CHEMISTRY IN INDIGENOUS AFRICAN KNOWLEDGE AND TRADITIONAL PRACTICES[1]: REFLECTIONS ON A PERSONAL EXPERIENCE

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Note from the Editor-in-Chief

After office hours during a joint official mission out of our respective duty stations, my colleague Florence and I were talking about our past (mainly school time) experiences. Although I knew that Florence studied Chemistry in her country Uganda, I was impressed by the kind of personal experiences at home that led her to study Chemistry. I thus asked her to put those valuable experiences in writing so that I publish it in the AJCE.

Enjoy reading the essay below from her that combines Chemistry, women and indigenous knowledge and experiences in Africa. I also invite you to send your thoughts, reflections, research works and experiences in indigenous knowledge and Chemistry education in Africa [AJCE, 2(3), July 2012).

INTRODUCTION

The article you are about to read is a contribution to reflections on difficulties to interest and attract young people to study chemistry in post primary education. Through the story of my childhood experiences with my aunt I have attempted to answer the question ***"why did you choose to study chemistry in high school and university?"*** The article illustrates the importance

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of participatory learning, progression from the simple to the complex, the relevance and use of chemistry in life, the role of the adult as teacher, educator, and facilitator of learning, reference book for indigenous knowledge and use of chemistry in economic, social and cultural life.

My discovery of chemistry dates back to my childhood and it relates to its use in daily life in the context of indigenous knowledge and its application. Ever since this discovery chemistry has been my best friend a much treasured souvenir from my early childhood past. Chemistry was not an abstract idea to me, rather a practice, knowledge about doing certain things, skills and attitude that includes observing things and reporting with accuracy what has been seen or felt as applied to real life situations. Doing it right led to earning money! I learned this definition of chemistry through the practices of my late aunt Ruzina, at the ages of 8-10 years before I joined secondary school, where I was formerly introduced to chemistry, consolidated my hence-on experiences and furthering my theoretical knowledge and discoveries in chemistry during my University studies, thus moving from real life chemistry to the abstract!

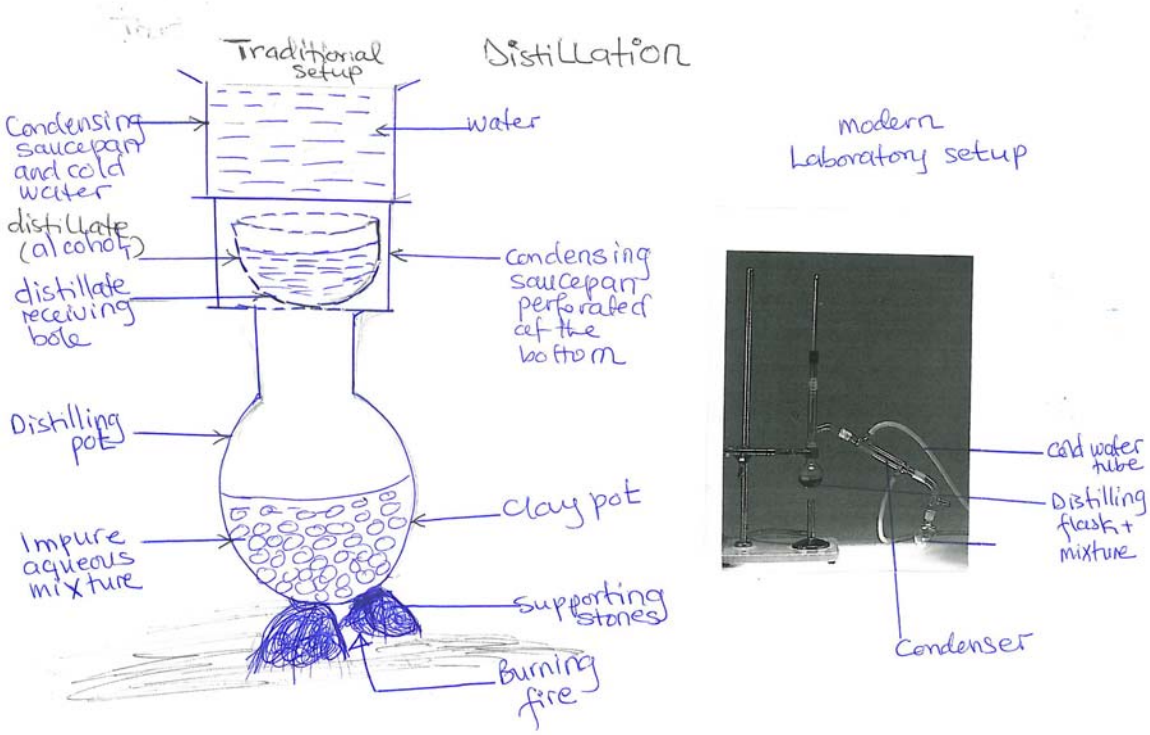
I vividly recall my first encounter with chemistry, it was in real life, participating in doing concrete things with my aunt Ruzina, an ordinary woman whose level of education was lower secondary (seven years of basic education). My first chemistry lessons were not in a classroom with a trained teacher. My aunt who never studied chemistry used it in her life to generate income and entertain social gatherings. She was a practical person, knowledgeable and patient educator, later becoming my role model. A non-alcohol drinker but she brewed the best *waragi* (the traditional alcohol); whose quality she controlled through burning small samples while the distillate was still very hot. To date she is remembered by the community as the best *waragi supplier at* social events (weddings, funerals and reconciliation ceremonies).

