PROFILES ON SELECTED COMMERCIALISABLE RESEARCH AND DEVELOPMENT (R&D) RESULTS

Produced by

FEDERAL MINISTRY OF SCIENCE AND TECHNOLOGY

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TABLE OF CONTENTS

FOREWORD

The Federal Ministry of Science and Technology is mandated primarily to coordinate, publicize and promote Research and Development (R&D) activities of the nation's Research Institutes and Tertiary Institutions in all areas of academic endeavour. Government is aware that over the years, the Research Establishments have undertaken quite a number of successful R&Ds with tremendous potentials for the nation's quest for technological development, job creation and national productivity. Government is also aware that so far only a few of the successful developed R&Ds have been adopted and commercialized.

As part of the on-going reforms, Government is determined to exploit the successfully developed R&Ds as a fresh initiative for effectively mopping up our intelligent crop of existing idle hands. Towards this end, a selection of rated R&Ds with promise of high viability is presented in this publication. The publication has the dual purpose of enlightening the general public and specifically attracting the private entrepreneurs. Presently, the emphasis is on simple processes that can easily be managed with full domestic sourcing of process technology and inputs.

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This document is produced for the benefit of all interested local and international entrepreneurs willing to invest in small and medium enterprises using almost 100 percent local contents in process technology, design and manufacture of equipment/machinery, raw materials, plant maintenance and repairs. Most of these have been developed by Nigerian Researchers through various efforts of the Research Institutions. For any of the projects summarized in this document, it is necessary that detailed feasibility studies be produced which can be obtained by either linking up with the Ministry of Science and Technology or the particular Institution that perfected/developed the project.

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Chapter One

LIST OF RESEARCH ESTABLISHMENTS IN NIGERIA

A. Federal Ministry of Science and Technology

1. Federal Institute of Industrial Research, Oshodi (FIIRO), Lagos.
2. National Office for Technology Acquisition and Promotion (NOTAP), Abuja.
3. Raw Materials Research and Development Council (RMRDC), Abuja.
4. Nigerian Building and Road Research Institute (NBRRI), Abuja.
5. National Space Research and Development Agency (NASRDA), Abuja and its Centres as follows:
    i. Centre for Satellite Technology Development, Abuja.
    ii. Centre for Geodesy and Geodynamics, Toro, Bauchi.
    iii. Centre for Space Science, Nsukka.
    iv. Centre for Space Transport and Propulsion, Lagos.
    v. National Centre for Remote Sensing, Jos.
    vi. Centre for Basic Space and Technology Education, Ile-Ife.
6. Sheda Science and Technology Complex (SHESTCO), Abuja.
7. National Agency for Science and Engineering Infrastructure (NASENI), Abuja and its Agencies as follows:
    i. Centre for Adaptation of Technology (CAT), Awka.
    ii. Hydraulic Equipment Development Centre, Kano
    iii. Engineering Materials Development Institute (EMDI), Akure.
    iv. Scientific Equipment Development Institute (SEDI-M), Minna.
    v. Scientific Equipment Development Institute (SEDI-E), Enugu.

vi. National Engineering Design Development Centre (NEDDEC), Nnewi.

8. National Information Technology Development Agency (NITDA), Abuja.
9. National Centre for Genetic Resources and Biotechnology (NACGRAB), Ibadan.
10. Nigerian Natural Medicine Development Agency (NNMDA), Lagos.
11. Regional Programme for Technology Management (REPTEM), Lagos.
12. National Centre for Technology Management (NACETEM), Ile-Ife.
13. National Biotechnology Development Agency (NABDA), Abuja and its Centres as follows:.
    i. North West Zonal Biotechnology Centre, Ahmadu Bello University, Zaria.
    ii. South-West Zonal Biotechnology Centre, University of Ibadan, Ibadan.
    iii. North-Central Zonal Biotechnology Centre, University of Jos, Jos.
    iv. North-East Zonal Biotechnology Centre, University of Maiduguri, Maudiguri.
    v. .South-East Zonal Biotechnology Centre, University of Nigeria, Nsukka.
    vi. South-South Zonal Biotechnology Centre, University of Port-Harcourt.
14. Nigerian Institute for Trypanosomiasis Research (NITR), Kaduna.
15. Federal College of Chemical and Leather Technology (CHELTECH), Zaria.
16. Project Development Institute (PRODA), Enugu.

17. National Research Institute for Chemical Technology (NARICT), Zaria.
18. Energy Commission of Nigeria (ECN), Abuja and its Centres as follows:
    i. Usman Danfodio Energy Research Centre, Sokoto
    ii. Centre for Energy Research and Development, A.B.U., Zaria
    iii. Centre for Energy Research and Development, OAU, Ife
    iv.. Centre for Energy and Training, UNN, Nsukka.
19. Nigerian Institute of Science Laboratory Technology (NISLT), Ibadan.
20. Technology Incubation Programme (TIP) at the following Centres:
    i. Lagos Technology Incubation Centre, Lagos State.
    ii. Aba Technology Incubation Centre, Abia State.
    iii. Kano Technology Incubation Centre, Kano State.
    iv. Calabar Technology Incubation Centre, Cross River State.
    vi. Minna Technology Incubation Centre, Niger State.
    vi. Nnewi Technology Incubation Centre, Anambra State.
    vii. Benin Technology Incubation Centre Edo State.
    viii. Birnin Kebbi Technology Incubation Centre, Kebbi State.
    ix. Bauchi Technology Incubation Centre, Bauchi State.
    x. Maiduguri Technology Incubation Centre, Borno State.
    xi. Warri Technology Incubation Centre, Delta State.
    xii. Uyo Technology Incubation Centre, Akwa Ibom State.
    xiii. Akure Technology Incubation Centre, Ondo State.
    xiv. Sokoto Technology Incubation Centre, Sokoto State.
    xv. Gusau Technology Incubation Centre, Zamfara State.
    xvi. Lokoja Technology Incubation Centre, Kogi State.
    xvii. Lafia Technology Incubation Centre, Nasarawa State.

xviii. Makurdi Technology Incubation Centre, Benue State.

xix. Ibadan Technology Incubation Centre, Oyo State.

xx. Oshogbo Technology Incubation Centre, Osun State.

xxi. Ado-Ekiti Technology Incubation Centre, Ekiti State.

xxii. Enugu Technology Incubation Centre, Enugu State.

xxiii. Owerri Technology Incubation Centre, Imo State.

xxiv. Abakaliki Technology Incubation Centre, Ebonyi State.

xxv. Damaturu Technology Incubation Centre, Yobe State.

xxvi. Yola Technology Incubation Centre, Adamawa State.

xxvii. Gombe Technology Incubation Centre, Gombe State.

xxviii. Jalingo Technology Incubation Centre, Taraba.

xxix. Katsina Technology Incubation Centre, Katsina State.

xxx. Kazaure Technology Incubation Centre, Jigawa State.

xxxi. Kaduna Technology Incubation Centre, Kaduna State.

xxxii. Abeokuta Technology Incubation Centre, Ogun State.

xxxiii Yenogoa Technology Incubation Centre, Bayelsa State.

xxxiv. Port Harcourt Technology Incubation Centre, Rivers State.

xxxv. Jos Technology Incubation Centre, Plateau State.

xxxvi. Ilorin Technology Incubation Centre, Kwara State.

xxxvii. Abuja Technology Incubation Centre, FCT.

B. Federal Ministry of Agriculture and Rural Development

21. Cocoa Research Institute of Nigeria, Ibadan.

22. Forestry Research Institute of Nigeria (FRIN), Ibadan.

23. Rubber Research Institute of Nigeria (RRIN), Benin.

24. National Root Crops Research Institute (NRCRI), Umudike.

25. National Cereal Research Institute, Bida.

26. National Institute for Fresh Water Fisheries Research, New Bussa.
27. National Horticultural Research Institute, Ibadan.
28. Nigerian Stored Products Research Institute, Ilorin.
29. Lake Chad Research Institute, Maiduguri.
30. Nigerian Institute for Oceanography and Marine Research, Lagos.
31. Institute of Agricultural Research and Training, Obafemi Awolowo University, Ibadan.
32. Nigerian Institute for Oil Palm Research, Benin City.
33. Federal Soil Conservation School, Owerri.
34. Federal College of Animal Health and Production Technology, Ibadan
35. Institute for Agricultural Research and Extension Services, Ahmadu Bello University, Zaria.
36. National Animal Production Research Institute, Zaira.
37. Federal College of Wildlife Management , New Bussa, Niger State
38. Federal College of Forestry, Ibadan.
39. Federal College of Animal and Production Technology, Jos.
40. Federal College of Fisheries and Marine Technology (FCFM), Lagos.
41. Federal College of Agriculture, Akure.
42. Federal College of Agriculture, Umudike.
43. Federal College of Veterinary and Medical Laboratory and Technology,
44. Federal Soil Conservation School, Kuru, Jos.
45. Veterinary Research Institute (VOM), Jos.
46. National Centre for Agricultural Mechanization, NCAM, Ilorin.

47. Rural Agricultural and Industrial Development Scheme, RAIDS, Ibadan.
48. Nigerian Agricultural Cooperative and Rural Development Bank (NACRDB), Kaduna.
49. Rural Management Training Institute (ARMTI), Ilorin.

C. Federal Ministry of Aviation

50. Nigerian College of Aviation Technology, (NCAT), Zaira.

D. Federal Ministry of Health

51. Nigeria Institute of Medical Research (NIMR), Lagos.
52. Nigerian Institute of Pharmaceutical Research and Development (NIPRD), Idu, Abuja.

E. Federal Ministry of Industry

53. National Automotive Council, Abuja.
54. National Sugar Development Council, Abuja.
55. Small and Medium Enterprises Development Agency of Nigeria (SMEDAN), Abuja and its 21 Industrial Development Centres (IDCs).
56. Bank of Industry (BOI), Lagos.
57. African Regional Centre for Design and Engineering Manufacture (ARCEDEM), Ibadan.

F. Federal Ministry of Commerce

58. Department of Patent and Registration, Abuja.

G. Federal Ministry of Solid Minerals Development

59. Nigerian Mining Corporation, Jos.
60. Nigerian Coal Corporation, Enugu.
61. Bitumen Project, Akure.
62. Geological Survey of Nigeria, Kaduna.

H. Federal Ministry of Power and Steel

63. Metallurgical Training Centre, Onitsha.
64. National Metallurgical Development Centre, Jos.
65. National Steel Raw Materials Exploration Agency, Kaduna.

Chapter Two

SUMMARY OF SOME COMMERCIALISABLE R&D RESULTS

2.1 Production of Electrical Porcelain Insulator

Description:

This is a ceramic product produced from Nigerian clays. The product is used for the insulation of buildings and other structures from direct contact with electric current. NEPA, the main consumer of the product in Nigeria, currently imports most of its requirements.

Products Derivable:

(a) Electrical porcelain insulators
(b) Related ceramic wares.

Capacity for Local Fabrication:

(a) Capacity for local fabrication has been demonstrated by PRODA which developed the product as local substitute for imported ones. These products have been exhibited at Trade Fairs and Science and Technology Fairs.
(b) Ceramic manufacturing machines could be adapted for the production of the electrical insulator.

