



A brief on the sheda science and technology complex , ABUJA

By

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SHEDA SCIENCE AND TECHNOLOGY COMPLEX, ABUJA.

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INTRODUCTION:

“The World today stands on two primary supports which are the foundation for power, influence and progress. These two supports are advanced scientific knowledge and the productivity of the people in line with this knowledge base. The developed World of today relies on science and productivity to change the standard of living and to be positioned as a World Force on this planet. For developing States to attain a similar level of progress, and development, requires the building of a science base, and a scientific culture”- Prof. Ahmed Zewail, Nobel Laureate in Chemistry, in his speech at the celebration of his national honour award as the Collar of the Nile.

It is in the light of the above statement, towards achieving the goal of making Nigeria a developed nation, that the Sheda Science and Technology Complex (SHESTCO), a parastatal under the aegis of the Federal Ministry of Science and Technology was established by Act No. CAP. S5 (formerly decree No. 95 of 1993) as a multi-disciplinary Research and Development Centre. The Complex was established for the purpose of enabling institutions and individuals to undertake a wide range of research and development in a comprehensive and organized manner. The Complex is to house facilities whereby there will be concentration of sophisticated and modern equipment for R&D involving the highest level of technology in one location.

This is to avoid their unnecessary wide diffusion with attendant cost effectiveness, thus ensuring their sustainability and intensity of use. In other words, the Complex is modelled as a Science and Technology Village with facilities for high technology research and supporting infrastructure of power, water supplies as well as housing and other social/recreational facilities. These facilities are for use by researchers from the academia (tertiary educational/research institutions) to conduct research and development activities for applications in the area of agriculture, healthcare and industrial productions.

Vision of the Complex:

The Complex was created with the vision to: 🎧 Provide Opportunities for utilizing High Technology to contribute to the upliftment of the standard of living of the Nigerian Citizenry as well as guarantee a wholesome environment. 🎧

To achieve this objective, the Complex is to promote effective information exchange between it and other institutions within the country as well as between it and international institutions. It is also to contribute to the competitiveness of industries by promoting innovation and thus assure their profitability and survival.

Mission of the Complex

The mission of the Complex is to 🎧 provide facilities for research and development at the highest possible level in the basic and applied science to the entire scientific community of the country to develop results of research for application in the areas of agriculture, health, industry and environment. 🎧

Mandate of the Complex

- Developing facilities for the effective practice of applications oriented Science & Technology in Nigeria,
- Carrying out research and development activities involving the highest level of technologies available in the world with a view to strengthening the technological base of the Nigerian economy,
- In particular, operating a nuclear research reactor facility capable of providing service in the fields of agriculture, medicine, industry and Basic Sciences.
- Operating internationally accessible and comprehensive data base, in the area of Science and Technology,
- Conducting research and development activities in the field of conventional and non-conventional energy,
- Carry out structured manpower training to meet the growing needs of Nigeria in the areas of high technology and
- Providing avenues through which all the institutions of high learning in Nigeria may carry out capital intensive research on a cost effective basis.

Operations of the Complex

The operations of the Complex are carried out through four (4) major National Advanced Research Centres and the Nuclear Technology Centre.

National Advanced Research Centres

This presently consists of Four Centres. These Centres have various programmes and projects relating to the mandates of the Complex and in line with the developmental aspirations of the Country.

The Centres are:

Biotechnology Advanced Research Centre (BARC)

Chemistry Advanced Research Centre (CARC)

Physics Advanced Research Centre (PARC)

Applied Mathematics and Simulation Advanced Research Centre (AMSARC)

NUCLEAR TECHNOLOGY CENTRE

- Gamma Irradiation Facility currently (managed by NAEC).
- Large Central Workshop equipped to meet Electrical and Mechanical Engineering needs: Quality Assurance, Production, Electrical/Electronics Maintenance, Sheet Metal work, Foundry, Painting, Gas supply (e.g. Liquid Nitrogen production), and Glass blowing.
- Power Supply Station capable of generating up to 4.5 mega watts.

Electromechanical Central Workshop (CWS)

- Electrical and Mechanical workshop equipped with high precision machines to support Science and Technology Research and Development. The Workshop can also be used for training youths in:
 - ❖ Metal Fabrication
 - ❖ Specialized Welding, such as Metal Inert Gas(MIG), Tungsten Inert Gas (TIG) and Manual Metal Arc (MMA) welding.



The Chemistry Advanced Research Centre (CARC)



The Physics Advanced Research Centre (PARC)



The Biotechnology Advanced Research Centre (BARC)



SOME ACHIEVEMENTS AND PRODUCTS OF THE COMPLEX

AGRICULTURAL PRODUCTION

At the Advanced Research Centres of the Complex, some inputs have been developed for agricultural production.

A temporary Immersion Bio-Reactor which allows rapid multiplication of planting materials has been successfully set up at the Biotechnology Advanced Research Centre . This enables the multiplication of banana, plantain, pineapple, eucalyptus, acacia, neem, sugar cane and other economic tree crop seedlings for boosting plantation agriculture for food security, erosion and desertification control and help in mitigating the effect of climate change.



