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Review Article

Chemistry Education for Life and Service to Humanity: Panacea for Wealth Creation and National Development in Nigeria.

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ABSTRACT: *Chemistry Education is indispensable in achieving Scientific and Technological Development of any nation. It is an aspect of Science Education which deals with the study of the composition of substances, energy contents of substances as well as the changes in the energies of substances undergoing transformations to other things, or in the course of their interactions with other substances. This paper focused on the role of chemistry in nation building and service to humanity, especially: career choice in agriculture, health, engineering, education, transportation, industries, among others. The factors that affect the effective implementation of Chemistry Education Curriculum were also treated and the remedies were also highlighted. Furthermore, the paper made the following recommendations. The States and Federal Governments should increase the budgetary allocation in education, curriculum developers and chemistry teachers should work cooperatively to produce Functional Chemistry Curriculum, Chemistry teachers should be exposed to in-service training, conferences, seminars and workshops, to update their knowledge on the current pedagogy in chemistry teaching and learning, among others.*

KEYWORDS: *Creation, Development, Education, Humanity, Life, Wealth*

I. INTRODUCTION

Chemistry is the scientific study of the composition, properties and reactions of chemical elements and their compounds [1]. Chemistry is a branch of pure science, which deals with the composition, properties and uses of matter [2]. It studies the principles controlling the reactions and the changes which matter undergoes. The study of chemistry also includes man's attempt to transform the natural world in order to benefit from nature's complexities and hidden resources [3].

Chemistry is a branch of science which deals with the study of the nature, composition and properties of matter and the changes matter will undergo under difference conditions [4]. Chemistry is the queen of the Sciences; that it is the subject that goes down to investigate the basic properties of substances in the physical universe [5]. All other branches of science borrow some knowledge or concepts from chemistry to interpret their principles or working mechanism [6].

The environment in which we live is made up of Matter; Chemistry therefore deals with the study of our environment and explaining things that are happening in the environment. Based on the characteristics of matter and the reactions in which they undergo, we can classify chemistry into three: 1. **Inorganic chemistry:** This deals with the study of matter in our environment which are non-living 2. **Organic chemistry:** This deals with the study of matter found in living things both plants and animals. 3. **Physical chemistry:** This deals with the study of energy changes accompanying transformation of matter. The three reasons why we should study chemistry are [7]:

(a) To discover as much as we can about the behaviour of different kinds of matter.
(b) To find out the reasons for this behaviour and so obtain a deeper understanding of its nature.
(c) To put this knowledge gained into practical use that would lead to the development of man and his environment.

II. IMPORTANCE OF CHEMISTRY IN OUR EVERYDAY LIFE

For any meaningful scientific development to take place, the learner must learn the acceptable values and the understanding of basic environmental principles. Chemical principles should be to understand nature in order to