Institution of Origin:

The Projects Development Institute (PRODA), Enugu; Life-Mac Industries Limited, Oji River, Enugu and The-Inter Linked Technology, Plc, Lagos.

Raw Materials Availability:

The clay materials needed for the manufacture of electrical porcelain insulator are available in every State of the Federation and the FCT. Quartz and feldspar are available in commercial quantities in Ajaokuta, Lokoja, Abeokuta and a few other places in Nigeria. Kaolin is available in Jos, Kankara, Nsu and Oji River. Ball clay is available in Oji River and Enugu.

Other Information:

(a) Know how and sources of equipment procurement can be obtained from PRODA.
(b) No patent needed.

2.2 Production of Ceramic Water Filter Elements and Plastic Percolator

Description:

(a) The ceramic water filter candle for filteration of potable water has been developed as substitute for imported ones. The know-how for the mould used to produce filter candles from clay as well as the clay mixture is available.

(b) This project will make household potable water filteration affordable.

Capacity for Local Fabrication:

The capacity for local design and fabrication of the facilities for the production of the water filter elements and the plastic percolator has been demonstrated by the local R&D team involved in the project.

Raw Materials Availability:

(a) The ceramic materials for the production of water filter elements are locally sourced.

(b) The raw materials for the production of plastic percolator are still being imported.

Institution of Origin:

The Projects Development Institute (PRODA) at Enugu.

Others Information:

(a) The production of water filter elements in Nigeria will reduce the country's dependence on importation. It is a viable venture.

(b) No outstanding patent.

2.3 Groundnut Processing for the Production of Kuli-Kuli

Description:

Roasted groundnut is decorticated and processed for oil and cake. The cake is used to produce various products including peanut butter, Kuli-Kuli, etc. It is an up-grade of existing indigenous technology.

Capacity for Local Manufacture:

All items of equipment, machinery and raw materials are locally sourced.

Raw Materials Availability:

Groundnut, the main raw material is abundantly available locally.

Institute of Origin:

(a) The Federal Institute of Industrial Research, Oshodi (FIIRO).

(b) National Research Institute for Chemical Technology (NARCT) at Zaria.

Other Information:

(a) Economically viable project.
(b) Patents not needed.

2.4 Production of Pharmaceutical Grade Starch from Maize

Description:

This is an oil-free starch used as base material for the formulation of many pharmaceutical products.

Products Derivable:

Pharmaceutical Grade Starch (PGS).

Capacity for Local Manufacture:

Local capability to design facilities to remove the oil from the maize grit so as to produce the high quality PGS has been confirmed.

Raw Materials Availability:

The raw material (maize) is abundantly available.

Institute of Origin:

(a) The National Institute for Pharmaceutical Research and Development (NIPRD) at Idu, Abuja.

(b) Federal Institute of Industrial Research (FIIRO), Oshodi.

Other Information:

(a) Current national needs of 3,000 metric tons are 100% imported.
(b) The project is economically viable.
(c) No patent.

2.5 ABO Blood Grouping Antisera Production

Description:

The antiserum is produced for use in the detection and characterization of the A.B.O. blood groups and other factors in the blood of human beings.

Products Derivable:

(a) A.B.O. Blood group characterization antisera.
(b) Rhesus factor detection antisera.

Capacity for Local Production:

The process for the production of the antisera has been fully developed locally and the products have undergone several field trials and certified reliable for all purpose application.

Raw Materials Availability:

Reagents for the production of the antisera are still imported. All other inputs are sourced locally.

Institute of Origin:

Nigerian Institute of Management Research (NIMR), Lagos.

Additional Information:

Local production of the antisera is an economically viable project due to its import substitution disposition.

2.6 Production of Hydrated Lime

Description:

This product is utilized in water treatment, leather processing, paper industries, fertilizer manufacture. It is also an important chemical general basification of acidic soils.

Products Derivable:

Hydrated Lime.

Capacity for Local Production:

The local capacity for the design and fabrication of lime kiln used for the production of hydrated lime has been amply demonstrated by the pilot commercial outfit at Zaria. There is also a plant in Lokoja owned by Messrs Quest Two Enterprises (Nig.) Limited.

Raw Materials Availability:

The main raw material for the production of hydrated lime is limestone and is readily available locally in Odukpani, Alfamosing, Jakura, Ashaka, Yaudev, Ubo, Ukpilla, Nkelegu, Kumbari Lokoja, Otukpa and many other locations..

Institute of Origin:

(a) Federal Institute of Industrial Research (FIIRO), Oshodi.
(b) National Research Institute for Chemical Technology (NARICT), Zaria.

Other Information:

(a) Delta Steel has a large scale hydrated lime plant, which however is not in operation presently. However, a few industries which use hydrated lime for its manufacturing process have established mini-plants for its production.

(b) A pre-feasibility study shows that hydrated lime manufacture is a most viable venture.

2.7 Production of Papain

Description:

The product is a valuable raw material for brewing, meat processing and pharmaceutical industry. It is produced from paw-paw (carica papaya).

Products Derivable:

(a) Crude papain.
(b) Refined papain.

Capacity for Local Production:

Local manufacture of crude papain has been perfected. Non-availability of spray-drier is the main constraint in the production of refined papain.

Raw Materials Availability:

Paw-paw, the raw materials for production of papain is abundantly available in Nigeria. The current production level of paw-paw in Nigeria can be expanded 5-fold.

Institute of Origin:

National Research Institute for Chemical Technology (NARICT), Zaria.

Other Information:

(a) There is a high demand for papain in Nigeria. 100% of current demand is met through importation.

(b) No patents.

2.8 Electricity (NEPA) Lamp with Automatic Voltage Regulated Source

Description:

An emergency lighting system which can sustain the supply of light about 6 hours after power failure. The system is made to operate using 4 of 2-feet fluorescent tubes which will light automatically when the power from the main grid goes off. The lamp is made up of a power storage source and an automatic voltage regulator (AVR) which is digitally controlled. The AVR can be used separately to safeguard domestic appliances from excessive power fluctuations.

Products Derivable:

(a) Automatic (power failure stimulated) lamp for 6 hours lighting.
(b) Automatic Voltage Regulator (AVR).

Capacity for Local Production:

The capacity for local design and manufacture of the automatic lamp has been demonstrated by the production of a functional model which has been exhibited at Science and Technology Fairs.

Raw Materials Availability:

All components and materials needed for the production of the system are available in the Nigerian market.

Institute of Origin:

The Centre for the Adaptation of Technology (CAT), Awka, Anambra State.

Other Information:

(a) This is a viable project the product of which serves as a valuable contingency for the constant power failure in Nigeria.

(b) No. patent.

2.9 Printed Circuit Boards (PCB) Production

Description:

Copper clad boards and flexible PCB type of electronic circuits. Available in single and double sided PCB. The circuit boards can be used for the manufacture of communication equipment, computers and electronics items.

Products Derivable:

(a) Single sided PCB.
(b) Double sided PCB
(c) Flexible PCB.

Capacity for Local Manufacture:

The capacity for local manufacture of PCB has been demonstrated by the locally manufactured products which have been exhibited at Science Fairs. Local Capability has also been developed for copying various PCB artworks of electronic circuits and the adaptation of such circuits.

Institution of Origin:

The Centre for Adaptation of Technology (CAT), Awka, Anambra State.

Raw Materials Availability:

There is no difficulty in acquiring all the materials for the production of PCB in Nigeria.

Other Information:

(a) This is a valuable project that will lend support of Nigeria's pursuit of self-reliance in computer and electronics technology.

(b) No patents needed.

2.10 Solar Water Distillation Plant

Description:

A distillation plant that has facility to absorb energy as source of power for the distillation process.

Products Derivable:

Distilled water.

Capacity for Local Fabrication:

The capacity for local fabrication of the solar distillation plant has been demonstrated in the functional prototype on display.

Institution of Origin:

(a) Science Equipment Development Institute (SEDI), Enugu.
(b) The Science Group of the Government Secondary School Gwarimpa, FCT
(c) Usman Dan Fodio Energy Research Centre, Sokoto .

Raw Materials Availability:

All components for the fabrication of the solar distillation plant are sourced locally.

Other Information:

(a) This is a valuable project that can be undertaken in all LGAs of the Federation.

2.11 Production of Industrial Alcohol from Cassava Starch Using an Enzyme Derived from Sweet Potato (the Potato B-amylase)

Description:

(a) This is a process that produces alcohol from very cheap raw materials. The enzyme is mixed with the liquor containing the cassava starch and allowed to ferment under a given condition for a given number of days. The fermented liquor is processed for distillation to obtain the alcohol. The first distillate usually contains 6% alcohol (W/W). This could be re-distilled to produce up to 95% alcohol.

(b) Other raw materials, especially molasses are popular inputs into alcohol production.

Products Derivable:
(a) Industrial alcohol.
(b) Pure or analar alcohol.

Capacity for Local Fabrication:
The capacity for local fabrication of fermentor and the process for the extraction of the amylase enzyme from sweet potato is well demonstrated.

Institution of Origin:
(a) The Project Development Institute (PRODA), Enugu.
(b) The Federal Institute for Industrial Research, Oshodi (FIIRO), Lagos.

Raw Materials Availability:
(a) The raw materials inputs, namely:
- cassava starch,
- sweet potatoes
- molasses
- yeast,

are all available locally.

(b) the materials for the fabrication of fermenters and distillation plants are all available locally.

Other Information:
(a) This is a most viable project, especially, as the local demand for the products is enormous.
(b) Patents not needed.

2.12 Production of Cassava Pellets for Livestock Feeds

Description:

The cassava pelleting machine processes the cassava to extrude the cassava pellets. The pellets are combined with other nutrient-bearing food-stuffs in the formulation of livestock feeds such as fish feeds, Layers, Poultry feeds, etc.

Products Derivable:

(a) Cassava pellets
(b) Livestock feeds
(c) Cassava starch
(d) Fish feeds.

Capacity for Local Fabrication:

(a) The capacity for local fabrication of the cassava pelleting machine has been demonstrated by a number of industrial and research outfits, including NIOMR at Lagos, NRCRI at Umudike, the FWRI at New Bussa, the Paul Omu Fish Farm in Rivers State.

(b) Local fabricators could adopt the available design and mass produce the machine.

Institution of Origin:

(a) The Project Development Institute (PRODA), Enugu.
(b) The Federal Institute of Industrial Research (FIIRO), Oshodi.
(c) National Root Crop Research Institute (NRCRI), Umudike, Umuahia.

Raw Materials Availability:

Nigeria is one of the largest producers of cassava in the world. Pelleting is one of the industrial uses of cassava.

Other Information:

(a) Cassava pellets producing machine could be adapted to process cassava into various forms for export.

(b) No patent.

2.13 Production of Fat-Liquor Oil

Description:

A given oil is sulphonated to produce fat-liquor oil. This is used to lubricate leather to prevent cracking and for improving its physical properties such as tensile strength, breakages, stretch, stitch, tear and comfort.

Products Derivable:

Fat-liquor.

Capacity for Local Production:

The process for local production of the fat-liquor has been perfected and a functional pilot plant effected.

Raw Materials Availability:

All the raw materials particularly the vegetable oil for local production of fat-liquor are readily available in Nigeria.

Institution of Origin:

The National Research Institute for Chemical Technology (NARICT), Zaria.

Other Information:

(a) This is a most viable business to undertake. There is a particularly high demand for the product in Nigeria.

