Costal Environment of Ghana

“...The coastal area of Ghana is subject to pollution from domestic and industrial activities largely as a result of incompatible land use, inadequate waste management facilities and ineffective legislation. Coastal pollution impacts the environment, economy and human health and safety. If every individual sweeps in front of their house, the community will be clean; if the community is clean; our coastal ecosystems shall be clear clean waters.”
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Editorial Board

Dr. Jacob Kwaku Agbenorhevi
Editor
Department of Food Science and Technology,
Kwame Nkrumah University of Science and Technology, Kumasi
Email: jkagbenorhevi.cos@knust.edu.gh / jkagbenorhevi@yahoo.com
Tel: +233 208 954 233

Dr. Mohammed Muniru Iddrisu
Deputy Editor
Department of Mathematics,
University for Development Studies, Tamale
Email: mmuniru@uds.edu.gh / immuniru@gmail.com
Tel: +233 243 642 642 / +233 209 962 859

Dr. Elsie Akosua Biraa Effah Kaufmann
Deputy Editor
Department of Biomedical Engineering,
School of Engineering Sciences,
University of Ghana, Legon
Email: eeffahkaufmann@ug.edu.gh / elsieek@yahoo.com / eek@ug.edu.gh
Tel: +233 244 621 935

Editorial Disclaimer:
Articles and imagery in this Magazine apart from those referenced, are the sole responsibility/views of their respective authors.
Introduction

The Ghana Science Association (GSA), a voluntary, non-profit making and multidisciplinary organisation of scientists, technologists and mathematicians was formed in 1959. The Association traces its origin to the West African Science Association (WASA) which was formed in 1953 at the University College of the Gold Coast. WASA was formed to provide West African scientists the forum to advocate the importance of Science and Technology as a necessity and bedrock for national development. The formation of GSA broadened the scope of activities from reading of scientific papers to involvement in national and international affairs. The Association was placed on government subvention under the Ministry of Education as far back as 1961 by a Presidential Fiat. Hence the Association is supported through budgetary allocation from the Ghana Government. Other sources of income include membership dues and proceeds from workshops and conferences. The GSA was mandated to promote, popularize and demystify science and create a scientific culture in the country. The Association has made tremendous contributions to National Development, Health and Economic Growth through scientific interventions. The Secretariat is a point where scientific and technological information and research findings are obtained by individuals and corporate bodies.

Membership of the Association is drawn from the Universities, Research Institutes, Industry, Government and Persons interested in the promotion of Science and Technology.

Vision and Mission

Vision

To become a dominant voice in Science and Technology advocacy by promoting and popularizing Science and Technology to meet national developmental needs.

Mission

Advancing Science, Technology, Engineering and Mathematics (STEM) through interaction and cross-fertilization of ideas of all interested people to:

1. Popularize, promote and disseminate scientific information and technology transfer for national development.
2. Contribute to the development of national Science and Technology policy.
3. Collaborate with industry to set national research agenda.
4. Establish linkages with industry to promote the transfer and application of Science.
5. Seek affiliation and foster cooperative links with other national and international organizations.

Activities

1. Organization and participation in scientific conferences, workshops, seminars, symposia, public lectures, quizzes and science fairs.
2. Promotion of carrier development of scientists in Universities and Research Institutes in Ghana and elsewhere.
3. Publication of the scientific journal, magazines and books (e.g. Journal of the Ghana Science Association and Everyday Science for Schools magazine).
4. Training programmes for mathematics and science teachers to improve the teaching and learning of these subjects in schools and colleges of Education.

Contribution to National Development

Issues of national importance have been regularly and consistently highlighted at biennial workshops, conferences etc. Communiqués had been submitted to Government and other stakeholders on very topical themes to help shape national policies.
Reduction of Food Losses and Waste

Jacob K. Agbenorhevi (PhD), Nadia S. Oppong (BSc)
Department of Food Science and Technology, Kwame Nkrumah University of Science and Technology, Kumasi.
Email: jkagbenorhevi.cos@knust.edu.gh / jkagbenorhevi@yahoo.com
Tel: +233 (0) 208954223

Introduction
Food is lost or wasted throughout the supply chain, from the farm down to the final household consumption. The issue of food losses is of high importance in the efforts to combat hunger, raise income and improve food security in the developing countries. Food losses have an impact on food security for poor people, on food-quality and safety, on economic development and on the environment.

Estimates indicate that 30 to 40% of the food produced globally is lost post-harvest or wasted because it is never consumed. Without these losses there is sufficient food available to feed the world population, even when it will reach 10 billion people by 2050.