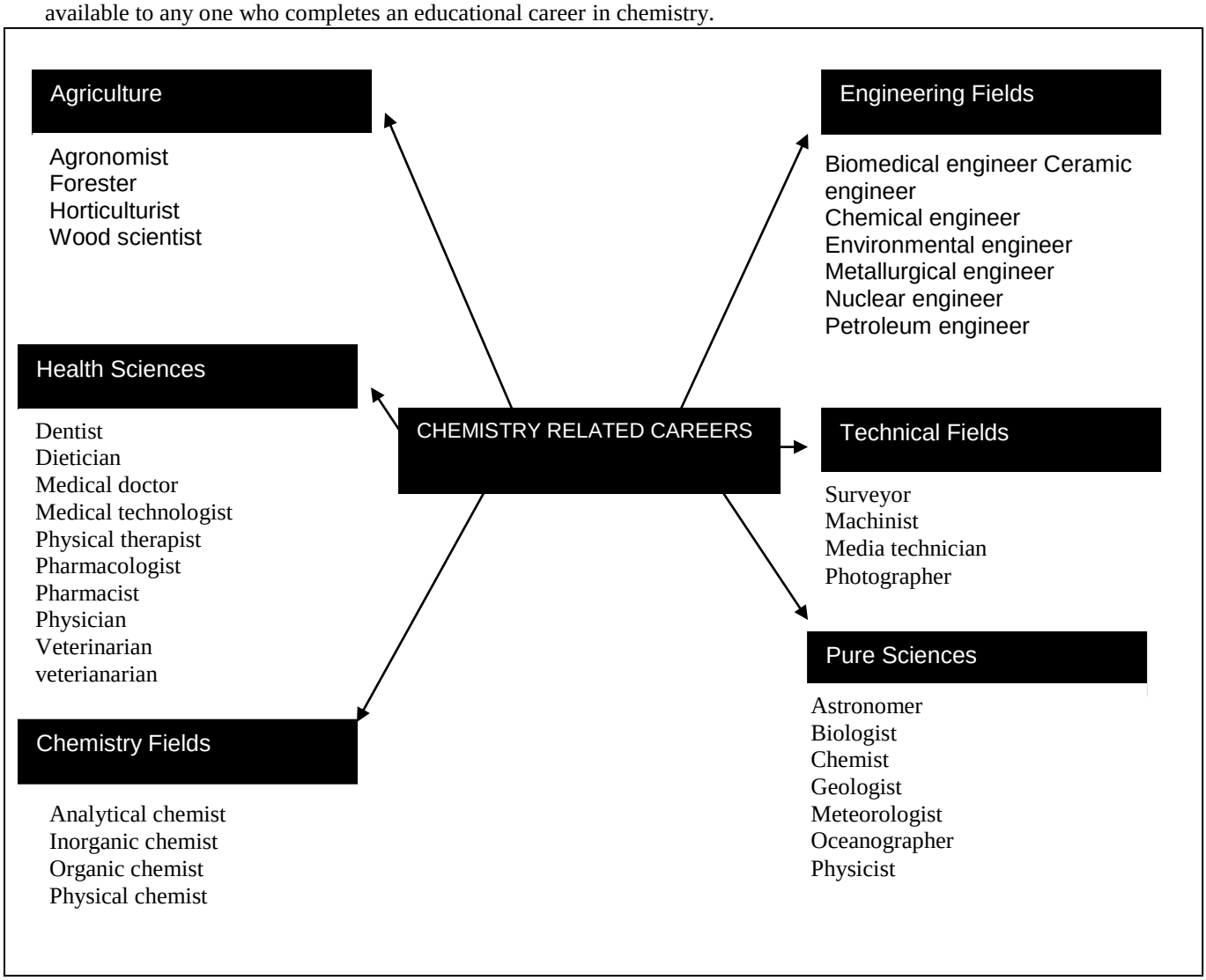
change it and make it better to serve human society; and also ensure that no damage is done to nature's delicate balance. Chemistry has contributed immensely in improving the quality of life we live. It seeks to serve man and his society in several ways; be it in the environment, at home, agriculture, industry, transportation, career choice among others.

2.1 Chemistry and Our Environment

There are two substances in our physical environment which are of great importance to all living things [8]. These two essential substances are Air and Water. Both air and water are essential for life. It is generally believed that human beings can live for about five minutes without air and about seven days without fresh water. Chemists claim that air and water constitute sources of raw materials for many chemicals processes. For instance, Oxygen and Nitrogen support combustion while water is widely used as a universal solvent. Technologically water is used to produce steam in a variety of power plants and is also used for cooling and cleaning. On a large scale, the oceans serve as a storehouse for a variety of minerals such as magnesium, calcium, pearls, among others. These mineral resources when processed industrially create wealth for man.

2.2 Chemistry-Related Careers

The study of chemistry should lead the students to those careers which are useful to the community and at the same time marketable. Chemistry is at the centre of the study of science; and because of this chemistry can groom students to many careers [9]. The table below summarizes the different types of career opportunities available to any one who completes an educational career in chemistry.