(b) No patents.

2.14 Soy-Ogi Production

Description:

Soy-Ogi is a fermented corn-based soyabean – fortified protein rich weaning food. The product is available for babies and for adults.

Products Derivable:

(a) Soy-Ogi (baby food)
(b) Soy-Ogi (Adult food)
(c) Soy-milk.

Capacity for Local Production:

Research into Soy-Ogi and final product development were undertaken in Nigeria. Design and fabrication of all necessary equipment and machinery (except spray dryer) are undertaken in Nigeria. Drum drying in the place of spray drying can also be applied in the manufacture of Soy-Ogi.

Raw Materials Availability:

The raw materials (Soyabean and Corn) needed for the manufacture of Soy-Ogi are abundant in Nigeria.

Institution of Origin:

The Federal Institute of Industrial Research, Oshodi (FIIRO).

Other Information:

(a) No large-scale industrial production of Soy-Ogi in Nigeria yet.

(b) Patented since 1971.

2.15 Production of Instant Pounded Yam Flour

Description:

Pounded yam flour is a special dish among Nigerians. The production system includes sorting, peeling and slicing; parboiling, drying, milling; weighing, packaging and sealing.

Products Derivable:

Instant Pounded Yam Flour with a shelf-life of one year in air-tight packaging.

Capacity for Local Production:

The product is in the market, produced and marketed by OFI Food Industries Limited, Ibadan.

Raw Materials Availability:

Raw Materials locally sourced . The equipments needed are locally fabricated. FIIRO has developed and standardized the production equipment to facilitate technology transfer to farmers and other entrepreneurs.

Other Information:

The development of instant pounded yam flour reduces post harvest losses and also removes the drudgery involved in the traditional method of preparing pounded yam.

2.16 Extraction of Essential Oils, Flavours and Fragrances from Local Aromatic Plants

Description:

Hydro-distillation, chilled water condensation have been used to extract essential oils from local aromatic plants.

Products Derivable:

(a) Essential oils
(b) Flavours
(c) Fragrances/Perfumes.

Capacity for Local Manufacture:

FIIRO has designed, fabricated and standardized the multi-purpose essential oil distillation plant that is very simple, appropriate and easily applicable for essential oils production. In spite of the above, Nigeria still imports essential oils, flavours, fragrances/perfumes basically because there are no local manufacturers of these all important industrial intermediates.

NARICT has documented important works accomplished on essential oils especially on Eucalyptus and neem seeds.

Raw Materials Availability:

Aromatic plants, which are the raw materials for the production of essential oils and others, are abundantly available in Nigeria.

Other Information:

(a) Creation of employment by the establishment of intermediate industries in this area.

(b) Reduction of the problem of rural-urban drift as rural dwellers will be involved in deliberate cultivation of these aromatic plants.

2.17 Design and Manufacture of Rotary Furnaces

Description:

Rotary furnace of different sizes are designed and fabricated for the production of grey cast iron from cast iron scraps.

Products Derivable:

Different sizes of Rotary Furnace and Foundry equipment.

Capacity for Local Manufacture:

Local capability to design, develop and fabricate rotary furnace has been confirmed with the many laurels the project has won locally and internationally.

Raw Materials Availability:

The lining materials for the furnace are sourced locally, kaolin, kaolinite clays and Alumino-silicates refractories being the commonest.

Institution of Origin:

Project Development Institute (PRODA) and Engineering Materials Development Institute, EMDI.

Other Information:

The furnace is fired with liquid fuels, diesel and low pour fuel oil. Foundry technology acquisition is cardinal to and critical for any successful replication of parts of any machine.

2.18 Development of Alternative Building Technologies

Description:

These are building materials technologies and innovations developed from locally sourced materials including agro-industrial wastes with premium placed on preservation of the eco-system.

Products Derivable:

Cement stabilized soil blocks [from laterites, 4%]
Fired bricks,[from laterites]
Improved sun-dried bricks
Brick making machine, locally fabricated
Roofing materials [e.g. fibre based roofing sheet, mador, tile fibre concrete roofing sheet]

Capacity for Local Manufacture:

NBRRI has perfected these technologies.

Raw Materials Availability:

One hundred percent locally sourced.

2.19 Production of Made-in-Nigeria Leather Football

Introduction:

Football has become a household sport and unifying force in Nigeria today. However, all footballs played in Nigeria are imported. The objective of producing footballs locally is to create jobs and reduce the cost of footballs and importation, thereby making savings in foreign exchange.

Raw Materials:

The jebu cattle hides have been found to be very good for the production of football leathers. Other raw materials such as the bladder, lining, threads, etc. can be sourced locally.

Processing:

The raw hides are cleaned in the beamhouse, tanned in the tanyard and then finished in the finishing yard.

Production of the football leather involves the usage of bates, lime and vegetable tannins Parkia clappertoniana (Dorowa) which can wholly be sourced locally. Production of the football involves cutting the leathers into the appropriate shapes and sizes, stitching and closing. A full complement of the technology is available on request from CHELTECH, Zaria.

Equipment:

The full list of equipment required for football production is available on request.

Capital Requirement:

A small cottage football manufacturing outfit can be set up with the company commissioning a mechanized tannery to produce its leathers to meet football leather specifications. By so doing, most of the capital cost may be greatly reduced. The football leather therefore becomes a raw material to the company

Returns on investment in within a very short period since there is a ready market for the products.

2.20 Production of Footwear and Leather Goods

Introduction:

There are various types of footwear to suit particular situations and applications. There are shoes for leisure, male and ladies shoes, industrial boots and military boots. Leather goods are also used as handbags, traveling bags, brief cases, puffs, and for upholstery or furniture. Nigeria has abundant resources for the production of these items.

Raw Material:

The raw materials for footwear and leather goods are hides and skins. The Sokoto red goat has been adjudged to produce the best leathers for footwear worldwide. Hides for the production of boots and other heavy leather goods are available locally. Other raw materials for the production of footwear include the linings, ornaments and soles which can be obtained locally.

Processing:

Hides and skins are cleaned in the beamhouse to remove dirt, excess flesh and other impurities by the application of lime and bates. The hides and skins are then taken to the tanyard where they are tanned using chrome or vegetable tannins such as Bagaruwa and Parkia Clappertoniana (Dorowa). Fatliquors and finishing chemicals are applied to meet the specific properties of the leathers. Only the vegetable tanning materials are obtained locally.

The technology of the conversion of the leathers into footwear and leather goods are available on request from CHELTECH, Zaria.

Equipment:

The footwear or leather goods manufacturer may buy his finished leathers from mechanized tanneries in the country. Technical advice on the equipment required for the production of footwear and leather goods are available obtainable from CHELTECH.

Capital Investment:

The capital cost for setting up a footweat factory depends on the types of footwear, the volume or output expected, etc. A small cottage production can also be embarked upon at a very minimal cost. These and other information can be obtained on request from CHELTECH.

2.21 Some Valuable Equipment and Machinery

A. ALCOHOL DISTILLATION PLANT

a) Function**:** Distillation of palm wine and other fermented sugar solution to produce alcohol and vinegar.

b) Description:
Consists of a boiler unit, condenser, cooling and condenser outlet.

c) Institution of Origin:
i) The Federal Institute for Industrial Research, Oshodi (FIIRO)
ii) The Projects Development Institute (PRODA), Enugu.

B. THE PASTEURISER

a) Function: Pasteurisation of perishable products such as milk, bottled palm wine, fruit drinks, etc.

b) Description:
A water-bath with heating elements, thermostat, pumping system for water circulation. The prototype has capacity to handle 150 bottles of products per hour.

c) Institution of Origin:
The Federal Institute for Industrial Research (FIIRO), Oshodi.

C. THE CORKING FACILITY

a) Function: For corking (capping) of bottles.

b) Description:
The crown hammer of the machine has a magnetic tip to hold the cork in position for capping. Corking is firm.

c) Institution of Origin:
The Federal Institute for Industrial Research (FIIRO), Oshodi.

D. SPECIFIC WEIGHTING MACHINE

a) Function: For measuring specific weights of products for packaging.

b) Description:
Consists of a hopper to introduce the item to be measured and a chute to collect the measured item. It has automatic device to set the desired weights.

c) Institution of Origin:
The Federal Institute for Industrial Research (FIIRO), Oshodi.

E. DISTILLED WATER PLANT

a) Function: To produce pure distilled water.

b) Description:
Consists of boiler unit, condenser, cooling tower and pump to supply water, pilot model can produce 15 litres of distilled water per hour.

c) Institution of Origin:
(i) Projects Development Institute (PRODA) at Enugu.
(ii) Federal Institute for Industrial Research (FIIRO), Oshodi.

F. MAIZE SHELLING MACHINE (motorized)

a) Function: For large scale shelling of maize.

b) Description:
Consists of wire mesh tray for grain separation. The shelling process is effected within a hollow core with rows of internal "**teeth**". This is driven by motor or engine.

c) Institution of Origin:
(i) Projects Development Institute (PRODA) at Enugu.
(ii) The manual maize sheller is available at the Institute of Agricultural Research (IAR), ABU, Zaria.

G. FISH SMOKE DRYER

a) Function: To smoke and dry fresh and/or frozen fish.

b) Description:
Consists of drying trays and chimneys for outlet of smoke. Firing of the equipment is manual.

c) Institution of Origin:
(i) The Federal Institute of Industrial Research (FIIRO), Oshodi.
(ii) Nigerian Institute of Oceanography and Marine Research (NIOMR), Lagos.

H. LAUNDRY SOAP KIT

a) Function: For the production of laundry and toilet soaps.

b) Description:
A set of reactor with caustic soda stand and metallic tray dividers. Also, a wooden cutting table, cooling trays and collection racks. Available model has capacity of 400 litres.

c) Institution of Origin:
(i) Federal Institute for Industrial Research (FIIRO), Oshodi.
(ii) National Research Institute for Chemical Technology (NARICT), Zaria.

I. WATER ACTIVATED HEATER

a) Function: For boiling water for household use and for industrial use.

b) Description:
The heater gets activated only when it is immersed in water for heating. Does not heat up or shock when placed outside water and connected (and switched on) to the current.

c) Inventor:
Mr. James O. Agboronfo
No. 6 Agboronfo Street,
Eguane – Uromi,
P. O. Box 292,
Uromi, Edo State.

2.22 Brown Sugar Production

Objective: The objectives of commercializing this project include:

(i) Bridging the demand/supply gap of sugar in the country.

(ii) Curtailing capital flight in importing sugar.

(iii) Proliferation of mini sugar industries among the numerous sugarcane farming communities in the country.

Process Description:

Cane processing in the mini plant follows a simple well-coordinated series of stops starting with sugar cane (raw material) and ending with both liquid sugar and free-flowing brown sugar crystals.

Cane stalk tied in bundles are first weighed using a hanging balance and the weights recorded. The canes are not fed into the mills, 2 – 4 stalks at a time. For the 10 tcd, two such mills, each having a milling capacity of 5tcd are used. When the stalks are fed into the mills at one end, the bagasse comes out at the opposite end and free falls into an area where it is later collected, spread out to dry and used as fuel for the open pan system. The extracted juice is collected by a tray and runs through a muslin cloth screen into the pipes through which it is conveyed to the boiler pans.