In Ghana, we have huge loss of foods produced annually due to limited postharvest management/technology as well as limited knowledge on how to manage wasted food among other factors. A conducive policy environment, and actively involved public services and private sector are prerequisites to reduce the amount of ‘missing’ food. The 2013 Ghana Food Wastage Report by Chefs for Change Ghana Foundation showed that, Ghana lost 3.2 million metric tons of food valued at $8.9 billion in 2013, that, Ghana lost 3.2 million metric tons for Change Ghana Foundation showed private sector are prerequisites to reduce and actively involved public services and as well as limited knowledge on how postharvest management/technology produced annually due to limited

Food losses refer to a decrease, at all stages of the food chain prior to the consumer level, in mass of food that was originally intended for human consumption, regardless of the cause.

Causes of Food Losses
• Food waste refers to food appropriate for human consumption being discarded or left to spoil at consumer level – regardless of the cause.

Causes of Food Losses
• Food gets lost when production exceeds demand.
• Food may be lost due to premature harvesting.
• High ‘appearance quality standards’ from supermarkets for fresh products lead to food waste.
• Poor storage facilities and lack of infrastructure cause postharvest food losses.
• Unsafe food is not fit for human consumption and therefore is wasted.
• Lack of processing facilities causes high food losses.
• Inadequate market systems cause high food losses.

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Figure 1: Typical examples of causes of food loss (Adapted from: Timmermans, 2015).

Figure 2: Food left over on your plate – wasted food. Limit your dish size, serve as you can eat.

Figure 3: Food waste from household and industries (Adapted from: Koomen and Gordijn, 2015).

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**The Food Value Chain – Joining the Missing Links**

Jacob K. Agbenorhevi (PhD) and Ibo N. Oduro (PhD)
Department of Food Science and Technology, Kwame Nkrumah University of Science and Technology, Kumasi.
Email: jkagbenorhevi.cos@knust.edu.gh / ioboduro.sci@knust.edu.gh
Tel: +233 (0) 208954223 / +233 (0) 244288315

**Introduction**

Over 60% of Ghanaians are into agriculture. However, the country is faced with challenges of food and nutrition insecurity partly due to limited postharvest management/technology, processing or value addition. Nevertheless, with the right attention paid to the food value chain, improvement can be made in the agricultural sector for enhanced livelihood and food security.

Food chain refers to the sequence of stages and operations involved in the production, processing, distribution, storage, handling of food and its ingredients till consumption. Food value chain (Figure 1) is the network of stakeholders involved in growing, processing, and selling the food that consumers eat—from farm to table. This includes (1) the producers that research, grow, and trade food commodities; (2) the processors, both primary and value added, that process, manufacture, and market food products; (3) the distributors, including wholesalers and retailers, that market and sell food; (4) the consumers that shop, purchase, and consume food; as well as (5) governments, non-governmental organizations (NGOs), and regulators.

Unlike the supply chain that requires only the transfer of materials from one place to another (final destination), in the value chain, certain values are added to the material along the chain to improve quality of produce. For example in supply chain of fruits, the produce can be transferred from farmers, to traders, to retailers, to consumers, without adding value but in value chains certain values are added like grading, sorting, processing, packaging and marketing. Thus actors are connected along the chain, producing and delivering goods and services to consumers through a sequence of value adding activities. Every stakeholder must be responsible and accountable for the sourcing, handling, and quality control of food.

A critical look at the food value chain provides opportunities for job creation because of the various activities that occurs from production to consumption. The food chain today is marked by the integration and consolidation of agricultural and food industries. Moreover, people (consumers) are demanding for a wider variety of foods: out of season, away from home, convenient but still safe.

Ghana has a lot of underutilized food materials which could be exploited in this wise using their nutrient strength to provide diversity and expand the food basket. Figure 2 shows some underutilized fruits/vegetables, cereals, legumes, roots and tubers in Ghana.

In order for these food crops to support the food and nutrition security agenda we need solutions that combine innovation and modern methods to join the missing links in the value chain. One key approach is through skill training in Food Science and Technology.

**Conclusion**

Food is essential to life – we all "eat food to live!" Therefore, all stakeholders in the food value chain need to work together to achieve food and nutrition security. Thus the need to train more Food Scientists and Food Technologists in fixing the missing links.