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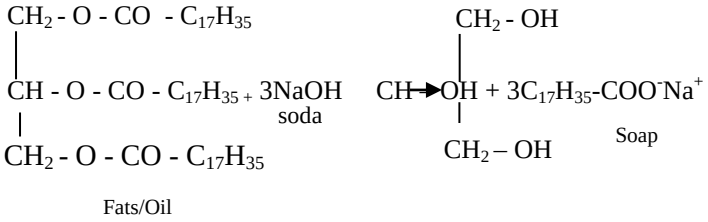
III. HOME CHEMISTRY

The home or house which we live in is made up of many chemical substances, examples, the zinc, cement, nail, toiletry materials are products of chemistry. The tooth-paste we use in brushing our teeth is a mixture of chemicals mainly some soluble inorganic salts. The brush may even be made of nylon. The toilet paper we use is made from wood and the toilet soap we use in washing our hand and other kitchen utensils is obtained from saponification process of fats and oils and Alkaliki (sodium hydroxide or potassium hydroxide). Example:



(1)

Esters which are the products of the reaction between an organic acid and an organic base are used,

- in flavouring essences and in perfumes'
- as solvents for substances like paints, nail varnishers and cellulose

The basic raw materials used for soap making in our homes are empty palm bunches, cocoa, plantain and kola nut peels burnt to ashes as alkalis and inedible palm oil (fibre oil). The resultant grayish substance from the mixture of heated alkali and fibre oil is the native (black) soap which is used in many homes for washing.

The water used in our homes for both drinking and other domestic purposes is purified by some chemical processes such as filtration, chlorination and sedimentation. Even by the process of cooking we have to transform the chemical substances in food items into another form suitable for human consumption.

3.1 Chemistry in Agriculture

Research in chemistry has led to the manufacture of different kinds of fertilizers suitable for specific kinds of crops.

This has led to increased food production and production of raw materials for different kinds of industries. Chemistry has produced many preservatives for wood, foods, etc. and pesticides for controlling rats, insects and other pests.

The United States dominance in Agricultural production is attributable to her leading position in the use of fertilizers, pesticides, herbicides and related agricultural chemicals. Infact, food is one of the most basic needs of all human beings. Therefore for any nation to be self-sufficient in food production, the use of agricultural chemicals is very necessary.

3.2 Chemistry in Medicine

Maintenance of good health is very important to mankind. Research in chemistry has made it possible for the production of many kinds of effective drugs for the treatment of different types of ailments. Studies into the properties of matter have led to the manufacture of optical instruments like the microscope used for the study of micro-organisms too small to be seen by the naked eye.

3.3 Building Construction

Shelter is one of the basic needs of human beings. Chemistry has contributed much in the production of building materials like Cement, Iron Rods, roofing sheets and many others. These materials which are products of research in chemistry enable human kind to build strong houses, high rise houses and special houses that are resistant to excessive heat and excessive cold.

3.4 Chemistry in Textile Production

Chemical research has made it possible to produce a wide range of synthetic fibers used for clothing. Ryon, nylon, and polyester are examples of synthetic fibre materials that are used in the manufacture of clothes.

3.5 Petroleum and Chemical Industries

The knowledge of chemistry is necessary in the chemically/petroleum industry. Such processes as cracking, distillation, extraction and chemical analysis all help to produce useful products of petroleum which include different types of fuels used in engines and for domestic purpose and petrol-chemicals. Chemistry and chemical technology are among the disciplines essential for national development [10].

3.6 Transportation

Transportation has developed rapidly due to the efforts of chemists who discovered different types of cheap fuels at different historical periods. All the means of transportation depend on petroleum products such as petrol, used in most cars, motorcycles and some trucks, diesel used in some cars and most large trucks and buses and ships, etc. kerosene used as fuel for jet engines, earth-Moving tractors, etc. Chemical research has also led to the production of asphalt and bitumen used for road surfacing.