There are three boiler pans, which are filled one after the other. Each pan takes about 400 litres of juice but the first pan which directly receives the fire is only half filed to avoid the loss of juice through frothing over. While boiling, okra stem extract is added to the juice and the scum floating on the surface is removed periodically to yield a clear juice. Contents of the first pan is boiled down and evacuated, the content of the second (middle) pan is transferred into it and, those of the third pan transferred into the second pan while the third is filled with fresh juice and so on.

Once boiled down, the juice concentrate or syrup is evacuated manually using large big-handed spoons. These are first discharged into large plastic drum before being transferred into the crystallizer.

The crystallizer is a double compartment metal tank with baffles or stirrers that rotate at stepped-down speed of about two revolutions per/minute. Each compartment of the crystallizer can take 500 litres of syrup at a time. When crystallization is adjudged to be complete, the resulting massecuite is discharged into buckets and fed into the centrifuge inorder to separate the sugar from the mollasses.The centrifuge can effectively take 7-10L of massecuite which can be spun down to the required dryness (15 – 25% moisture content) within 45 – 10 seconds. Some time is used for loading and off-loading, the centrifuge. Also after about 5 runs, the inner basket is washed with water so as to un-clog the sieves of the centrifuge.

The molasses are discharged through vents in the outer jacket of the centrifuge into buckets. The sugar crystals obtained after centrifugation are then dried using an electric air (rotary) drier or spread on a raised platform in the factory house for 1 hour while constantly being turned over. The sugar is next graded using sieves. The sugar lumps obtained during grading are dissolved and reprocessed. Finally, the dry finished product – brown sugar is packaged in labeled polyethene packs and scaled.

End Product Features:

The major product of this project is crystalline brown sugar while the by-products include baggase, and molasses. The product is called brown sugar due to the colour of the crystalline sugar, which is brown.

Capacity for Local Fabrication:

The Federal Government of Nigeria through the Federal Ministry of Sciience and Technology 1986, set up a task force to design, fabricate and establish a motor-type brown sugar plant using indigenous technology. The prototype with a crushing capacity of 2 tonnes cane per day (tcd) was commissioned at the National Cereal Research Institute,Badeggi by government in 1988. The prototype was advanced to a 10 tcd mini plant using funds provided by Federal Ministry of Industries and was commissioned in 1989.

However, between 1994 and 1998 fresh fund from the World Bank sponsored National Agrricultural Research Project (NARP) and special grants under the auspices of the Federal Ministry of Agriculture and Rural Development were provided for the Mini Brown Sugar Technology. All the major components and processes were redesigned such that by 1996 a more efficient model of the 10 tcd plant had been fabricated and installed at NCRI Badeggi. With this development, the National Cereals Research Institute (NCRI) now has the full

complement of the mini brown sugar plant ready for adoption by interested investors.

Raw Materials Availability:

The major raw material is sugar cane, of which, ten tonnes is required daily. No chemical is used at any stage during the processing. A local plant Okra, Abelmoschus esculents, is used for clarification. The stem of this plant is macerated in water and its extract is added to the juice while boiling and the scum formed is periodically removed. About 10L of the extract is required for one pan. Extract from about and soyabeen seed and ground etc, can also be used.

The major raw material – sugar cane, is to be sourced from farmers among whom the project is to be used. It is estimated at between 20 – 25 farmers planting 1 – 2 ha of land each would produce at least 2,000 tonnes of sugar cane at an average field of 60 tonnes/ha. This will supply all the cane needed by the factory. Groundnut or soyabean seeds can easily be sourced from the market and the quantity needed for a production season is about 20kg each. As for Okra stem, this can be planted round the factory site on a 0.1 ha plot for ready use once the Okra fruits is harvested.

Institution/Collaboration:

The major Institution is, the National Cereal Research Institute (NCRI), Badeggi.

Recommendation:

This project is ideal for commercialization as the demand for sugar is high and the project will lead to rural transformation through wealth creation. The project is already being commercialised by NOTAP as earlier stated.

2.23 Benniseed oil Production

Objectives:

The objectives are to produce benniseed (sesame seed) oil for local and expert markets and to produce benniseed meal or cake for cattle feed.

Process Description:

The extraction of benniseed oil is as shown in the flow chart below:

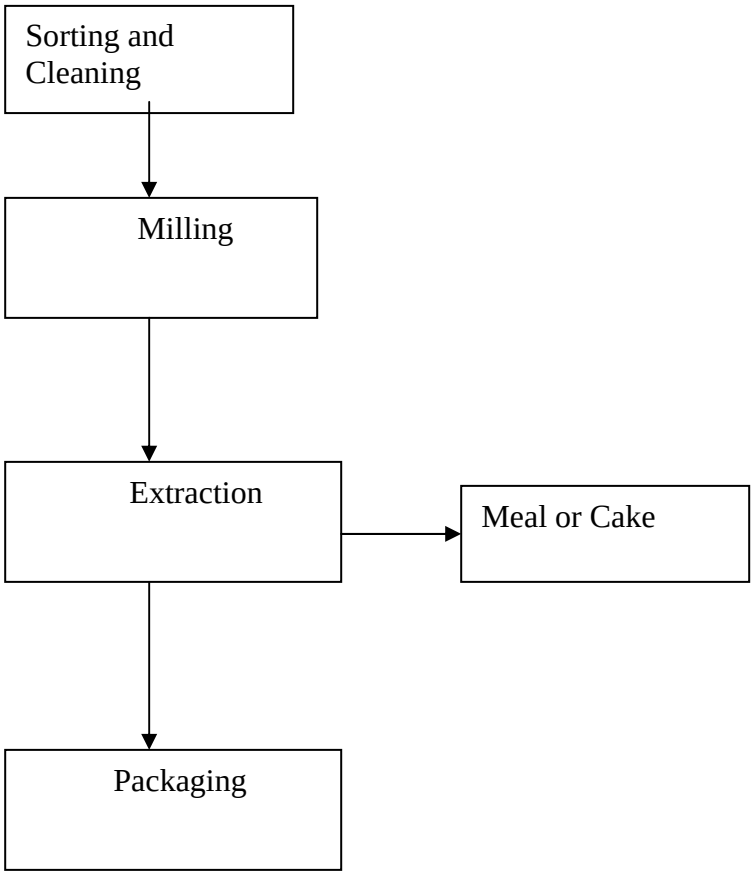


Figure 1: The Flow Chart for Processing Benniseed Oil.

i. **Sorting and Cleaning:**

The seeds are sorted and cleaned to remove foreign objects.

ii. **Milling:**

The seeds are then milled to fine or coarse form.

iii. **Extraction:**

The resultant milled product is cooked for a period until it softens for extraction either mechanically or through the use of solvent method.

iv. **Packaging:**

The extracted benniseed oil is packaged and labeled for the market.

v. **Meal or Cake:**

The meal or cake which is a co-product is a rich source of protein and can be used as cattle feed.

End Products//Features

The end products are benniseed oil and benniseed cake. An analysis of benniseed indicate the following composition:

Crude protein 25%
Ether extract 50%
Crude fibre 4%
Ash 5%
Nitrogen free extract 11%
Moisture 5%

Capacity for Local Fabrication and Production:

The technology for extracting benniseed oil can be sourced from the following institutions and organizations:

i. Federal Institute of Industrial Research Oshodi (FIIRO), Lagos.
ii. Products Development Institute (PRODA) Enugu.

iii. National Research Institute for Chemical Technology (NARICT) , Zaria.
iv. Kano Technology Business Incubation Centre (KTBIC) , Kano.
v. J.J. Advance Technical LTD.
vi. Barrage Engineering Company Orlu, Imo State.

The production capacity is estimated at 20 metric tonnes per annum.

Raw Materials Availability:

The raw materials are readily available in Nigeria as indicated in table 1 below:

Table 1: Estimated output of Benniseed in Nigeria

Year	Production/Tonnes	Value (N'000)
1992	49,000	1,470
1993	52,000	1,560
1994	56,000	1,680
1995	60,000	1,800
1996	64,000	1,920

.

Source: C.B.N Statistic Bulletin, 1997

Status/Problems:

The project is completed and is ready for commercialization.

Recommendations:

The project is recommended for commercialization to diversify the industrial base of the country and to meet local and export demands of benniseed of oil.

2.24 Groundnut Processing for oil

Objectives:

(a) To fill the gap in the local supply of edible oil due to high demand.

(b) To save foreign exchange as a result of stoppage in importation of foreign edible oil.

Process Description:

The production of oil from groundnut is summarised below :

(a) Harvested groundnut seeds are mechanically cleaned, sorted and stored in 50kg bags or silos at 12% moisture content.

(b) The seeds are washed in tanks to remove dirt, stones, dusk, weevils etc. They are then soaked in running water at room temperature for 4.5hrs to absorb water.

(c) Mix soaked seeds with hot water at an approximate ratio of 2.8 before grinding;

(d) Filter the slung using stainless steel cloth.

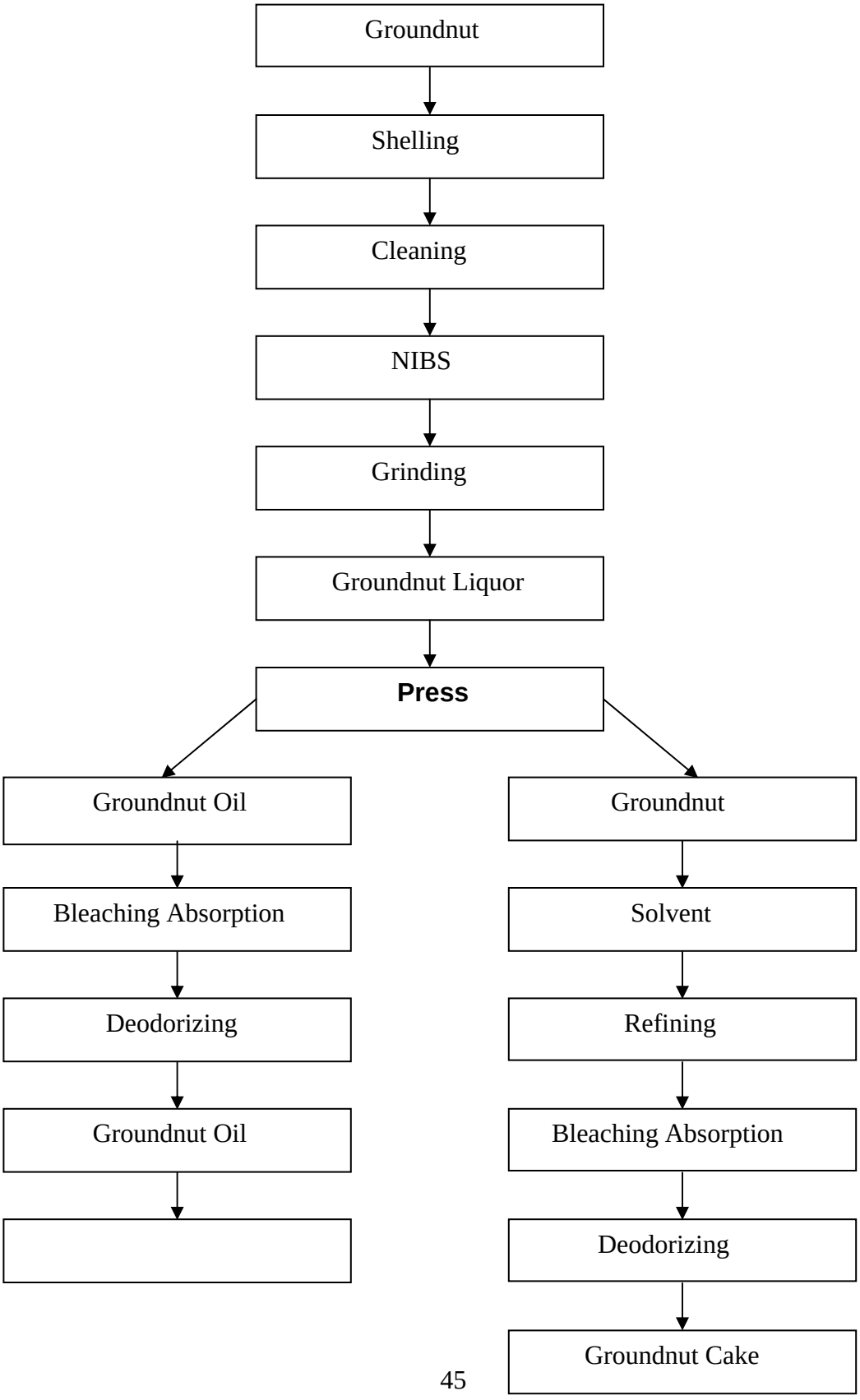
(e) Heat the extracted oil with the added salt and stabilizing agents in a formulation tank with agitators.