**References**


van der Maden, E. (2015) Introduction to value chains and value chain analysis. In: Lost Harvest and wasted food course, Wageningen UR.
It is well known that energy can neither be created nor destroyed but transformed from one form to another. It is very common to give examples such electrical energy can be turned to heat energy with an electric iron or the wind energy can give electrical energy by the use of a windmill. We also know that food substances give humans energy when eaten. The energy food substances contain are called chemical energy. Now, think about this. When food substance is ‘spoilt’ and cannot be eaten does it still contain energy? But what do we do with spoilt food substances? Don’t we throw them away? That is energy being thrown away. All food substances, wood, grass, algae and all things that can ferment are called biomass, and whether fresh or waste they contain energy (Figure 1).

Don’t we use firewood to cook? When there are bush fires what happens? All kinds of dry grass burns. Biomass stores chemical energy in the form of carbohydrate, proteins and lipids. Biomass energy can be extracted in ways such as either by complete burning in the presence of excess oxygen to give heat (fire) or partial burning in less oxygen to give activated coal (like charcoal). When biomass contains little moisture (almost dry) extracting its energy by burning is appropriate. What about biomass such as pawpaw, watermelon, mango fruit or fresh wood, which contains a high moist? The energy of high moisture content biomass is difficult to extract by heating. This is because trying to burn high moisture content biomass will first require evaporating almost all its water content, which is very difficult. It is just like when one wants to use wet firewood for cooking. An alternative method to extract energy from high moisture content biomass is through a method called anaerobic digestion.

Anaerobic digestion is a biological process whereby organic fraction of matter is digested in an airtight container called digester. Let me ask you a simple question. If you want the energy from mango what do you do? You eat it, right? If this same mango is put in an airtight container how will its energy come out? It must be eaten. By who? Microorganisms, called anaerobes are introduced into the airtight container (Figure 2). They feed on the organic substance and release energy in the form of methane (CH₄) and carbon dioxide (CO₂). Methane is highly combustible and that is the energy needed. Simply put ‘organic matter, especially waste ones put in an airtight container with anaerobes introduced can give out energy’. This energy is referred to as biogas. This gas can be stored in soft polymers or car tire inner tubes. When the biogas is connected to a special type of gas cooker it can produce energy for cooking. When connected to a special type of generator it can give out electricity.
Lactose reduces. The reduction in pH goes on, the lactic acid content of the optimum temperature of 45°C. The Lactobacillus bulgaricus and Streptococcus thermophilus are two lactic acid bacteria (LAB). 42-43°C which is a compromise between fermentation is usually done between the yoghurt production reported was as full fat yogurt, low fat milk produces yoghurt obtained. Whole milk produces yoghurt and dried yogurt. Strained yogurt contains fruits, oilseeds, spices, milk, tree nut, meat and dried fruits. However, some crops are more susceptible to aflatoxin than others. Some of these crops include cereals (maize sorghum, wheat, rice), oilseeds (maize sorghum, cotton meal and maize), legumes, spices and tree nuts (Neme and Mohammed, 2017). The major crops that are affected by aflatoxins are groundnut, peanut, cotton meal and maize is 20ppb. According to WHO (2015), Africa has a high burden for aflatoxin and it is estimated that about 4.5 billion Africans are exposed to detrimental amounts of aflatoxin in their diet. Approximately 25% of food crops are affected by mycotoxins worldwide amounting to about 1 billion tonnes of foodstuffs annually (Bryden, 2012).

Aflatoxins

Aflatoxins are naturally occurring toxins which are produced by some fungi strains such as Aspergillus flavus and Aspergillus parasiticus. They belong to a larger group known as mycotoxins which include fumonisins, ochratoxins, trichothecenes, aﬂatoxins and ergot alkaloids. Of these, aflatoxins are the most abundant and toxic. The four main types of Aflatoxins are B1, B2, G1 and G2. This classification is done based on its characteristic texture. The low pH (about 4.5) also deters the growth of undesirable microorganisms (Tobergte and Curtis, 2013). The two strains of Lactobacillus bulgaricus and Lactococcus bulgaricus are in a symbiotic relationship in the ratio 1:1. Streptococcus thermophilus ensures the starting of lactic fermentation of yoghurt, and their growth is stimulated by amino acids released because of the ability Lactobacillus bulgaricus to break down milk proteins. This is evident in the first phase of fermentation by a higher number of Streptococcus thermophilus. When lactic acid concentration increases, it exerts an inhibition action on Streptococcus thermophilus and leads to a reduction in their total count.