I was a curious child, full of questions yet she provided answers to my numerous questions, to me was extraordinary, the way she assembled her distillery intrigued me and further nourished my curiosity. I spent most of my early childhood years with my aunt, watching her in action, and obeying her orders. I was the young apprentice, she was the teacher.

The process of distillation of the alcohol, *waragi* from fermented "spoiled brown sour porridge" consisted of several steps. Step 1: Grinding into flour dried corn (maize); Step2:, Mingling the flour with a measured quantity of clean drinking water; Step 3: Fermentation for three weeks of the mixture in a big saucepan (100l); Step4: Drying in the sun of the fermented paste; Step5: Baking or grilling the semi-dried fermented flour over the fire in a big half-open pot; Step 6: Grinding of some dried germinated millet grains on a grinding stone to serve as yeast (catalyst); Step 7: Reaction: The baked paste is cooled, transferred into the reaction pot, the yeast is added to the pot and the pot is filled with clean drinking water. The reaction pot is placed in a corner of the kitchen near the traditional stove, the family cooking fire place, to ensure a regular warm temperature required for optimum action of the yeast (the catalyst). After 2 days the brown aqueous mixture tastes like sour porridge and may be drunk as such. Some adults preferred to drink this form of sour porridge, this serves as mid-reaction quality control testing. On the fifth day of the reaction, no more foam is observed. The yeast (catalyst) is exhausted and has become inactive, the mixture is considered ready for distillation.

Step8: Distillation phase, the equipment (see diagram below) consisted of a big boiling pot, an aluminum saucepan (30cm) is filled with cold water and placed on top of another aluminum saucepan (30cm) but porous (bearing several holes) at the bottom holding a clay bole, the distillate collector. The porous saucepan is placed on top of the pot half-filled with the brown

aqueous boiling mixture. The pot is supported by three big stones, making the traditional stove, fed with fire from burning wood and twigs.



My job was to watch-over the setup; ensure that the fire burned in a regular manner to maintain a consistent temperature. The liquids in the boiling mixture reached boiling points at different temperatures, the evaporated liquid passed through the fine holes in the saucepan above and condensation was facilitated by the cold water in the second saucepan. The distillate was collected in the bole placed in the porous saucepan. Whenever the water in the condenser was hot, it was replaced by cold water and after three rounds, the setup was dismantled. The distillate bole was removed, the residue was removed and the boiling pot cleaned and a new aqueous mixture was poured into the boiling pot.

Step 9: Quality control: The distillate, while still very hot would be tested for quality. It was fascinating to watch my aunt pour a small portion of the distillate into a tiny clay bole, hold a burning match stick over the distillate. When it burned with a blue flame, she decided it was very good distillate (30-35%), and when it burned with a weak yellowish flame she said it was weak (15-20%), and she would either serve it free to relatives and friends or pour it back into the boiling pot. This was her quality control measure.

Step 10: Storage: The cooled distillate, the alcohol (waragi) would fill 3-4 clean bottles (75ml), ready for sale! Stronger the alcohol, on that burns with blue flames higher the price and the weaker the alcohol (burns with yellow flames) lower its price (half the price of the stronger). Then Step 8 to 10 is repeated until all the aqueous mixture is distilled.

The key chemical terms and concepts described are *distillation,* the separation of liquid mixture into its components on the basis of difference in boiling points. *Heat of condensation,* (expressed in kJ/mole), is the amount of heat that must be removed from a specific amount of vapor at its condensation point to condense the vapor with no change in temperature. This is the heat that heats up the cold water in the first saucepan in the traditional distillation setup. *Condensation* is the liquefaction of vapor/steam, which makes it possible to collect the distillate in the bole placed in the second porous saucepan in the traditional distillation setup and *evaporation* is the process of vaporization of a liquid, which makes it possible for the vapor or steam to pass through the fine holes in the second saucepan and condense into the distillate collector[2].

