded and squeezed to release the coconut milk. This drains through the cloth or basket that has been placed on top of wooden plank with collecting basin underneath. As the grated coconut is mixed it is squeezed to release the milk which collects in the basin below. This process is filtration.

Filtration is a separation technique that is used to separate insoluble solid particle from a liquid. A porous material like filter paper or white cloth is used to carry out this process. Here, the milk is the filtrate which is needed and used for further processing (Effiong&Nkwo, 2012).



Fig. 2: Mixing of grounded coconut meat with water.

Retrieved on October 22, 2017, from

<https://www.google.com/process+in+coconut+oil+extraction>



Fig. 3: Filtration of grounded coconut meat with water.

Retrieved on October 22, 2017, from

<https://www.google.com/filtration+process+in+coconut+oil+extraction>

- The next stage is that the milk (filtrate) that drained in the basin below is a mixture of milk and water used to wash the grounded coconut. This mixture is left overnight for 24 hours. This allow for the milk to float on the surface to be decanted off to separate the milk from water. At times, local oil producers set fire on top of the milk using coconut husk and disuse metal containers (containing the fire source). The heat transmits to the milk, thereby forming thick viscous layer with partial oil formation. The process applied in the above is *decantation method*.
- This oil, layer is carefully decanted off leaving water.
- The separation technique applied in the above is *decantation method*

Decantation is a separation of mixture technique in which supernatant liquid is separated from solid sediment.



Fig. 4: Showing the floated coconut milk for decantation.

Retrieved on October 22, 2017, from

<https://www.google.com/process+in+coconut+oil+extraction>

- The decanted partial oil is placed in a flat/ heating pan, thus starting the process of heating to evaporation to remove any water. This heating to evaporation is done with continuous stirring for 1-2hrs.

This ensures all water is removed and the fragrance of the oil can be felt around. This is evaporation which is a separation of mixture technique used to recover a solid solute from solution and in this process the solvent is usually sacrificed.



Fig. 4: Showing the evaporation of the coconut milk.

Retrieved on October 22, 2017, from

<https://www.google.com/evaporation+process+in+coconut+oil+extraction>

- The coconut oil is poured into muslin or basket well knitted to filter soft sediment from the pure oil. This is called sedimentation.

Sedimentation is a separation technique use to remove solid suspension from a liquid.

- The filtered oil is the pure virgin coconut oil. It is allowed to cool for few hours before bottling for sale or use.

Meanwhile, the soft sediment can be re- squeezed and kneaded with water to release more oil with water. The oil is

filtered from the surface and heat to evaporate to release more oil. Some of the sediments can be used for confectionaries like sweet, toffee candy and so on.



Fig. 4: Showing the bottled coconut oil after extraction.

Retrieved on October 22, 2017, from

<https://www.blog.allnigeriarecies.com/coconut-oil>

V. CONCLUSION

The opinion expressed in this paper revealed that using indigenous knowledge system to support the teaching and learning of concepts in basic science classrooms will not only foster creativity in learners but also exposed them to ways of using locally available materials to enhance and facilitate learning of scientific concepts. When learners are involved and allowed to participate in these processes, it will not only enhance their acquisition of science process skills but also promote entrepreneurship education for self reliance and sustainability.

VI. RECOMMENDATIONS

The researchers made the following recommendations.

- Government should allow the use of indigenous language as medium of instruction in science classrooms for meaningful learning of concepts.
- Demonstration activities that will stimulate students' critical thinking and problem solving abilities especially, one that involve the use local materials in the conceptualization or concretization of concepts and processes related topics should be included in the basic science curriculum
- Basic Science teachers should be given the opportunity to develop themselves professionally through regular attendance of workshops, seminars and conferences to update their teaching practice and skills necessary to meet up with the curriculum demand.
- Government should provide more classrooms and well equipped laboratories in each secondary school in order to engage students in regular hands-on and minds-on practical activities.
- There should be infusion of entrepreneurial skills in the basic science curriculum at junior secondary level for self reliance towards sustainable development.

REFERENCES

- [1.] Ababio, O.Y. (2013). *New School Chemistry for Senior Secondary Schools (6th ed.)*. Onitsha: Africana First Publishers Limited.
- [2.] Abah, J., Mashebe, P. & Denuga, D.D. (2015). Prospects of integrating African indigenous knowledge systems into teaching of science in Africans. *American Journal of Educational Research*, 3(6), 668-673.
- [3.] Ajewole, G.A. (2010). *History and Philosophy of Science and Science Teaching*. Lagos: Raytel Communications Ltd.
- [4.] Antoniraj, O. (2017). *10 Steps to Make Coconut Oil*. <http://www.instructables.com/id/How-To-Make-Coconut-Oil-From-Scratch>. (Accessed September 16, 2017)
- [5.] Chikaire, J., Osuagwu, C.O., Ihenacho, R.A., Oguegbuchulam, M.N., Ejiogu-Okereke, N., & Obi, K.U. (2012). Indigenous knowledge system: The need for reform and the way forward. *Global Advanced Research Journal of Agricultural Science*, 1(8), 201-209.
- [6.] Effiong, U.U. & Nkwo, N.I. (2012). *Basic Science for Junior Secondary Schools Book 3*. Lagos: Tanus Books Limited.
- [7.] Erinosh, S.Y. (2008). *Teaching Science in Secondary Schools. A Methodological Handbook*. Lagos: Africana Culture International Centre.
- [8.] Hamza, F.M. and Mohammed, G.O (2013). Problems of Realization of Integrated Science Objectives in Nigerian Secondary Schools. *The Nigerian Journal of Educational Review*, 6 (6), 98.
- [9.] Kaino, L.M. (2013). Traditional knowledge in curricula designs; embracing indigenous mathematics in classroom instruction. *Sud Tribes Tribals*, 11(1), 83-88.
- [10.] Khupe, C. (2014). *Indigenous knowledge and school science: Possibility for integration*. A P.hD Thesis, University of the Witwatersrand, Johannesburg.
- [11.] Marina, A.M., Che Man, Y.B., & Amin, I. (2009). Virgin coconut oil: Emerging functional food oil. *Trends in Food Science and Technology*, 20(10), 482-487.
- [12.] McCallium, D. (2012). Working effectively with indigenous people. www.https.googleweblight.com (Accessed September 16, 2017)
- [13.] Mansor T.S.T., Che Man, Y.B., Shuhaimi, M., Abdul Afiq, M.J. & Nurul, F.K.M. (2012).
- [14.] Psychochemical properties of virgin coconut oil extracted from different processing methods. *International Food Research Journal*, 19 (3), 837-845.
- [15.] Nigeria Education Research and Development Council (2012). *9 - Year Basic Education Curriculum and Basic science and Technology*. Lagos: NERDC Printing Press.
- [16.] Saibu, S.O., Shittu, A.O., Alaka, M.O. & Olude, A.S. (2017). Students' perception about the need for curriculum reform in basic science education for sustainable development in Nigeria. *Science Education: Panacea to Combating Global Economic Recession, Climatic Change and Environmental Degradation*, 2(1), 102-109.
- [17.] Sunitha, C. (2017). How to Make Pure Coconut Oil at Home Free of Preservatives and Chemicals. <http://food.ndtv.com/food-drinks/how-to-make-pure-coconut-oil-at-home-free-of-preservatives-and-chemicals-1718029>