Differences in the type of yogurt obtained mainly depends on the ingredients used, the manufacturing procedure and the strains of microorganisms. The type of milk used has a bearing on the type of yogurt obtained. Whole milk produces full fat yogurt, low fat milk produces low-fat yogurt and skimmed milk produces non-fat yogurt. The yoghurt commonly available on the market are set and stirred yoghurt. Set style yoghurts are thick and are refrigerated in retail containers. No water removal takes place after the fermentation process. Stirred or Greek yoghurt in process of growth of milk and a portion of whey is removed after fermentation.

Due to the different manufacturing processes, differences arise in characteristics such as texture. Set type yoghurt has a continuous gel structure while stirred yoghurt has a viscous and smooth texture (Sfakianakis and Tzia, 2014). Other forms of yoghurt include sweet drinking yoghurt which is stirred yoghurt containing additional colours and is less sour. Fruit yoghurt, which contains fruits, frozen yoghurt, cheese fruit and dinked yogurt. Stained yogurt is another type in which the whey has been separated and hence is thicker. In probiotic yoghurt, the yoghurt is not pasteurized after fermentation such that the lactic acid bacteria are live. Other bacteria such as Lactobacillus acidophilus, Bifidobacteria and Lactococcus casei can be added to probiotic yoghurt. Yogurt confers some health benefits such as improved bone health, improved diet quality and reduced occurrence of chronic diseases such as cardiovascular diseases, obesity and metabolic syndrome (Donovan and Shami, 2014).

References

Coastal Environment of Ghana
L.G. Akita1, M. Alivernini2, P.J. Frenzel2, M.O. Akrong3, E. Klubi1, J. Laudien4, H. Takada5
1Department of Fisheries and Marine Science, University of Ghana
2Institute for Geosciences, Burgweg 11, 07749 Jena, Germany
3Council for Scientific and Industrial Research, Water Research Institute, Ghana
4Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research. Am Alten Hafen 26, 27568 Bremerhaven, Germany
5Laboratory of Organic Geochemistry (LOG), Tokyo University of Agriculture and Technology, Fuchu, Tokyo 183-8509, Japan
Email: lailah.akita@gmail.com
Tel: 0506146713

Ghana is richly endowed with diverse natural resources. Coastal marine resources (e.g., estuaries, lagoons, mangroves, ocean, rivers, wetlands etc, Fig.1a-c) are exploited (e.g., fishing, industry, tourism, aesthetic, historical, cultural and educational) to meet the growing demands of the population. Increasing human activities such as urbanisation, infrastructure development, industrialisation and transportation exert pressure and steadily degrade the components of these fragile coastal ecosystems. The pollution of coastal ecosystems (Fig.2a-d) includes solid waste, untreated sewage discharge, pesticide usage in agriculture, mining activities and toxins from electronic waste (e.g., polybrominated diphenyl ethers (PBDEs), http://www.pelletwatch.org). Where is the culture of cleanliness to protect the coastal ecosystems?

Pollution
Solid waste management is a major source of pollution. Primarily open dumps in Ghana produces 2,000 tons (daily) and 3,000 million tons (annually) of solid waste (EPA, 2002). For example, plastic material dominated the total litter at 66% for Kofo and 53% for La, beaches respectively (Sitsofe et al 2009). The solid waste management is of great concern due to increasing open dump and urban litter and inadequate maintenance landfills sites, (e.g., Tweeblo and Oblogo) due to lack of equipments for compaction of waste.

Pollution Impacts:
- Environmental impacts; (a) Direct: Threat to coastal marine wildlife (mammals, sea turtles and shorebirds through ingestion and entanglement of plastics. (b) Indirect: Ecosystem alteration: loss aquatic habitats, services (loss of native plants and animals) and species mortality.
- Economic impact: Tourism, fishing, industry and navigation through loss of revenue from tourism, catch revenue as well as costly vessel repairs.
- Human Health and Safety Impacts: human health risk, water-borne diseases, illness etc.

Strategies for Engagement:
- Changing of behaviour patterns that contribute to the plastic pollution.
- Increasing awareness on importance of coastal ecosystems, environmental and socio-economic issues relating to coastal marine litter and impacts.
- Provision of alternatives to plastic bags (e.g., paper to cotton bags) and advocating for adoption of 6Rs (Reduce, Reuse, Recycle, Responsibility, Remember and Rethink).
- Environmental monitoring to evaluate the state of coastal ecosystems and human health risk from contaminations (Fig.3a-b) (e.g., Biomonitoring project sponsored by Volkswagen Foundation).
- Reinforces of traditional values (e.g., cultural norms) for the control of activities in coastal areas and water bodies.
- Clean-up campaigns within communities.
- Strengthen participation of all stakeholders.