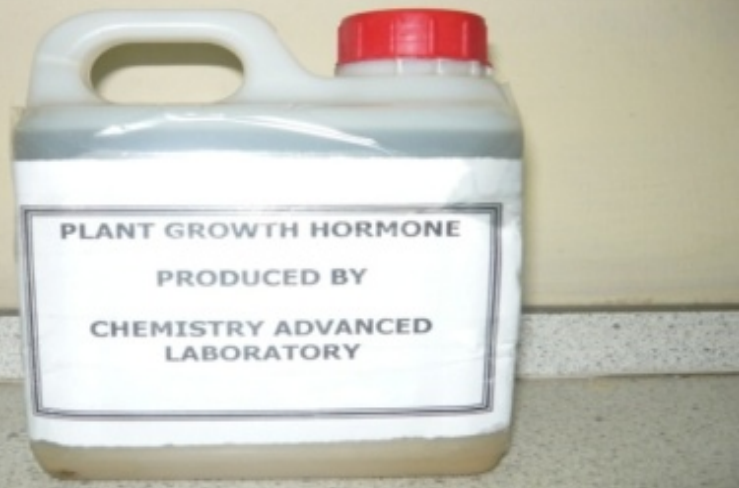
ACCLIMATISATION OF PLANTLETS



High yielding Brazilian sugar cane plantlets multiplied by TIB at SHESTCO, being taken by Sugar Development Council for distribution to farmers.

Pictures of plantlets (continued)





Plant growth hormone capable of boosting crop yield by 25-30%



Slow release nitrogen fertilizer made from maize cobs and urea went through both green house trials and phase II field trials with encouraging results.

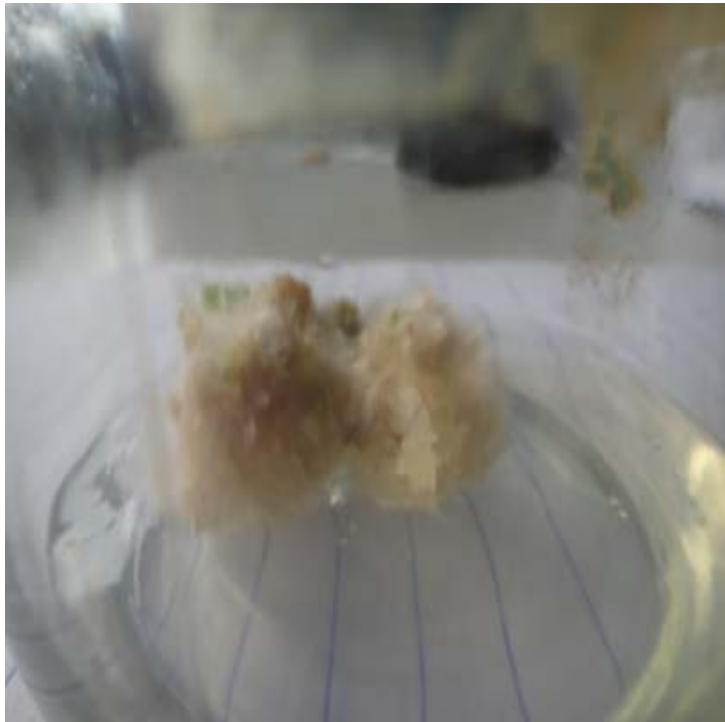


Moringa fortified fish feed for aquaculture



Moringa fortified livestock feed (for poultry, rabbits, cattle)

❖ In her effort to explore biofarming as a means of producing industrial biomaterials, the Complex developed protocol for the production of ginger callus as a source ginger oleoresin and essential oil.



Above are ginger calli developed in vitro

❖ We have successfully regenerated: (1) Rice (2) Wheat and (3) Cassava from callus cell into full plantlets as a necessary requirement for using transformation biotechnology (Genetic Engineering) to add rice blast resistant gene, develop heat and drought resistant (Local Nigerian wheat varieties) and glutenin gene (cassava starch for bread) respectively.

Figure 1: Regeneration of local rice varieties as a prerequisite for transformation with useful genes (e. g. Chitinase against rice blast fungus)