3.7 Polymer Chemistry and Plastics

Research in chemistry has led to the production of plastics of different types for different uses. Plastics are used in the construction industry, furniture production, packaging of manufactured goods, electrical insulation and domestic wares such as buckets, baskets, cups, combs, among others.

3.8 Basic Educational Materials Production

Chemical research has produced paper of all kinds for writing and publishing. Ink of different colours; for writing and printing and chalk for teaching. These are very essential for book production and education generally.

3.9 Negative Effects of Chemistry

Many things made by man have advantages and also disadvantages. Chemical research activities lead to production of resources that improve the quality of life. At the same time, there are negative or adverse effects which tend to affect human beings and the environment badly. Some of these adverse or negative effects according to the Science Teachers Association of Nigeria [11] are: Drug abuse, environmental pollution, production of chemicals used for mass destruction.

IV. FACTORS MILITATING AGAINST THE TEACHING AND LEARNING OF CHEMISTRY IN OUR SECONDARY SCHOOLS IN NIGERIA

The following factors affect the teaching and learning of chemistry in the secondary schools:

(a) Funding: Finance is a crucial factor which enables a programme to sustain itself effectively in meeting the commitment of the organisation, the groups and the individual who consume the output of the goods or services of such an organisation. The delay in the educational system in Nigeria today has been largely ascribed to inadequate funding [12]. He observed that whereas UNESCO Prescribes funding level of 15% for GNP for developing countries such as Nigeria only between 6.0% and 7.5% GNP was allocated to education during the past few decades, consequently, provision of facilities, teachers' preparation, teachers motivation, instructional delivery, research and development had suffered untold damage.

(b) Lack of Infrastructure: Lack of infrastructure affects the teaching and learning of chemistry in our secondary schools. In many schools, there are inadequate classroom facilities such as textbooks, laboratories and laboratory equipment, inadequate electricity supply, plumbing facilities and no portable water supply. This condition hinders effective teaching and learning of chemistry. For Scientific and technological development to take place, the above constraints must be addressed.

(c) Methodology of Teaching Chemistry: Most chemistry teachers in our secondary schools use basically discussion and lecture strategies in their chemistry instruction. They present facts and principles contained in textbooks and students are rarely involved in any practical Laboratory experiences. When

chemistry students are not exposed to practical work and hands-on-activities, their interest in chemistry is killed.

(d) Lack of trained chemistry Teachers: There is scarcity of adequately trained, skilled and equipped manpower resources in chemistry. Chemistry Education in Nigeria has been placing emphasis on theoretical aspects to the detriment of practical acquisition which will provide technical skill that lead to technological advancement of a nation [3]. Inadequate provision of facilities and quality trained chemistry teachers may lead the available teacher to use any method [6]. Trained chemistry teachers have the virtues of transparency, accuracy, precision and honesty which scientific research and teaching require. Therefore, chemistry teachers must be trained in the pedagogy required for effective implementation of the chemistry curriculum. They must be exposed to in-service training, conferences, seminars and workshops on regular basis. This will enable them to learn the new strategies required in teaching and learning of chemistry.

(e) Low Enrolment in chemistry: Many students in the secondary schools in Nigeria have poor background in primary school basic science and Technology. Some of them even come to the secondary school with certain misconceptions and superstitious belief about chemistry and science in general. Some belief that chemistry is difficult because it contains some mathematics related topics. This misconception scares them away from the subject. Hence, the science quota of 60:40 ratio of art admission into the Universities or Tertiary institutions could not be filled.

(f) Corruption and Misappropriation of Fund: In some schools, money meant for purchase of chemistry and other science materials are not always used for it. Some head teachers/Principals always arrange with some officials from the ministry of Education to use the money for other things which may not be related to the teaching and learning of chemistry and science in general.