Opportunities for Young Scientist:
- Participation in environmental monitoring.
- Plastic pellet collection.
- Enthusiastic students should express interest via email: lailah.akita@gmail.com

Conclusion
God loves cleanliness, if we love God, we must keep our coastal environment clean.
The coastal area of Ghana is subject to pollution from domestic and industrial activities largely as a result of incompatible land use, inadequate waste management facilities and ineffective legislation. Coastal pollution impacts the environment, economy and human health and safety. Education campaigns make a valuable contribution to awareness of impacts of marine litter. If every individual sweeps in front of their house, the community will be clean, if the community is clean; our coastal ecosystems (rivers, lagoons, wetlands etc) shall be clear clean waters. Local efforts to prevent the incidence of environmental pollution are ineffective without regional, national and international collaboration to address the sources of the problem.

Reference:
Health Implications of Domestic Burning

Victor Y. A. Barku (PhD)
Department of Chemistry, School of Physical Sciences, College of Agriculture & Natural Sciences, University of Cape Coast.
Email: vbarku@ucc.edu.gh

Many dwellers depend on burning of firewood as the main source of energy for their domestic chores. Many women burn firewood or charcoal in their kitchens to prepare their meals and process other food substances. Many fishermen also use firewood to smoke their fish for preservation. Despite the benefits derived in the form of energy supplied for the effective processing of fish by burning wood there are many negative aspects which are detrimental to human health.

Wood alcohol also referred to as methanol is a toxic organic liquid present in woods. During the course of burning, incomplete or partial oxidation of this compound takes place which produces formaldehyde.

\[\text{2CH}_3\text{OH} + \text{O}_2 \rightarrow \text{2HCHO} + \text{2H}_2\text{O}\]

Formaldehyde, another gaseous organic compound is therefore naturally present in the smoke of wood fires. This gas although it assists in the preservation of the smoked food, is somewhat toxic to humans. It is partially responsible for the eye tearing when exposed to smoke. It causes irritation to the eyes at levels higher than 0.1 ppm. It has also been found to be a probable carcinogen (cancer-causing agent) by USA Environmental Protection Agency in 1987.

Another effect of concern is the production of polycyclic or polynuclear Aromatic Hydrocarbons known as PAHs. PAHs are by-products of incomplete combustion of wood, fuels, tobacco and others is a PAH called Benzo[a] pyrene (BaP).

![Benzo[a] pyrene](image)

Unfortunately, it is not those who smoke cigarettes or are direct users of firewood and coal that are exposed to these pollutants. The greatest exposure to carcinogenic PAHs arises from our diets, especially from charcoal-broiled and smoked meat and fish. These foods contain some of the highest levels of PAHs. For instance, barbecuing meat produces PAHs when the fat drops onto the hot coals and is partially decomposed. Unfortunately, barbecuing meat is patronized and enjoyed by many, especially, during social events.

The good news however, is that apart from a number of wood smoke compounds that act as preservatives phenol and other phenolic compounds in wood smoke are both antioxidants, which slow racemization of animal fats, and antimicrobials, which slow bacterial growth. There are other antimicrobials in wood smoke that include formaldehyde, acetic acid, and other organic acids, which give wood smoke a low pH—about 2.5.

Ghana initiated its reactor project milestone late in the 1960's, but due to political regime changes the project was curtailed. The nation's commitment for the reactor project materialized in 1991 when an initial contract was signed between the Government of Ghana (GAEC), China Nuclear Industry Corporation and International Atomic Energy (IAEA) for the supply of a research reactor [2].

The Ghana Research Reactor -1(GHARR-1) is a low power research reactor (LPRR) of nominal power 30kW. It is a small, safe nuclear facility, which employs highly enriched uranium (HEU) as fuel, light water as moderator, coolant and shield and beryllium as reflector. The reactor is cooled by natural convection.

GHARR-1 is a commercial type of the Miniature Neutron Source Reactor (MNSR) designed, manufactured and constructed by China Institute of Atomic Energy (CIAE), Beijing, China. It is designed for use in universities, hospitals and research institutes mainly for neutron activation analysis, production of short-lived radioisotopes, education and manpower development. The reactor is located at the National Nuclear Research Institute (NNRI) of Ghana Atomic Energy Commission (GAEC). It became critical in 1994[3].