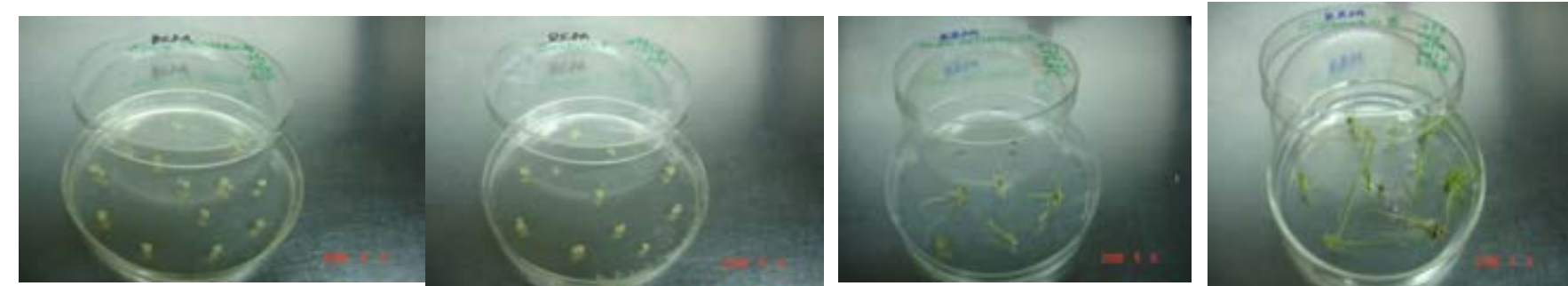
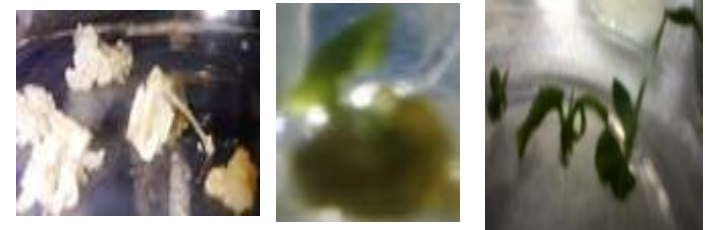
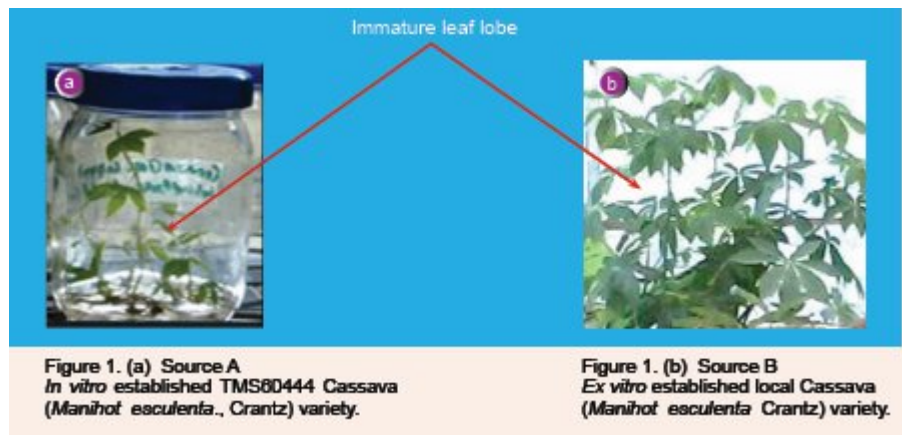


figure 2 a: Plants from which explant for calli production were obtained

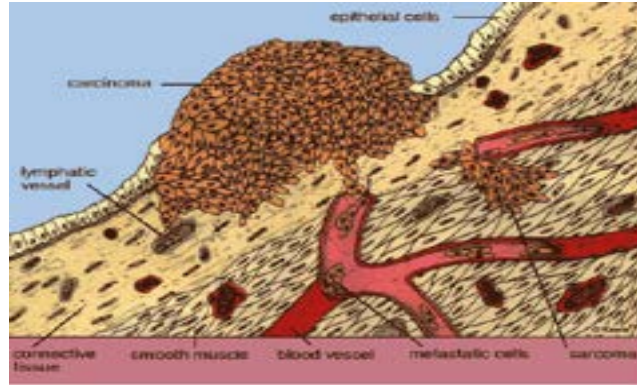


HEALTH

Efforts have been made at the Complex to develop inputs for health care delivery.



Cross-section of scientific *Moringa* Powder (food supplement) processing unit at SHESTCO, FMST



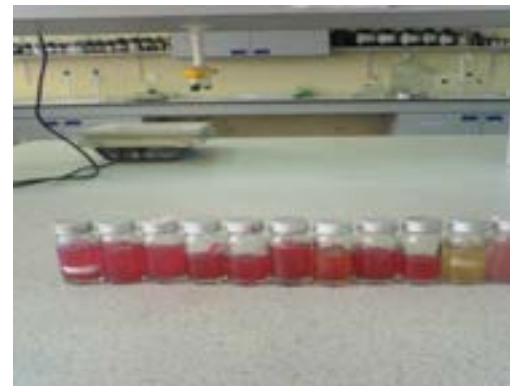
Schematic representation of Cancerous tumour



Prototype BioMENS fabricated domestically for use in targeted cancer drug release



Phyto-principle from a local plant for treatment of epilepsy formulated as sachet 'tea'



Anti-cancer principle, Prodigiosin produced uniquely domestically from *Serratia* sp.

From collaborative Studies involving SHESTCO, FMST, Abuja, AUST, Abuja Princeton University USA, part funding from STEB-B grant.



Clean room with some equipment

The clean room houses the only human cell line for studies in cancer treatment, especially breast cancer.

SHESTCO has produced a DNA library of five hundred herbal medicines and drugs purportedly used in the management of diabetes and organised a workshop and training for relevant stakeholders in the country.