(f) Sterilize formulated oil for a few seconds in a plate type hat exchanger and chill rapidly.

(g) Pack the processed oil in litre polyethylene bottle or pouches.

(h) Finally, dry the residue for processing as cake.

FLOW CHART OF GROUNDNUT OIL



End Products/Features:

The end product is processed groundnut oil which could be put into various uses some of the uses of processed groundnut oil include manufacture of cooking oils, drying oils, salad dressing and ice cream. The meal, which is a by-product of oil extraction, can be processed into cake.

Capacity for Local Fabrication/Production:

About 2,500,000 litres of groundnut oil and 1100MT of groundnut cake can be produced per annum by an installed plant working at an optimum capacity of 25 days/month and 8 hrs/day.

Raw Materials Availability:

The only major raw material needed for the production of groundnut oil is groundnut seed. Groundnut is available in the country most of the year and more abundant in the month of August – November. It is possible that all raw groundnut seeds requirements of the plant could be sourced from the country. Other raw materials which are equally easily accessible in the country include water, stabilizing agents, colouring agents, and packing materials like polyethylene paunches caustic soda and sodium hydrochloride.

Status/Problems:

Research and Development for the production of groundnut oil in the country has been completed. The only problem to be envisaged is availability of working capital.

Recommendations:

Considering the present attention to agro-allied industries and SME sector by the government and also the recent ban on imported edible oil in the country, which consequently create an enabling environment, investment on the production of groundnut oil will be viable.

2.25 Production of Ethyl Alcohol

Objectives:

The objectives are to produce ethyl allohol (ethanol) for local and export markets and to diversify the industrial base of the country by utilizing an indigenous technology.

Pocess Description:
The production process for ethyl alcohol is as indicated in the process flow chart below:

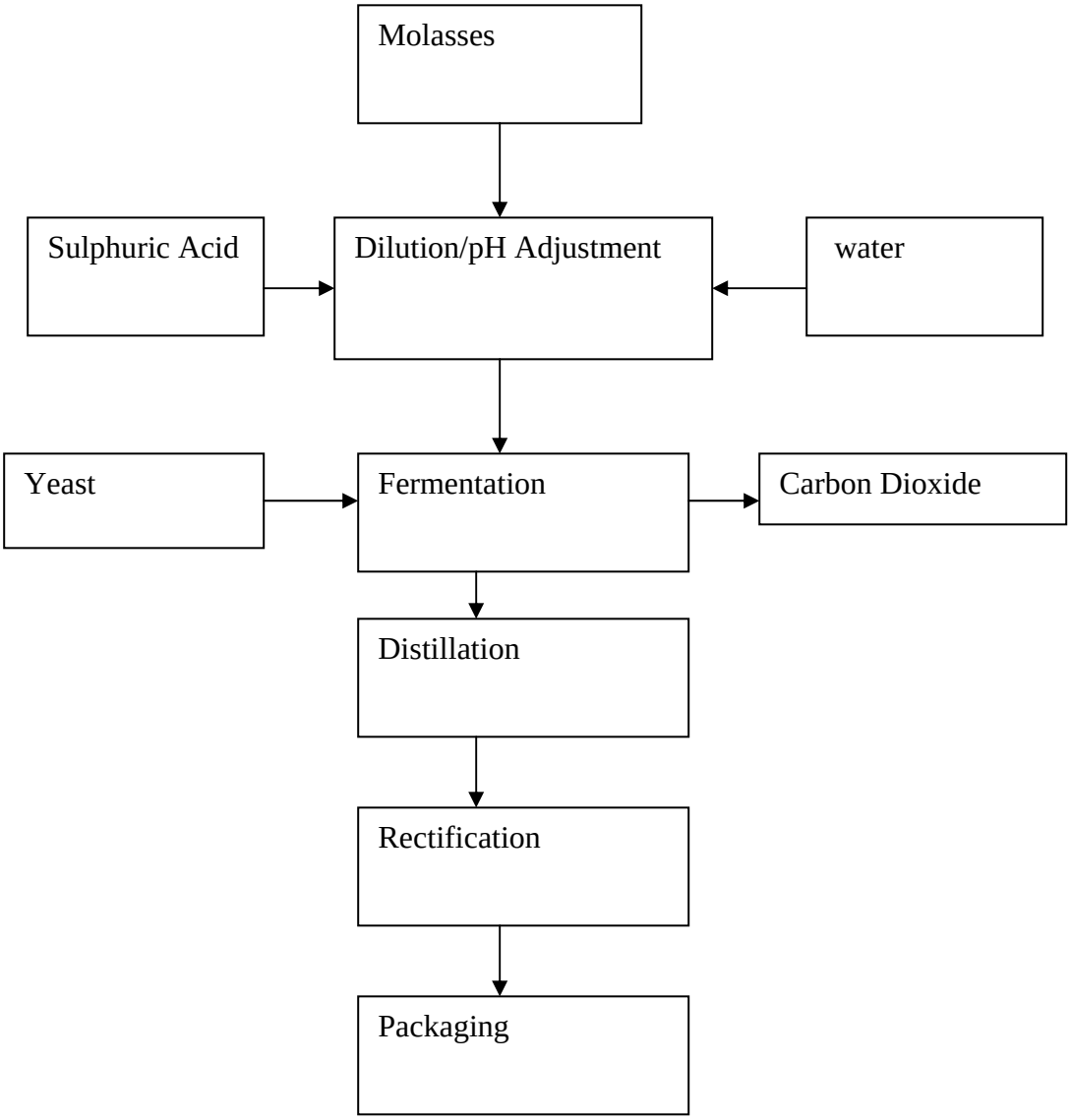


Figure : 1 Process Flow Chart of Ethyl of Alcohol.

i. **Molasses:**

The major raw materials is molasses, a co-product of sugar production from sugar cane.

ii. **Dilution/pH Adjustment:**

The molasses is first diluted with water to produce a solution containing 10% sugars. Sulphuric acid is then added to produce pH 4.5 environment.

iii. **Fermentation:**

The pretreated molasses is fed to the fermentation tank, which is followed by the addition of yeast culture of *saccharomyces cerevisae*. Fermentation is complete in 36 to 72 hours when the specific gravity of the mash becomes constant. At this stage ethyl alcohol is 5 –19% of the mash, while carbon dioxide is a co-product.

iv. **Distillation:**

The marsh is pumped to the distillation system where the alcohol is removed from fermented residue and water. The ethyl alcohol leaves the top of the final column at about 96% concentration.

v. **Rectification:**

The ethyl alcohol is rectified to produce industrial and beverage grade alcohol.

vi. **Ethyl Alcohol:**

The final product ethyl alcohol is package and labeled for the market.

End Products/Features:

The end products produced are ethyl alcohol and carbon dioxide. The carbon dioxide can be compressed and sold as an industrial input for food freezing and carbonation of beverages.

Capacity for Local Fabrication/Production:

The technology for the production ethyl alcohol can be sourced from the following institutions and organizations:

i. Federal Institute of Industrial Research (FIIRO), Lagos;
ii. National Research Institute for Chemical Technology. (NARICT) Zaria;
iii. Products Development Institute (PRODA), Enugu;
iv. Chemical Engineering Department, University of Lagos, Lagos;
v. Allen Murray Technical Engineering Co. Ltd , Lagos.

Production Capacity is 1,000 m^3 per annum.

Raw Materials Availability:

The basic raw materials required is molasses which can be sourced from:
i. Nigerian Sugar company limited, Bacita.
ii. Savanna Sugar Company Ltd, Numa.

Status/Problems:

The project is completed and is ready for commercialization.

Institution/Collaboration:

i. FIIRO, Lagos
ii. NARICT, Zaria
iii. PRODA, Enugu.
iv. Chemical Engineering Department, University of Lagos, Lagos.
i. Allen Murray Technical Engineering Co.Ltd, Lagos.
ii. National office for Technology Acquisition and Promotion (NOTAP) Abuja.

Recommendations:

The production of ethyl alcohol is recommended to meet local demand and export market.

2.26 Dehydration of Vegetables

Objectives:

The objectives of commercializing the dehydration of vegetables are to:

(i) Preserve vegetables for out of season use and minimize post harvest wastage.
(ii) Reduce the storage volume and weight of vegetables
(iii) Diversify the industrial base of the country by commercializing an indigenous process technology for the local and export markets.