The MNSR is the Chinese version of SLOWPOKE and could be installed in city areas with dense population and in situations where even most of the staff of the operating organization may not have broad technical knowledge of nuclear reactors; it was decided to provide safety margin in the commercial design to enhance the control of release of radioactivity. The main objectives of the design are ensure the inherent safety of the reactor, prevent radioactive materials from leaking and finally to mitigate the radiological consequences in case accident occurs.

The engineering features chosen for the design of GHARR-1 are simple, coherent with normal laws, easy to handle and have “fail-safe” principles.

Milestones of Ghana Research Reactor Project

For over twenty years, the GHARR-1 reactor project has gone through several project phases. Some major milestones in its history are as follows:

1964: Foundation stone for the construction of an initial 2MW research reactor was laid.
1966: The construction work of the initial 2MW reactor building curtailed and the commission dissolved.
1972: Government constituted a committee to review the reactor project.
1973: Ghana signs agreement with IAEA for the application of Safeguards in connection with the Treaty on the Non-Proliferation of Nuclear Weapons.
1991: Contract for a new 30 kW MNSR signed. Among the following parties
• Government of Ghana (GAEC)
• China Nuclear Industry corp.
• International Atomic Energy Agency (IAEA) as 3rd witness

Ghana MNSR facility acquired with IAEA Technical/HR Assistance (Reactors/Facilities under IAEA Project and Supply Agreement) via TC Project GHA/1/0/10 [4]

1993: The commission was re-organized by the amendment of Act 204

1993: The Radiation Protection Institute (RPI) now Radiation Protection Board (RPB) which is the sole regulatory authority for the purpose of nuclear and radiation safety was established by Provisional National Defense council Law 388 of 1993 by amending the Ghana Atomic Energy Act 204 of 1963. The Radiation Protection Regulations LI 1559 of 1993 prescribed the mandate and responsibilities of the Board as a licensing Authority for the radiation Protection and Waste Safety and radioactive material applications

1994: The National Nuclear Research Institute applied for the following licenses from the regulatory body (RPB) [4].

• Source loading license, GHARR-1-95-04
• Criticality tests license GHARR-1-95-05
• High power test license GHARR-1-95-01-3
• Operator's license and Senior operator's license GHARR-1-95-01-3
• Provisional operational license GHARR-1-95-07

1994: GAEC requested the IAEA through a Technical Assistance project GHA/1/010 in 1994 for the provision and installation of a 30kW research reactor.

1994: The reactor building was completed and installations of the reactor unit and its auxiliary systems all installed. (The reactor building is located on the site where the initial 2MW was to be constructed. Hence studies on the site characteristics which includes site geology, seismology, meteorology, hydrology, oceanography and baseline radiological level studies approved as a suitable location for construction.)

1994: GHARR-1 reactor became critical

1995: GHARR-1 reactor was commissioned

1995: The interim SAR was submitted to the RPB after internal review by the Reactor Safety Committee (RSC) and Radiation Safety Committee (RSC).

1995: Ghana signed the Convention on Nuclear Safety


2006: Under the IAEA Technical Cooperation Project (GHA-4-012-001N) GAEC, NRRI, IAEA, CIEA and CNEIC agreed to supply a new software and hardware for the upgrading of the Micro Computer Closed Loop System (MCCLS) [2]

2006: CRP on Core convention was initiated to change the core from HEU to LEU, facilitated by the IAEA

2009: A new controlled drive mechanism was installed by a team of Engineers and Technologies without foreign expatriate.

2011: The US Department of Energy supported Ghana to upgrade and refurbish its radioactive waste storage facility. It would be used as central storeroom to manage all waste emanating from utilization of nuclear technology in Ghana and the Sub-region.

Assisted by the IAEA under the GTRU/ RERTR program converted its HEU (90.2%) fuel to LEU (13%) fuel.

2016: Unloading of GHARR-1 HEU core.

2017: Loading of GHARR-1 LEU core.