DNA based authentication of raw and processed herbal medicines and drugs in Nigeria

Collection of Plant Samples



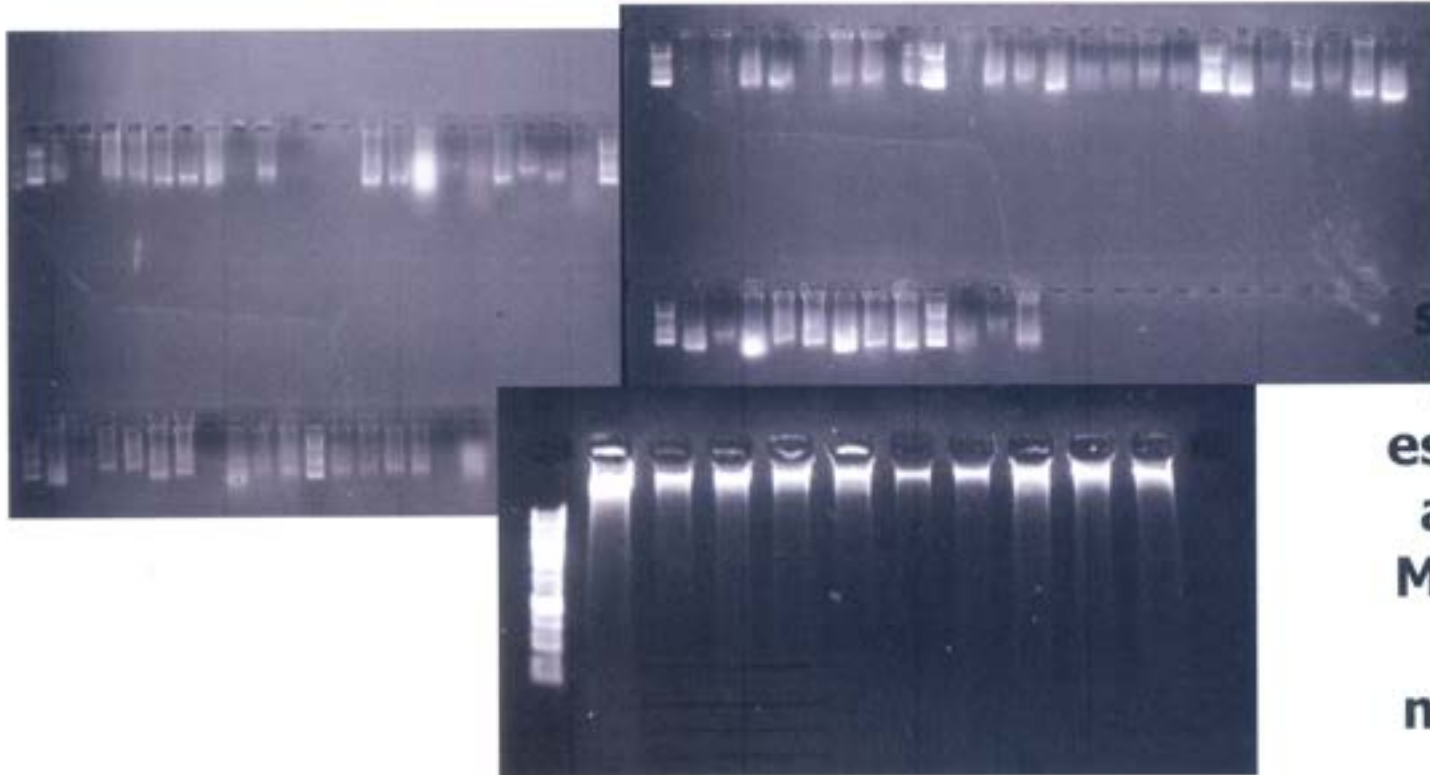
**500 plant
samples
established
to have
potentials in
management
of Diabetes**