[2] *Sources and for further reading refer to:*
General Chemistry, 5th edition
Kenneth Witten, Raymond Davis, M. Larry Peck
Saunders College Publishing, 1996

IS THIS 'CHEMISTRY IN INDIGENOUS KNOWLEDGE' OR 'INDIGENOUS KNOWLEDGE IN CHEMISTRY'?

Whatever your answer, I later discovered that my aunt was a chemist, she used scientific knowledge inherited through her own mother from foremothers for generations. Without any prophesy she introduced me to my future profession, a contemporary chemistry teacher. When she wanted to teach me a trade, brewer of waragi for sale to earn a living, she increased my intellectual curiosity and the desire to study chemistry, investigate the continuum in knowledge-natural sciences, social and human sciences, and culture, economic and micro-finance. My aunt relied on chemistry in real life, applied general chemistry. Her knowledge and use of chemistry in daily life was part of her cultural intangible heritage, a traditional practice inherited from mother to daughter, which mean only women had the knowledge and skills to brew and distil alcohol, including for sale. Girls from her part of the world were initiated to the chemistry of brewing before marriage so that they would be financially independent from their husbands and be able to support their family.

My aunt had no problems answering my many questions, standing up to my curiosity as she believed she was teaching me a trade, how to make my own money when I grew up. Instead she initiated me to the study of chemistry, laying the foundations of my choice and study of chemistry and degree in Bachelor of Science in chemistry and biochemistry. I watched and participated in the practical exercises (experiments) conducted by my aunt in her kitchen with much pleasure, later practical classes of chemistry in the University were fun, I would enjoy my several hours in the chemistry laboratory conducting experiments, patiently observing, touching, feeling, smelling and reporting as accurately as possible.

As described above, in the 1970s I observed the use of fundamental chemical principles of fermentation, distillation, evaporation, condensation, heat transfer, cooling and collecting distillate, precautions and quality control as part of her indigenous knowledge, as inherited from my grandmother, from their foremothers. Likewise, I did my apprenticeship with my aunt. I watch her in action, imitated her, observed with fascination the display of skills of observation, discipline, precaution, attention, concentration and remedying and correction measures. At the age of 12 years I had memorized the process of distillation, the several steps that described preparation, reaction, distillation and post-distillation.

By the time I went to secondary school, I was motivated and interested in studying a subject that would help me to better understand and explain observations of scientific phenomenon made during my childhood and wanted opportunities to further the practices of my aunt based on indigenous knowledge. I was lucky to be able to study, be formally introduced to secondary education chemistry in year one, it was compulsory to study chemistry, physics, mathematics, geography and history, considered to be core subjects in the education system of Uganda in the 1970s. In the third year, students were invited to choose three science subjects, including biology, mathematics, and physical sciences (chemistry and physics) (science option) or history, geography and literature (arts option). I chose the science option, and studied physical sciences, biology and mathematics and at university level, chose to major in Chemistry, bio-chemistry. I was very happy, as I had wanted to study and understand sufficiently the theories and principles of distillation, evaporation, condensation, heat transfer through the evaporation-condensation process in order to teach it to others, interest other girls to study chemistry and bio-chemistry and I hope I have convinced you that chemistry is part of daily life and not something abstract.

Thus the reputation of chemistry as difficult among young people, its characterization "character assassination" as abstract or removed from real life are false. They may relate to difficulties in teaching due poor preparation of the teacher, inappropriate curriculum, absence of user-friendly instructional materials, outdated facilities and equipment for practical classes, theoretical teaching-learning processes, stereotyping and cultural prejudices, low budget allocation for pedagogical innovations and for ongoing research.

My knowledge and experiences have revealed to me that there is chemistry use in indigenous traditional knowledge as well as in modern scientific knowledge. Chemistry is interesting and made easy when teaching-learning processes are participatory, when teachers and learners are co-creators of knowledge, observe, record and explain what is observed together. When through research, investigation and discussion young students acquire scientific culture, provide answers to traditional practices in their community, such as how the traditional bread bakery works, why the traditional stove located eastwards or westwards near the kitchen door, why pawpaw leaves are used to wrap fresh meat where there is no refrigerator, why boiled drinking water is kept covered in a porous clay pot, why hand wash with ashes is effective in killing germs and why drink strong alcohol after eating raw meat?

Is the relation between indigenous and modern not a continuum in knowledge?