2017: Zero power test of LEU

2017: Full power test of LEU

Reactor Utilization

For the past twenty years, the reactor has been used in determination of major, minor and trace elements in samples and archaeo logical, environmental, geological and biological origin [5]. It has also been used in teaching and learning in Nuclear Engineering, Applied Nuclear Physics and Nuclear and Radiochemistry for students from the universities and polytechnics. The reactor is currently used to support the various sectors of the economy such as Mining, Industry, Health and Agriculture. The Reactor is also used for training nuclear scientists and engineers in the sub-Saharan Africa. The reactor is the central equipment on which School of Nuclear and Allied Sciences (SNAS) test. SNAS was jointly endorsed as an IAEA African Regional Designated Centre (RDC) on which School of Nuclear and Allied Sciences (SNAS) rest. SNAS was jointly established by the Ghana Atomic Energy Commission (GAEC) and the University of Ghana (UG) in cooperation with the International Atomic Energy Agency (IAEA) in 2006 to train high caliber human resource in the field of nuclear science and technology. SNAS was endorsed as an IAEA African Regional Designated Centre (RDC) for Professional and Higher Education in Nuclear Science and Technology in September 2009 and Radiation Protection in October 2011. SNAS is an IAEA regional hub for the Africa region’s AFRA Network for Education in Nuclear Science and Technology (AFRA-NEST). In future, GHARR-1 shall be used to further support forensic studies in Ghana.

Conclusion

Ghana has undergone over twenty years of milestone development in research reactor project experience. The successful implementation of the GHARR-1 reactor project is a clear demonstration of what can be achieved through active commitment from Government of Ghana and the IAEA. The project has been a major key component to the studies of nuclear science in Ghana. Ghana remains grateful to the IAEA for its support through scientific and technical assistance.

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[1] GAEC. Corporate Strategic plan 2012- 2016
Introduction

In Ghana and throughout the world, people sometimes identify local or native animals with names that properly apply to exotic ones. A typical example is the original wrong naming of the annual festival of the Effutu people of Winneba as a “deer hunt festival” even though the animal involved is a bushbuck (Tragelaphus scriptus), a type of antelope. This article discusses this and other cases of “mistaken identity” of animals in Ghana. For the purposes of this article, a native animal is defined as “an indigenous animal species that originates from a particular area,” while an exotic animal is “an animal introduced from elsewhere (another place or region).”

Deer or antelope?

Antelopes and deer are both herbivores. Deer are exotic to Ghana, while antelopes are native to Africa and Asia. Male deer possess branched antlers, while both sexes of antelopes have unbranched horns.

Crocodile or alligator?

Alligators are exotic, occurring naturally only in the United States and China. Crocodiles are native to Ghana and many other parts of the world. Biologically, alligators have the teeth in the lower jaw almost completely hidden when the mouth is closed, while in crocodiles, some teeth in the lower jaw are exposed when the jaw is closed.

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Rabbit or hare?

Hares and rabbits are similar large-eared herbivorous mammals, but only hares occur naturally in Ghana. Hares are native to Europe, Asia and the Americas. Hares have shorter ears than rabbits and are also not burrowers like rabbits. Hares are diurnal (day-active), while rabbits are nocturnal (night-active).

Whale or fish?

Both whales and fishes are aquatic vertebrates (animals with backbones), but whales are mammals which breathe air, possess hair, and are viviparous (give birth to live young). Fishes breathe through gills, have scales on their bodies, and are generally oviparous (lay eggs).

Insect or spider?

Spiders and insects are invertebrates described as arthropods because they possess jointed appendages and a hard exoskeleton. Insects possess three body parts (head, thorax and abdomen), three pairs of legs, and usually two pairs of wings in flying species. Spiders are arachnids with four pairs of legs and two body parts: an anterior cephalothorax (head+thorax), and a posterior abdomen. There are no flying spiders.

Guinea-pig or grasscutter?

Grasscutters or cane rats are endemic (limited) to Africa south of the Sahara and occur widely in Ghana, but all guinea-pigs are native to South America. Guinea-pigs have vestigial tails, and are easily domesticated, while grasscutters are more difficult to domesticate.

Both birds and bats are winged flying vertebrates. Bats are however small nocturnal mammals with hair and teeth, and give birth to live young. Birds lay eggs, possess feathers and are toothless.
Monkeys or ape?

Monkeys, apes and humans belong to the same group of mammals (primates) characterized by binocular vision (forward-facing eyes), opposable digits, prehensile tails, and possession of nails instead of claws. Apes are however tail-less and bipedal (semi-erect). Monkeys are tailed and quadrupedal (walk on four legs).

References


From Farm to Mouth: Where Food Meets Science

Francis Kwela Amaglobi (PhD)
Department of Food Science and Technology, University for Development Studies, P.O. Box TL 1882, Nyankpala Campus, Tamale, Ghana
Email: fjamaglobi@uds.edu.gh
Tel: +233 50-711-3355

Introduction

Eating is one of the crucial things we do for our daily existence. We cannot survive starvation for a very long time. We will lose our ability to function if we do not eat. Before we get the substances (nutrients) in food that are required for our daily sustenance, there is a branch of science involved called Food science and technology.