Project Milestones

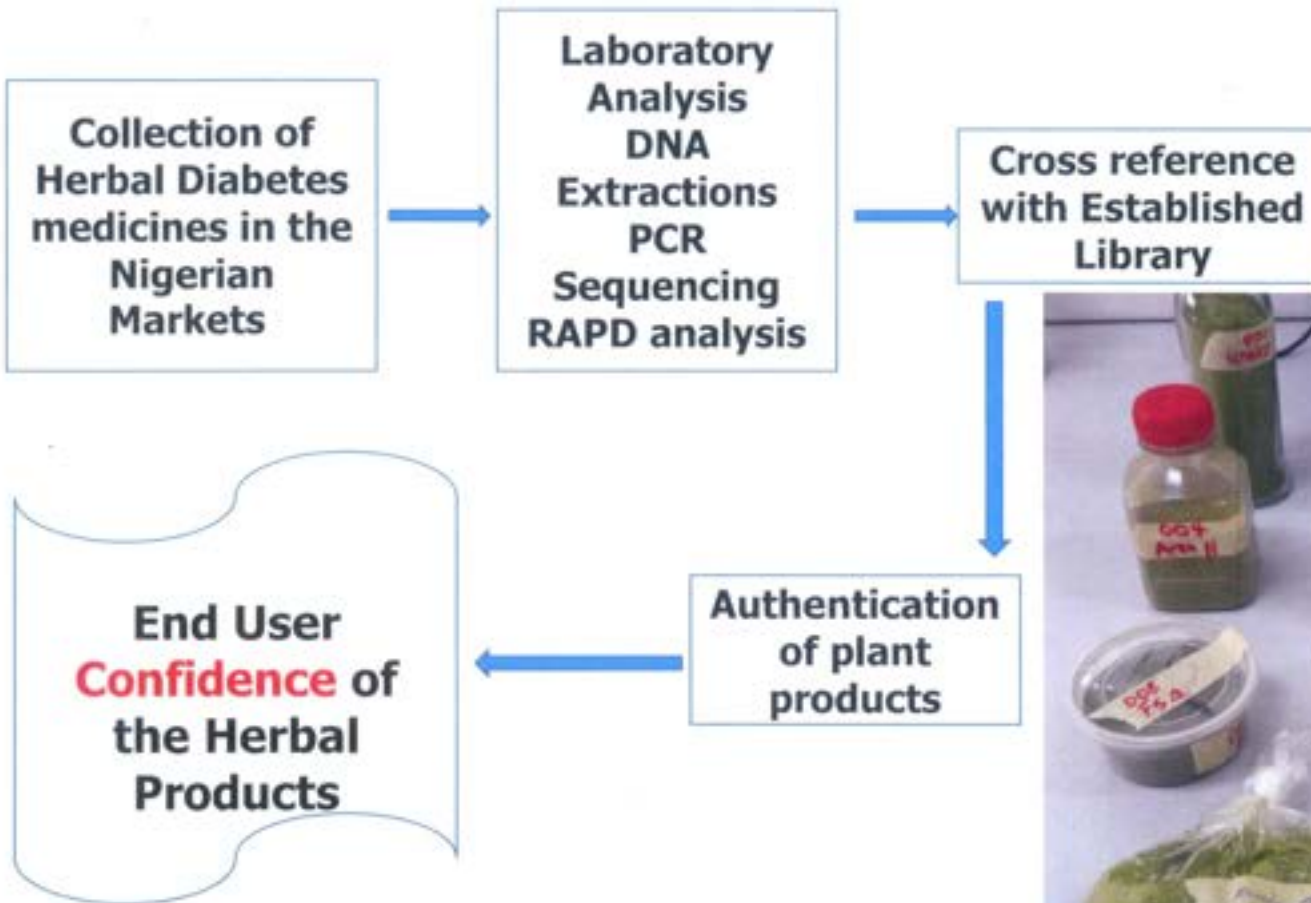


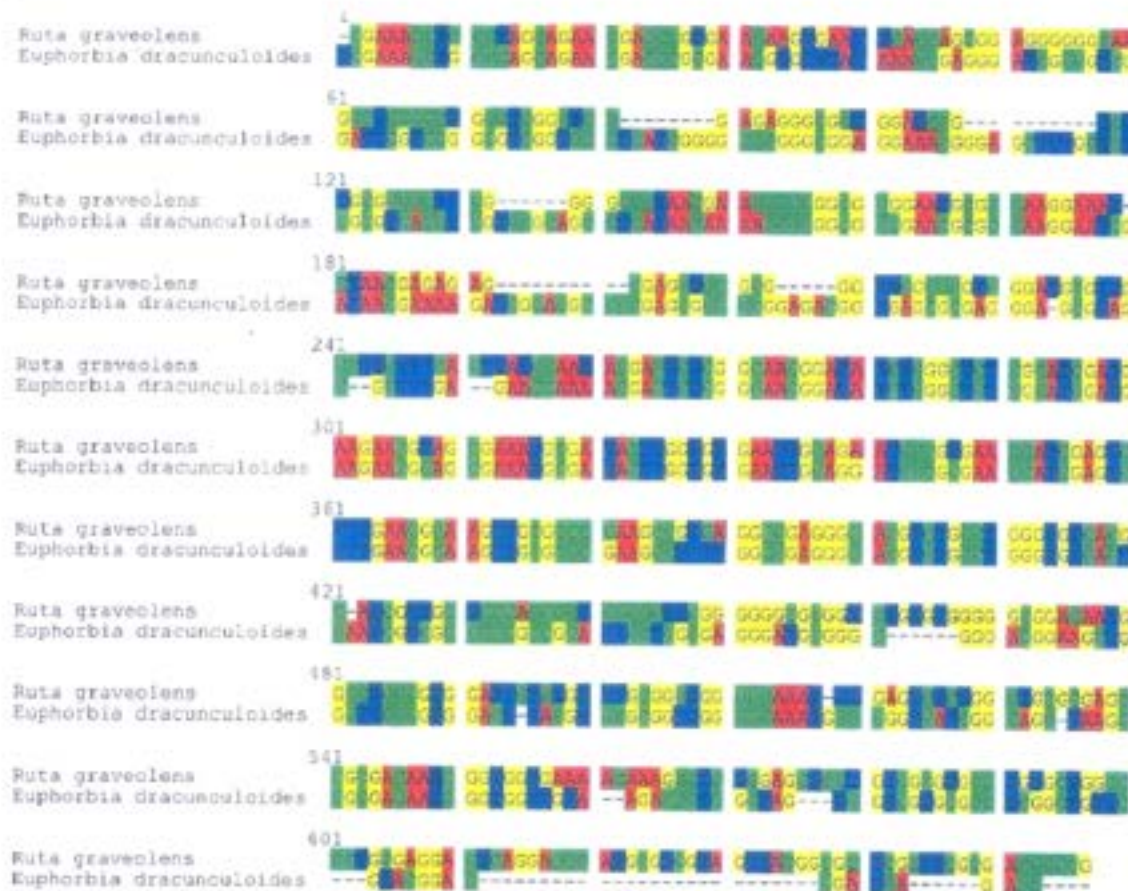
**Innovative
platform (IP):
Herbal Medicine
practitioners',
Food Regulators,
Health Policy
makers, Raw
material
Development
agencies**