Process Description:

The dehydration of vegetables is carried out by artificially produced heat under carefully controlled conditions of temperature, humidity and air flow. The production process for the dehydration of vegetables is illustrated in the flow chart below:-

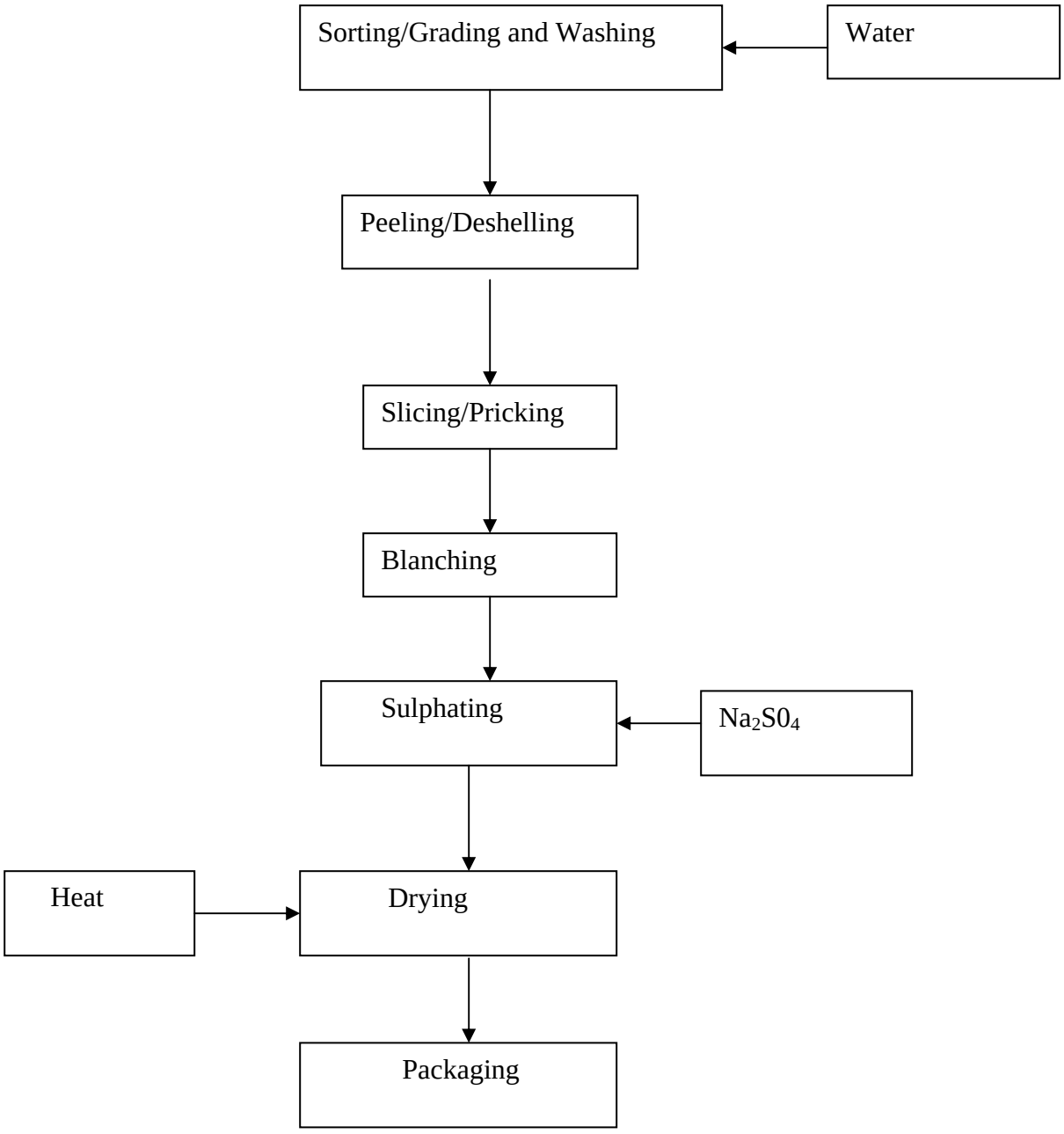


Figure 1 . Process Flow Chart of the Dehydration of Vegetables.

i. **Sorting/Grading and Washing:**

The first step in the dehydration of vegetable is sorting and grading to ensure the raw materials are of good quality which is followed by washing with water.

ii. **Peeling/Deshelling:**

The Vegetable are either peeled or deshelled and in the case of onions or peas respectively.

iii. **Slicing/Pricking:**

The vegetables are then sliced with a slicer or pricked in a pricking machine.

iv. **Blanching:**

Blanching is employed to arrest the action of enzymes present in fresh vegetables. The process involves the dipping of the vegetables in boiling water or steam for 3 – 12 minutes. All vegetables except singer, garlic and onions are given this treatment.

v. **Sulphation:**

This step involves treating the vegetables with any of these chemicals:

- Sodium Sulphate
- Sodium bisulphate
- Potassium Sulplate
- Potassium bisulphate

Sulphation of vegetables is a pretreatment to increase the shelf life of the final products.

vi. **Drying:**

The vegetables are dehydrated in various types of driers depending on the type of the vegetable. Such driers include:

- Tray drier
- Rotary Kiln Drier
- Tunnel Drier.

Prior to dehydration the pretreated vegetables are loaded in trays of suitable material, generally at a load of one of two kilograms per 300 milimetre square. The trays are then packed in the driers and the temperature raised to 72.50^0c to 87.50^0c for between 1 to 14 hours. After the dehydration the moisture is reduced to 3.5% to 5.5%.

vii. **Packaging:**

The dehydrated vegetables are finally packaged in moisture proof containers and labelled .

End Product(s)/Features:

The ends products are assorted dried vegetables.

Capacity for Local Fabrication and Prodiction:

The Equipment can be sourced locally from:

i. Federal Institute of Industrial Research Oshodi (FIIRO), Lagos
ii. Products Development Institute (PRODA), Enugu.
iii. Nigerian stored Products Research Institute (NSPRI), Ilorin.

The production capacity is estimated at 1,500 metric tones per annum.

Raw Material Availability:

The raw materials to be used are readily available. They are, peas , onions, garlic, carrot, cabbage, lettuce, water leaf, tomatoes, garden eggs, okoro, pepper, spinach, bitter leaf, etc.

Status/Problems:

The research into technology for dehydration of vegetables has been completed and is ready for capitalization.

Institution/Collaboration:

i. NSPRI, Ilorin

ii. FIIRO , Lagos

iii. PRODA Enugu

iv. National Office for Technology Acquisition and promotion (NOTAP) Abuja.

Recommendations:

The project should be commercialized to diversify the industrial base of Nigeria. The dried vegetables have potentials for out of season use in Nigeria and export market.

2.27 Gum Arabic Processing

Objectives: These include the following:

(a) Provision of an essential raw material for food and beverage, packaging dhesives, pharmaceutical chemical and allied industries.
(b) Encourage high export potentials;
(c) Import substitution with savings in foreign exchange;
(d) 100% local sourcing of raw materials for processing;
(e) Rural employment generation.

Process Description:

The crude gum is first broken into small pieces, cleansed and carefully sorted according to size and colour. The basic process consists of the following steps:

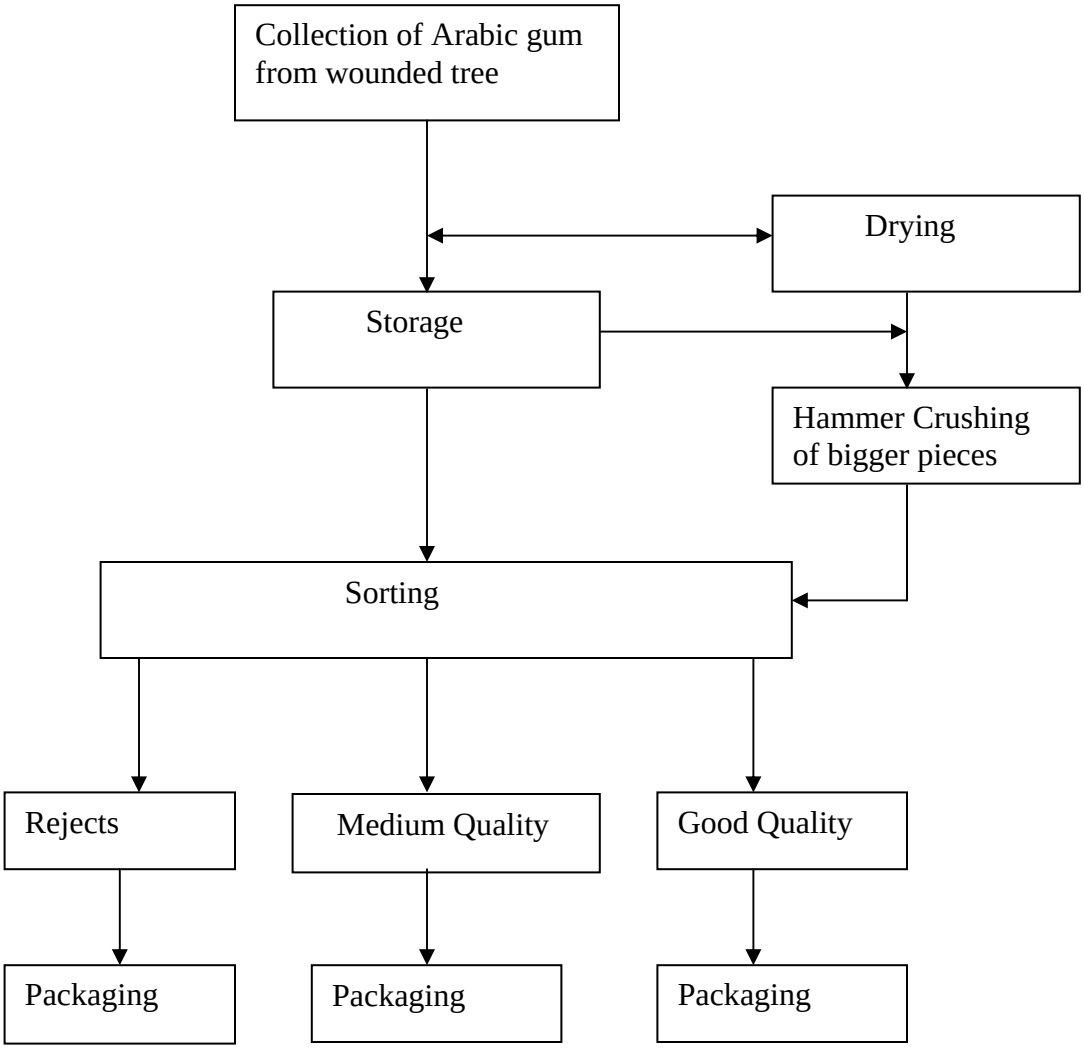
(a) Collection of Crude Gum – The crude gum is collected by some skilled workers from the bark of trees in the area and after the collection of the required quantity the same is kept in storage.

(b) Hammer Crushing: In this process the larger pieces are crushed into smaller ones with the help of a hammer and brought down to smaller sizes;

(c) Sorting: In this process the sorting of good quality pieces is done. This practice is done to remove black coloured small impure pieces from the good quality yellowish this flakes or angular payments. The good quality gum can be marketed as top quality grade for edible purposes.

The medium quality can be used for white washing in the paint industry and finally the rejects which may or may not have a defined use but can be exported for further processing.

3.1 FLOW CHART FOR REFINING OF GUM ARABIC



End Product(s)/Features:

Arabic Gum (or Gum Arabic) is a commercial designation for acacia gum, a hardened exude from the tree of Acacia Senegalis. Gum Arabic is in the form of thin flakes, powder, granules or angular fragments. It has a colour white to yellowish white and is almost odourless and has a mucilaginous taste. It is completely soluble in hot and cold water, yielding a viscous solution of muscilage. It is insoluble in alcohol. The aqueous solution gives an acidic inference on litmus. It is non-toxic and combustible.

Capacity for Local Fabrication/Production:

Working at optimum capacity, the plant produces 3.6 tonnes of Gum Arabic per annum.

Raw Materials Availability:

Hand picked gum from tree barks (acacia tree).

Status/Problems:

Research and Development works have been completed hence this project is ready for commercialization without any problem.

Institution/Collaboration:

(a) National Research Institute for Chemical Technology,
Zaria, Kaduna State

Recommendations:

Available statistics show that there is wide price margin between local and imported refined gum arabic. Refining the raw gum arabic will take care of importation of refined gum arabic by manufacturing industries and consequently savings in foreign exchange both from import and export activities will be enhanced. In addition, the industry will boost economic activities in the country.