Food science is the study of the production, processing, preparation, evaluation, and utilization of food (Institute of Food Technologists, 2011). Food technology, on the other hand, is the use of the information generated by food scientists in the selection, preservation, processing, packaging, and distribution, as it affects the consumption of safe, nutritious and wholesome food (Potter and Hotchkiss, 1986). This branch of science is a union among several other core or branches of science including: mathematics, engineering, biology, chemistry, physics and psychology.

Since ancient times, human beings have been concerned with the science of food; but it is not until recently that it has become a course in various senior high schools and a degree programme in tertiary institutions. People who major in Food Science and Technology from degree-awarding institutions are called food scientists or food technologists.

Importance of Food Science and Technology

Between harvest and consumption (i.e., from farm to mouth), postharvest losses usually occur. However, postharvest losses are minimised or prevented through processing and packaging that are integral parts of food science and technology. Through the application of food science and technology, the supply of raw food is increased and conserved for a relatively long period of time for human benefit. Food scientists and technologists have significantly complemented agriculturalists to ensure the supply and availability of safe food with consistent high quality available at all time, and a wide range of delicious foods for consumption (Flores et al., 2010).

Food Science has again led to a reduction in nutrient deficiency-related diseases. For example, in Ghana, the Department of Food Science and Technology, University for Development Studies, is collaborating with development partners to promote the production and consumption of orange fleshed sweetpotato to help address the astronomically high vitamin A deficiency in the country. Products including bread, gari and yoghurt have been developed from the orange-fleshed sweetpotato which contains significant amount of dietary provitamin A, which is converted to vitamin A in humans.

Also, food scientists or technologists have contributed to the provision of foods that are less costly, convenient and require less preparation time, reduction in food waste and efficient global food distribution and storage (Flores et al., 2010). Thus, in today's world, food scientists or technologists play a vital role by improving the quality of food consumed by human beings in a sustainable way.

Career Opportunities

Food technologists or scientists apply science and engineering to food production, processing, packaging, distribution, preservation, evaluation and utilisation. Their goal is to ensure adequate, acceptable, and safe supply of food both at home and around the world. Many career areas are related to food science and technology due to its diversified branches as mentioned earlier. These include: food product development and processing, biotechnology, technical sales, quality control, teaching, research, etc. (Mehas and Sharon, 1989).

Among several industries in the world, the food industry is one of the largest and as long as human beings continue to eat, it creates employment opportunities with good salaries for food scientists or technologists. From the annual salary report of the Institute of Food Technologists (2011), a degree in food science offers several opportunities to earn top-dollar salaries. The average annual salary in 2011 for people with a B.Sc. in Food Science or Technology worldwide was $80,000 (1$ = GHC 4.43) and even higher for those with postgraduate degrees (Institute of Food Technologists, 2011).

Food scientists or technologists may find employment with companies or industries that produce canned, dried, refrigerated, frozen, freeze-dried, fermented, smoked, pickled, irradiated or baked food products. They can also work in such companies or industries to find tasty, nutritious and appealing food substitute that are cost effective. Also, they may work in large fishing vessels where they ensure that fish caught maintains the highest quality as long as the ship remains at sea for weeks. Other potential career opportunities include being inspectors for regulatory bodies to protect the public from foodborne illness.

In the Public Health Act 851 of Ghana, Section 106, it stated that “A person who shall not manufacture a food for sale unless the food is manufactured under the supervision of a person with appropriate knowledge and qualification who can ensure the purity, quality and wholesomeness of the food”. Therefore,
any business of food for consumption should have a food scientist or technologist. But more importantly, the training acquired equipped food scientists or technologist to start their own food processing business.

Conclusion

It is commonly accepted that we are what we eat, this may not be wholly true. A food technologist trained at University for Development Studies knows that we are not only what we eat, but we are what we do not excrete. Thus, if you are considering a career to improve upon the life of humans, consider this noble discipline: Food Science and Technology, where food meets science.

Just for Your Information

Entry Requirements for BSc. Food Processing Technology in University for Development Studies

One must obtain (A1 – C6 in WASSCE or A – D in SSCE) in three Elective subjects: Physics, Chemistry and Biology; and three core subjects (English, Mathematics and Integrated Science). Diploma graduates in applied sciences with passes in core sciences (Physics, Chemistry and Biology) or related subjects can apply. Higher National Diploma (HND) graduates with at least 2nd Class Upper Division in Food Technology/Science related field (excluding Home Economics) would be admitted from second year.

References