Extraction of DNA using a Modified CTAB method



**500 DNA
samples which
has led to the
establishment of
a DNA Bank of
Medicinal plants
in the
management of
Diabetes
established.**





**Complete alignment
matrix of the internal
transcribed spacer
(ITS) gene sequences
between *Ruta
graveolens* and
*Euphorbia
dracunculoides***

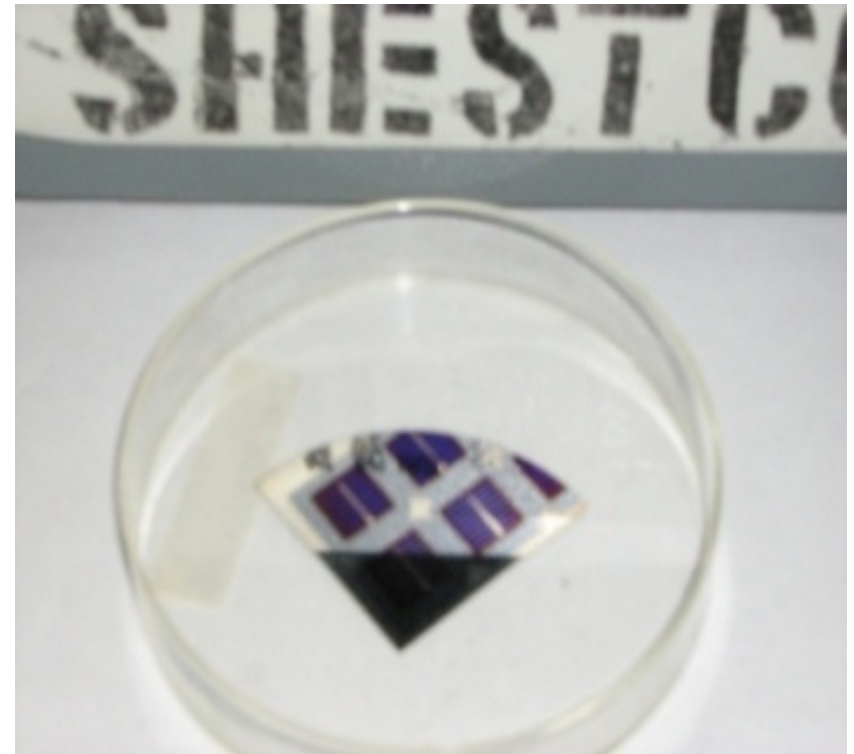
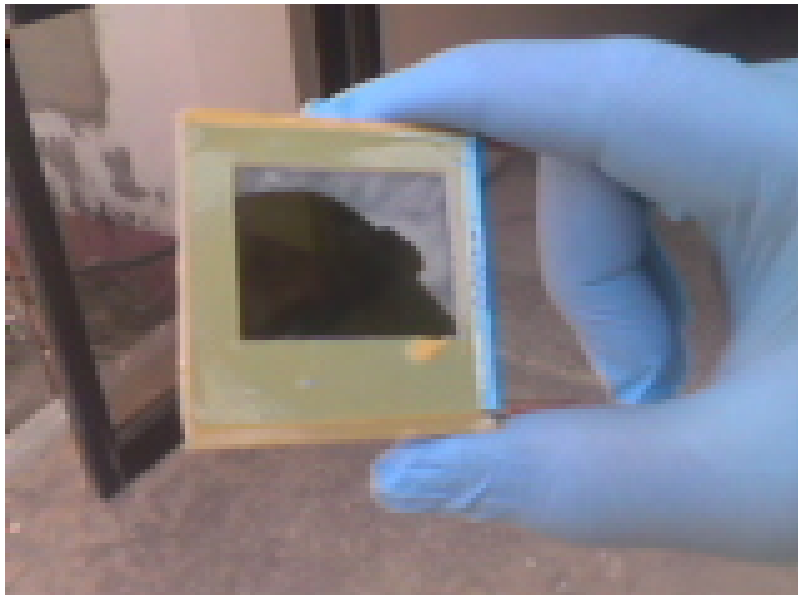


POWER & ENERGY

SHESTCO is carrying out Research and Development in the areas of New and Renewable Energy with emphasis on:

- (a) Development and production of low cost solar cells.
- (b) Production of MX biodiesel

This is with a view to contributing to electricity generation and supply as well as reducing the use of fossil fuels thereby enhancing environmental conservation.



**High Efficiency Silicon Heterojunction solar cell
developed in collaboration with IMM-CNR Italy**

CONTRIBUTIONS TOWARDS INDUSTRIALISATION

Towards Nigeria's industrialization drive, the following are some of the equipment fabricated at the Complex :



Production of frame of Point of Service (POS) Kiosk as import substitute.
(Partially commercialized).