2.28 Gasified Kerosine Stove (Soscon Pressurised Kerosine Stove) Production

Objectives:

Objectives of the project is to produce stoves, which are meant to solve the problems associated with the conventional stoves that use gas or wick by gasifying the kerosene and burning the gas.

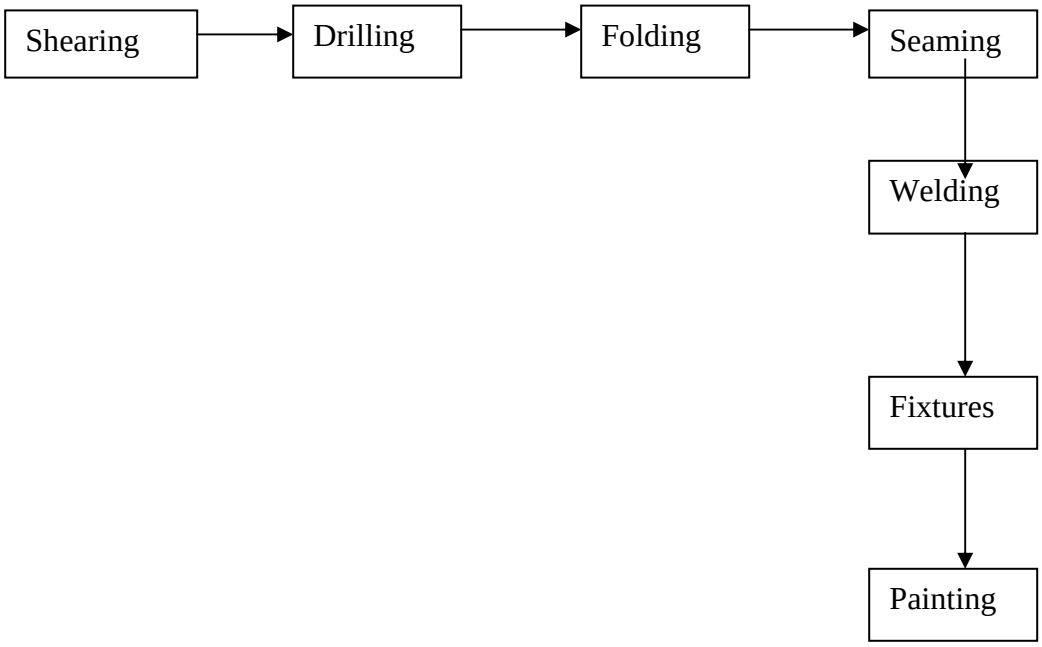
The conventional stoves suffer the following disadvantages:
(a) The kerosene is incompletely burned with a resultant loss in economy.
(b) The flame produced is yellow, sooty and at times noisy.
(c) The cooking fuel (Propane) for gas stove is highly expensive.

The 'SOSCON' Pressurized Kerosene stove would combine efficiency and economy with the overriding requirement of safety. Such stove would operate to produce less noise, smoke free flame, consumes less fuel, cooks fast, etc thereby solving the problems associated with conventional gas and wick stoves.

Process Description:

The process of manufacturing stats with the shearing of materials into required sizes and shapes. The cut sheets are drilled and made straight with deep drawing double action press. The metal sheets are folded and seamed as designed. Welding and general fabrication are carried out to get desired shape with the fixtures attached. Finally, painting is done in the painting workshop.

Flow Sheet Diagram for Manufacture of Pressurized Kerosene Stove



End Production (s)/Features:

Pressurized Kerosene stoves with low cost, improved performance/high efficiency, user friendliness, simple operations and less health hazards associated with using wick and gas stoves.

SOSCON pressurized kerosene stove is designed to make use of manual pump in pressurizing the kerosene within the tank and the flow is controlled by knot. Also, SOSCON tank is large, separate and contains three litres of kerosene

Capacity for Local Fabrication/Production:

Based on twenty-five working days in a month (300 day/annum) the production capacity of 18,000 sets/annum of Pressurised kerosene stoves will be produced.

Raw Materials availability:

The raw materials Metal Sheet (1.5mm), Angle Iron (2x2), stainless pipe (4mm), Tank – metal sheet (3mm) and scrap metals are readily available at local markets.

The project is said to be completed even though a consultant - Ebunso (Nigeria) Limited - has observed some problems in unit they listed which can be explained as follows:

i. The leakage of air from the tank is caused by a faulty value in the hand pump system,
ii. The problem of the ignition.
iii. The smoky flame is caused by the non-uniformity of the fuel heater, due to crude method of manufacture.

However, Ebunso (Nigeria) Limited has recommended that they can confidently rectify the aforementioned problems manufacturing and supplying by all the faulty equipment with a period of three months.

Institution/Collaboration:

SOSCON Industries, 42, Itire Road, Surulere, Lagos.

Recommendations:

The project is ready to be commercialized immediately the observed problems are corrected.

2.29 Production of Hydrated Copper Sulphate from Copper Scraps

Project Description:

Copper scraps are generated as wastes from industrial activities. It is a very pure form of copper metal, about 98% pure. These copper scraps are being used as a cheap source of raw material for the production of hydrated copper sulphate, which is a useful industrial and laboratory chemical, that is still being imported to the country.

Process Technology:

The polymeric coat on the copper scraps was initially removed using some quantity of industrial grade of sulphuric acid, which can later be washed off to obtain the pure copper metal scraps. The copper metal scraps were digested at elevated temperature with constant stirring using concentrated sulphuric acid.

After digestion, the copper sulphate was extracted with a lot of distilled water and later filtered to remove all unwanted and undigested wastes in the mixture.

The filtered blue solution of copper sulphate was later concentrated to allow the formation of hydrated copper sulphate. The crystals were later re-crystallized in distilled water to obtain a purer form of the salt.
The crystals were later dried and packaged.

Machinery Required:

i. Stainless steel reaction vessels with stirrers
ii. Fume cupboard.

Raw Materials Required:

i. Copper scraps
ii. Concentrated sulphuric acid

Capacity of Project:

A small scale plant is designed to produce 1000Kg of hydrated coppersulphate per batch.

Manpower Required:

i. C0hemist - 1
ii. Chemical Engineer - 1
iii. Unskilled labour 5

Institution of Origin:

National Research Institute for Chemical Technology, Zaria.

2.30 Production of Essential Oil from Aromatic Plants

Project Description:

Essential oils are volatile oils obtained from odoriferous constituent of plants. They are used in perfume, beverages, food and pharmaceutical industries.

Process Technology:

Essential oil is produced by steam distillation.

Machinery Required:

The equipment, which is essentially a simple, cottage scale industrial distillation unit can be fabricated locally. A separate boiler unit to generate live steam can also be procured.

(a) A locally fabricated distillation unit
(b) A burner

Raw Materials Required:

Leaves, fruits, seeds, stems, barks, wood and roots of certain plants are abundant in all parts of Nigeria. A plantation of these can easily be established, e.g. lemon grass and Eucalyptus.

Capacity of Project:

The capacity of essential oil production has been scaled up to a 1.5litres of essential oil per batch (depending on the percentage oil in the plant) using stainless steel for both the distillation and condenser units.

Manpower Required:

Biochemist	-	1
Operators	-	2
Gardeners	-	3.

Institution of Origin:

National Research Institute for Chemical Technology, Zaria.

2.31 Production of Papain from Carica Papaya

Projection Description:

Papain is an enzyme derived from the fresh latex of mature, unripe pawpaw fruit. It is used for chillproofing of beer, tenderisation of meat, treatment of scar tissues on wound and in leather bating. Papain is essentially an export product.

Process Technology:

Papain is obtained by tapping the latex of unripe but almost mature papaya fruit. The latex is dried at relatively low temperature in an air oven for several hours. This is then pulverized and packaged as crude papain.

Machinery Required:

The equipment needed for this project include air oven or a spray-drying machine and a UV/V spectrophotometer.

Raw Materials Required:

Dwarf variety of pawpaw trees with unripe mature fruits. Pawpaw trees grow abundantly in most parts of Nigeria especially, the middle and southern parts.

Capacity of Project:

The pawpaw plantation of 10 hectares is considered in this feasibility report. In a year, 100kg dried crude papain is expected from 1 acre of land containing 1000 pawpaw trees. The total estimate for the crude papain is 10,000kg per year.

Manpower Required:

Biochemist	-	1
Farm Manager	-	1
Non-skilled Labour	-	6.

2.32 Purification of Industrial Sodium Chloride and Rock Salt into a Puper form (Analytical Grade)

Project Description:

Nigeria is abundantly rich in some inland brine lakes and rocks which can be exploited for the production of laboratory grade sodium chloride for schools and colleges. The production of this chemical will considerably reduce the importation.

Process Technology:

Rock salt is dissolved in distilled water and filtered. The filtrate is bleached with activated charcoal. The mixture is filtered and the filtrate is concentrated to give sodium chloride crystals. This is further recrystalized with water to give away pure sodium chloride crystals.

Machinery Required:

i. Atomic absorption spectrophotometer
ii. Flame photometer
iii. Hot plate
iv. Air oven
v. Vacuum Pump
vi. Fabricated Aluminium pot (20 litres capacity).

Raw Materials Required:

i. Brine (from lakes)
ii. Rock salt.

Capacity of Project:

The yield of the product is 750kg per batch production.

MANPOWER REQUIRED:

Chemist	-	1
Laboratory Assistant	-	1
Unskilled labour	-	2.

Institution of Origin:

National Research Institute for Chemical Technology, Zaria.

2.33 Production of School Chemicals and Reagents in Nigeria

Project Description:

The deplorable conditions of the science laboratories of the nation's secondary schools and tertiary institutions, in terms of chemicals and reagents led to the mandate given by the National Council on Science and Technology (NCST) to develop a programme for local production of chemicals and reagents for use by schools and higher institutions in Nigeria.

Process Technology:
The produced chemicals and reagents have been in use by secondary schools during examinations practical in schools and Senior Secondary West African Examination Council (WAEC) and (NECO) Practical Examinations.

Machinery Required:
i. p^H Meters.
ii. Glassware apparatus and water tank.
iii, Distilled water production-instrument (complete sets) fabricated at moderate cost to schools for production of distilled water for their practical classes.
iv. Heating mantle, stove/gas burner and gas cylinder.

Raw Materials Required:
Tap water, well water and stream water could be used as far as this production is concerned. The handy and portable equipment complete sets are available.

Capacity of Project:
The system produces 1.5 liters within 1 hour. The capacity of the equipment can be increased in terms of volume for use by industries for distilled water.

Manpower Required:

i.	Chemists	-	1
ii.	Chemical Engineer	-	1
iii.	Unskilled labour	-	5.

Institution of Origin:
National Research Institute for Chemical Technology, Zaria.

2.34 Bleaching Earth

Project Description:

Waste product of trona after processing into sodium carbonate and sodium bicarbonate is essentially clay which can be chemically processed into an important product with value added to it. This product called bleaching earth is well utilized in the oil refineries in the bleaching of coloured oils in order to enhance their values. Bleaching earth is also used in the bleaching of vegetable oils.

Process Technology:

Bleaching earth can be obtained from trona waste by treating it with mineral acid. The excess acid is washed off to a p^H of 4 – 5 with water. The chemically transformed clay (bleaching earth) is filtered, dried, milled and sieved on a 200mm mesh and packaged for use.