V. STRATEGIES FOR ACHIEVING EFFECTIVE APPLICATION OF CHEMISTRY EDUCATION IN SERVICE TO HUMANITY AND NATIONAL DEVELOPMENT

(a) Teaching chemistry with the right spirit of inquiry: The experience of the past 3 decades have brought about a strong awareness in Nigeria that the present form of science and technology taught in the schools do not prepared pupils to function well in a society undergoing transition from a rural economy to a modern economy [13]. For a learner to be productive and functional after graduation in a changing society, he/she must acquire the right attitudes, habits and salable skills. These attitudes, habits and skills could be developed by our students if chemistry and science and technology are taught with the right spirit of inquiry.

(b) Relating Chemistry to basic Human experiences: One major aim of teaching science, chemistry inclusive is to make students enjoy the subject; thereby developing interest in it. The degree of relevance of science Education could be improved by relating science in general to basic human experiences: a simple game of race and darts throwing competition, catapult shooting for example could effectively demonstrate average speed and range of a projectile respectively for secondary school students. Separation of particles in sand or rice at home could be used as a separation technique in chemistry in the classroom practical lesson.

(c) Exposing Learners to an Integrated General Science Knowledge: A conscious effort should be employed to integrate the different aspects of chemistry to cover subject areas such as Biology, Agricultural science, Health science, mathematics, Technology, environmental conservation and preservation. For instance, as a teacher of chemistry, he/she should bring in the relationships between some concepts in chemistry to Biology, mathematics, physics or Agricultural science.

(d) Teaching and emphasizing the connection between school learning and the world of work: Chemistry and other science curricula should provide skills and behaviours for participating in a complex democratic society and the development of individual Talent and self expression [13]. The skills should be aimed at readiness for world of work and economic responsibilities. A responsive chemistry education is an instrument for the reduction and removal of illiteracy and poverty. It should place emphasis on the utilitarian aspect of chemistry subject, by identifying examples of practical application of chemistry in the society.

VI CONCLUSION

Chemistry is the study of matter, their structure, transformations, interactions and energy implication of chemical changes. It plays a dominant role in all human activities such as Agriculture, Health, transportation, Education, Industries, among others. Chemistry is very useful in our everyday life. It enables us to produce useful products like clothing for covering our bodies, improved quality and quantity of food, and improved housing and environment. Everything that exists is made of chemicals. Therefore, it is necessary to conclude that the establishment of functional chemistry education will help in scientific advancement, technological break through and industrialization of Nigeria and other developing countries in Africa.

VII RECOMMENDATIONS

- Funding: Financing of chemistry education and research should not be left to the government alone. Funds should be sought from corporate bodies and international organizations like chemical society of Nigeria. All multinational co-operations and firms employing up to 60 chemistry specialists should be required by law to contribute 5% of their pre-tax profit to an endowment for chemical and science Education in general.
- Chemistry teachers need to liaise with the industry to develop curricula relevant to our aspirations for sustainable development. This is because the industry is a key factor in eradicating poverty and generating employment. The chemistry curricular content and teaching methods should be oriented towards the application of chemical principles rather than the acquisition of paper certificates that people carry about without getting jobs. Training in chemistry education should help the individual to acquire the necessary skills required in transforming natural or man-made recourses to wealth creation.
- Science Education right from the primary school level should be adequately equipped and staffed with the right caliber of teachers. The skill and training given to the students in chemistry education should link them with what the society will need for sustainable development.
- All schools at our educational levels should be connected to the internet to enable teachers and students access information in conformity with the rapid demands of globalization. Teachers should be encouraged to be ICT compliant by helping them to acquire computers on loan at subsidized prices. The ICT centers built in some colleges should be made functional by providing the necessary equipment.
- The chemistry teachers should be encouraged to attend seminars, conferences, workshops and short courses to improve their pedagogy. As part of capacity building, the teachers should be exposed to curriculum implementation and development.
- The government should fulfill its promise of providing enabling environment for qualitative and functional education by injecting heavily in the education sector.

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