Some of the Spare Parts produced at the Central Workshop



Pulley for split AC indoor fan produced for Obajana Cement Factory



Tail End Diverter Rod Shaft produced for Obajana Cement Factory



Tail end Diverter Rod Shaft produced for Obajana Cement Factory



Atmospheric hemical vapour deposition apparatus



Battery development cyclic voltametry



Proportional integral differential temperature

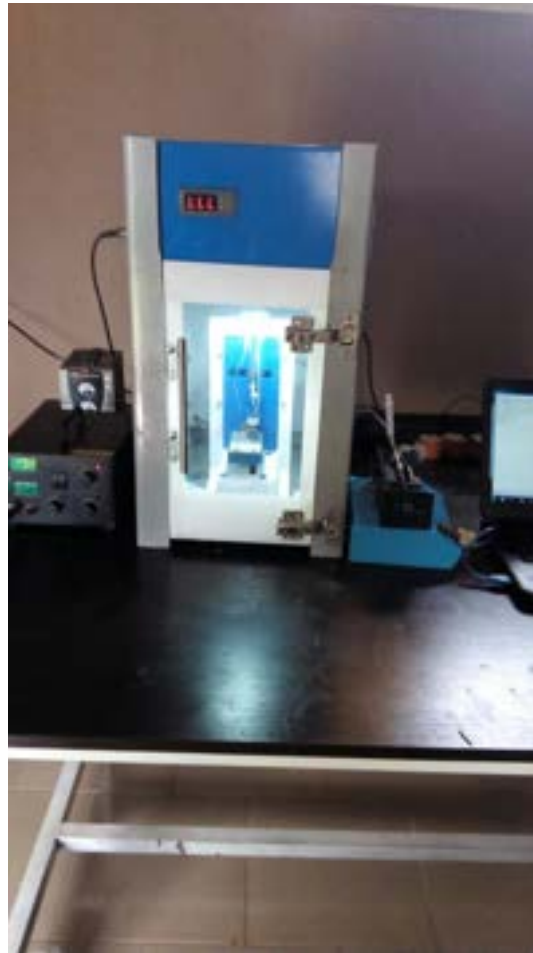


Version 1 and 2
Vehicle speed
limiter 1



Version 1 and 2
Vehicle speed limiter

High voltage spray pyrolysis machine produced in the Complex.





Automated Hand washing Machine



Rice Thresher



Rice de-stoning Machine

ESTABLISHMENTS THE COMPLEX HAS MOUs WITH:

- i. Princeton University, New Jersey, USA.
- ii. African University of Science & Technology (AUST),
Abuja.
- iii. Benue State University, Makurdi , Benue State.
- iv. University of Port Harcourt, Rivers State.
- v. Federal University, Ebonyi (FUNAI) Ebonyi State
- vi. PTDF Professional Chair of Chemical Engineering
Department of Chemical Engineering ABU Zaria.
- vii. African Biosciences Limited.

ESTABLISHMENTS THE COMPLEX HAS
MOUs WITH: (continued)

- viii. Nasarawa State University, Keffi,
Nasarawa State
- ix. The Nigerian Air force.
- x. Federal Ministry of Environment through: The
Environmetally Sound Management and Disposal of
Phychlorinated biphenyl (PCB) Project (ESMDP).
- xi. Messrs Access Solutions Ltd.
- xii. Ahmadu Bello University Zaria. (Dept. Of
Chemical Engineering).

SUMMARY OF POSSIBLE AREAS OF INTERVENTION AND COLLABORATION WITH STATES OF THE FEDERATION

1. Capacity Building and Empowerment

- Introduction of selected youth to emerging technologies of nanotechnology, Biotechnology, ICT-4D and advanced material development.
- Training in usage, maintenance and repair of scientific equipment.
- Training in metal fabrication, specialised welding including pipeline welding and glass blowing.
- Skill development for reverse engineering of electrical and electronic equipment.
- Youth empowerment in “Tissue Culture and micro-propagation Techniques” to enable them own micro-propagation business for wealth creation and poverty alleviation.
- Scientific processing and applications of products of useful plant materials.

SUMMARY OF POSSIBLE AREAS OF INTERVENTION AND COLLABORATION WITH STATES OF THE FEDERATION (continued)

2. Establishment of Temporary Immersion Bioreactor (TIB) for mass production of planting materials for food, and desertification and erosion control.
3. Conservation and domestication of endangered plants especially medicinal and economic plants.
4. Planning and establishment of science laboratories, and especially an ideal and cost effective Biotechnology Laboratory.
5. Collaboration in monitoring of water quality, soil fertility and associated environmental parameters

Milestone I: (Short-term Plan (January 2021 to December 2021):

- Deployment with current and available working infrastructure for research at PARC for continuing research and development in.
 - Solar thermal Heliostat Tracking
 - Completion of Solar Stove/Boiler station
 - Lead Acid battery Research
 - Body Armor development
 - Missile and Gravity Bomb Guidance System development
- Deployment of HPC infrastructure/relevant mathematical software libraries for advanced computational analysis, modeling and simulations.
- Relevant manpower training/acquisition of basic skillsets in the following areas:

Milestone I: (Short-term Plan (January 2021 to December 2021): continued

- Advanced computational analysis and modeling with MATLAB,
- Advanced computational modeling/simulations with MATLAB/MATLAB Simulink,
- Advanced computational modeling/simulations with MATLAB toolboxes,
- Advanced computational modeling/simulations with Python packages, etc.
- (ii) Practical applications of advanced computational modeling/simulations in scientific R&D:
- Security and Defence modeling (mathematical insurgency)
- Health and Epidemiological modeling (mathematical epidemiology)
- Food and Agricultural modeling (mathematical agriculture),
- Power sector analysis and energy modeling, & simulations
- Environmental hazards/global warming modeling, & simulations etc.,

Milestone II: Medium-term Plan (January 2022 to December 2024):

- Specialized/Suitable Staff manpower acquisition
- Upgrade of Solar thermal Heliostat Tracking to 1 MW thermal power
- Optimization of Lead Acid battery Research
- Optimization of Body Armor development
- Optimization of Missile and Gravity Bomb Guidance System development
- Deployment of Printed Circuit Board Facility for Electronics Devices
- Deployment of foundational knowledge/skillsets in Machine learning, Data analytics and Artificial Intelligence (AI) methodologies for advanced scientific R&D activities,
- Relevant manpower training/acquisition of basic skillsets in the following areas:
 - Introduction to mathematics for machine learning, data analytics and AI methodologies,
 - Introduction to Artificial Intelligence algorithms in MATLAB,
 - Introduction to Artificial Intelligence algorithms in Python,
 - Introduction to Artificial Intelligence algorithms in R, etc.

Milestone II: Medium-term Plan (January 2022 to December 2024): (continued)

- Practical applications of Machine learning, Data analytics and AI methodology in scientific R&D:
- Security and Defence modeling (mathematical insurgency)
- Health and Epidemiological modeling (mathematical epidemiology)
- Food and Agricultural modeling (mathematical agriculture),
- Power sector analysis and energy modeling, & simulations
- Environmental hazards/global warming modeling, & simulations etc.,

Milestone III: Long-term Plan (January 2022 to December 2025):

- Development of mass manufacturing capabilities for
 - Solar thermal Heliostat Tracking to 100 MW thermal power
 - Lead Acid battery Research suitable for small scale industries
 - Body and Vehicle Armor suitable for the military and security agency's use.
 - Deployment of Missile and Gravity Bomb Guidance System development
 - Deployment of Printed Circuit Board Facility for Electronics Devices
- Deployment of high availability web-based servers for hosting internationally accessible and comprehensive research database management (DBM) and storage system tagged Journal of Advanced Inquest in Science & Technology (JAIST),
- Develop synergy and explore opportunities for inter-Centre/inter-Agency collaboration in advanced scientific R&D using machine learning, data analytics and AI methodologies,

Milestone III: Long-term Plan (January 2022 to December 2025): continued

- Develop synergy and explore opportunities for inter-Centre/inter-Agency collaboration in advanced scientific research datasets sharing and management,
- Explore and maintain a digital virtual environments for structures training/manpower development in Machine learning, Data analytics and AI methodologies as well as computational modelings and simulations
- Research and explore understandings of the Nigeria's AI R&D workforce needs,

Milestone III: Long-term Plan (January 2022 to December 2025): continued

- Environmental Biotechnology and biosecurity stewardship
 - Green Chemistry to produce and develop biochemicals for industry. Recycling, reuse and deployment of persistent organic pollutants and wastes to value added products. Blue Economy potential development in rural communities
- Food production and food security
 - Agricultural input development to boost food and income security
- Health Improvement through novel drug and theragnostic products development
 - Production, functionalization and conjugation of novel drugs for cancer treatment.
 - Ethically guided clinical trials to develop cancer and cardio-vascular diseases drug candidates.
 - Ultrasonography applications to diagnosis and triage of COVID 19 patients.
 - Development of rapid Diagnostics techniques for detection of zoonotic and emerging diseases

Milestone III: Long-term Plan (January 2022 to December 2025): continued

- Develop synergy and explore opportunities for public/private partnerships in AI technology to accelerate advances in AI scientific R&D,
- Bioeconomy Development Initiatives
 - Training a critical mass of technocrats to guarantee knowledge inflow into the STI ecosystem.
 - Bio-pesticides development programs.
 - Biofertilizers development programs.
 - Nanotechnology products development to boost national economy through sector-based interventions in manufacturing, health, agriculture and environment.

Challenges and Suggestions for improvement

- (a) With its relatively appreciable concentration of specialised and expensive equipment including a nuclear source emitting the ionizing gamma radiation, effective security is required. There is therefore the need to fence the entire Complex, which together with its associated S&T Park presently covers about 395 hectares.
- (a) In order to provide a conducive environment for R&D to flourish, there is the need to place the Complex on a high priority power supply line from the National Grid.
- (a) The greatest challenge is the insufficient budgetary allocation to SHESTCO. There is the urgent need for improved budget to the Complex to maintain the existing facilities and update them to be able to operate at the level expected of the Complex.

SHESTCO welcomes Researchers/Institutions to use the facilities and /or collaborate.

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