Machinery Required:

Pulverizer, sieves, reactors, stirrer, p^H meter.

Raw Materials Required:

Trona clay, concentrated mineral acids.

Capacity of Project:
About five tons of bleaching earth can be produced in a batch operation.

Manpower Required:

Chemist	-	1
Laboratory Technologist	-	1
Unskilled Labour	-	5.

Institution of Origin:

National Research Institute for Chemical Technology, Zaria.

2.35 Production of Corn Starch

Project Description:

Starch is the reserve carbohydrate source of plants and is found in cereals, roots, tubers etc. Starch is an essential raw material in the food, beverage, pharmaceutical and textile industries. Starch may be marketed in modified and unmodified form.

Process Technology:

The corn is dehusked to remove both the husk and the germ. This is then winnowed, soaked in clean water for few days and then wet milled in a milling machine. The slurry is sieved and washed several times with clean water. After allowing it to settle for some hours, the clear supernatant was decanted and the paste is then dried in a drying cabinet at a relatively low temperature to avoid gelatinization for several hours. The dried paste is then pulverized, sieved and packaged.

Machinery Required:
A wet milling machine, a medium-sized drying cabinet and a pulverizer.

Raw Materials Required:
Maize.

Capacity of Project:
500 kg per batch production.

Manpower Required:

Biochemist	-	1
Microbiologist	-	1
Laboratory Assistant	-	1
Unskilled Labour	-	2.

Institution of Origin:
National Research Institute for Chemical Technology, Zaria.

2.36 Production of Benzoic Acid from Toluene

Project Description:

Benzoic acid (C_6H_5COOH) is an aromatic mono-carboxylic acid of immense economic importance. It is a basic raw material for the production of a number of benzenoid/ aromatic chemicals and drugs that are being used worldwide. It is used as preservative for food stuff and soft drinks. It is also used for down-hole drilling mud additives in oil drilling. Medically for tropical application as antiseptic, stimulant and irritant in dermatological treatments of ring worms and eczema. The benzoic acid derivative (sodium benzoate) is used as corrosion inhibitor, as insecticide formulation and insect repellant in industries as raw materials.

Process Technology:

Production of benzoic acid and its derivatives (sodium benzoate)

Industrial production of benzoic acid is accomplished by oxidation through pressurized hot liquid toluene and potassium permanganate. This involved the refluxing the mixture and distilled water for 8hours. The derivative of sodium benzoate production involves benzoic acid and sodium carbonate. The aqueous solution of the two substances in chemical reaction vessel is stirred with glass rod. Both mixtures are filtered, crystallized and recrystallized. The products would be concentrated on hot plate at $250^{O}C$. these products are redried in air oven set at $100^{O}C$ for 1 hour while the sodium benzoate can be dried in the oven at $150^{O}C$ for 1 hour duration. The purity can be checked by melting point technique. The product can be further checked using instrument system.

Machinery Required:

i. Heating mantle of 5 litres capacity with thermal regulator.
ii. Single surface water bath with electrical regulator
iii. Aluminum vessel 10litres capacity can be fabricated for industrial production with glass condenser to fit.
iv. Melting point apparatus/instrument for purity determination of the product and melting point tubes.
v. Drying oven.
vi. vi. Thermometer ($0\text{-}360^{O}C$)
vii. vii. Pressurized rubber tubing.

Raw Materials Required:

i. Toluene
ii. Potassium Permanganate
iii. Distilled water
iv. Hydrochloric acid.

Capacity of Project:

The small scale plant is designed to produce 25Kg per batch.

Manpower Required:

i.	Chemist	1
ii.	Chemical Engineer	1
iii.	Unskilled workers	5.

Institution of Origin:

National Research Institute for Chemical Technology, Zaria.

2.37 Small Scale Production of Hydrated Lime

Project Description:

Hydrated lime chemical is produced from limestone which is available in vast quantities in several parts of Nigeria. Hydrated lime is used extensively for water, sewage, and effluent treatment, leather processing, paper making, fertilizer manufacture, and iron and steel production. The main equipment required for the small scale production of the chemical is a simple, inexpensive, locally designed but highly effective kiln.

Process Technology:

Limestone is loaded manually into a 5-tonne capacity kiln. The kiln is fired continuously for 6 to 8 hours maintaining the internal kiln temperature at about $1100^{o}C$ for at least 4 hours. The fuel for this project can be kerosene, gas or fuel oil. The calcined product is allowed to cool before transferring it to a hydrating system. Specified amount of water is sprayed into the system to mix properly with the calcined product. The resulting hydrated lime is milled into very fine powder and conveyed mechanically through a pipe to a cyclone which precipitates the product into packaging bags.

Machinery Required:

i. Kilns made of refractory bricks (at least 2 Nos. so that while one is firing, the other is loading).
ii. Hydrator
iii. Burners (6 Nos.)
iv. Hammer mill equipped with cyclone.
v. Water sprayer
vi. Fuel storage tank

Raw Materials Required:

Limestone, water, kerosene/gas oil

Capacity of Project:

This project is designed for a kiln that will process 5 tonnes of limestones, from which 3.3 tonnes of hydrated lime $Ca(OH)_2$ is obtained.

Manpower Requirement:

i.	Manager (Chemical/Mechanical Engineer)		
ii.	Plant Supervisor (Technologist)		
iii.	Plant Operators (SSCE graduates)	-	2
iv.	Labourers (First School Leaving Certificate Holders)	-	4

Institution of Origin:

National Research Institute for Chemical Technology, Zaria.

2.38 Deodorization of Kerosine

Project Description:

The project involves the removal of odour from crude kerosene using materials and responsive process techniques. The deodorized kero solvent is used in the paint, cosmetics and chemical industries, as well as a dry cleaning solvent.

Process Technology:

The kerosene is refluxed with furfural, followed by acid treatment with sulphuric acid and neutralisation with an alkali with drying by distillation over activated carbon. The crude kerosene is put in reflux unit and refluxed for a minimum of six hours with furfural. The furfural portion is run-off and sulphuric acid added. The mixture is refluxed for another one hour after which the mixture is transferred to the settling tank and allowed to separate into two layers. The bottom layer is run-off and the sodium hydroxide is added in the neutralisation tank. The neutralized product is put in a distillation unit where the activated carbon and a water-free deodorized kero is obtained.

Machinery Required:

Refluxing unit, settling tank, neutralization tank and a distillation unit.

Raw Materials Required:

Furfural, sulphuric acid, sodium hydroxide, and activated carbon.

Capacity of Project:

The small scale plant is designed to produce 668.8 litres of deodorised kero from an 836litres crude kero input per batch.

Manpower Required:

One chemist, one engineer, one technologist and five unskilled workers.

Institution of Origin:

National Research Institute for Chemical Technology, Zaria.

2.39 Production of Natural Rubber Latex Concentrate, Rubber Goods and Composites

Project Description:

The project entails the concentration of natural rubber latex tapped straight from the rubber tree, the processing of the rubber into various types of goods and composite materials by incorporation of additives and blending. The product is used in the manufacturing of adhesives and in the production of pre-vulcanized rubber sheets. They are also used in the carpet industry in the production of underlays.

Process Technology:

The concentration is achieved with the careful tampering of the sensitive rubber-serum interface by addition of stabilizers and use of particular process methods like vacuum distillation. The goods are made by the addition of stabilizers, fillers, colour etc and curing into desired shapes using moulds. The rubber latex is put in a settling tank and a percentage of soap is added to the latex and stirred for 30mins. The mixture is then transferred into a centrifuge and a stabilizer in the form of natural starch is added. The latex is centrifuged for 1hr at a speed of 5000rev/min. The latex is separated from the bottom serum and stored in air tight container. The rubber goods are made by compounding the smoked rubber sheets with stabilizers, colourants, activator and retarders where needed, in a two-roll mill. The well mixed rubber material is transferred to the metallic mould and placed in a hydraulic press where a pressure of 10tons and temperature of $135^{O}C$ for 15mins is applied. The cured material is demoulded and trimmed to an attractive finish.

Machinery Required:

Settling tanks, industrial centrifuge, vacuum distillation unit, two-roll mill, metallic moulds, hydraulic press, trimming machine.

Raw Materials Required:

Natural rubber latex, stabilizers, curing agents, colourants, mould release-oil, activators, retarder.

Capacity of Project:

The small scale plant produces 500Kg of latex concentrate while over 3,000pcs of rubber goods is obtained from the rubber-goods section/batch.

Manpower Required:

One chemist, one Chemical Engineer and ten unskilled workers.

Institution of Origin:

National Research Institute for Chemical Technology, Zaria.

2.40 Production of Dyestuffs, its Intermediates and Blends of Inks of Various Colours, Shades and Usages for the Textile and Allied Industries

Project Description:

Base raw materials and intermediates from the petrochemical industry, are reacted by appropriate diazotization, coupling or condensation; neutralization and purification to obtain dyes. Some of the dyes are then blended with solvents and other additives to obtain inks of different types. These dye products are used in the textile, paint, pharmaceutical and oil industries, while the inks are used for writing and painting works, lithographic printing etc.

Process Technology:

The primary reactants are brought into intimate interaction by either, diazotization, extraction, reduction or oxidation depending on the particular dyestuff being manufactured. The reacted species are then coupled/concentrated/neutralized or precipitated. At this point the product is purified by crystallization, dried and packaged. The inks are made by vigorous mixing of dyestuff, solvent/carrier, preservatives, thickener and gloss improver. The end product is then poured into containers and sealed.

Machinery Required:
Reactor, coupling tank, a vat, a mixing tank with stirer, filter press, dryer, pulverizer and wrapping machine.

Raw Materials Required:
Anthranilic acid, chloroacetic acid, sodium hydroxide, potassium hydroxide, sodium carbonate, sulphanilic acid, N,N-dimethyl aniline, aniline, phthalic anhydride, phenol, urea, ethanol etc. It all depends on desired end product.

Capacity of Project:
The dyestuff production plant is designed to produce 71Kg of dyestuff material, on the average per batch.

Manpower Required:
One chemist, one engineer, one technologist and five unskilled workers.

Institute of Origin:
National Research Institute for Chemical Technology, Zaria.

Chapter Three

OTHER COTTAGE/SMALL SCALE VIABLE PROJECTS

3.1 Scouring Powder Production

Introduction:

Scouring powder is a form of powdered soap with abrasive properties. It is used for cleaning out stubborn dirts, stains and grime from pots, pans, tubs, dirty floors, etc. Dirts that cannot be cleaned by ordinary soap or detergent are easily cleaned with scouring powder leaving all surfaces sparkling and bright.

Raw Materials:

1. Calcium carbonate base medium such as kaolin, or ground granite;
2. Degreasing agent;
3. Cleansing agent such as sulphonated detergent;
4. Whitening agent for bleaching such as hydrosulphite salt.

These items can be obtained locally

Equipment and Machinery:

1. Milling machine;
2. Vibro-sifter;
3. Blending mixer;
4. Weighing scale;
5. Powder filling machine (optional).

Source of Machinery and Equipment:

(a) NOVA Technologies Nig. Ltd.,
Ajibode Bus Stop,
Between VI and NISER gates,
Ibadan.

(b) Techo-quip Limited, 15, Olushola Ikare Street,
Off Ogidan Street,
Ikotun road, Alake Bus Stop,
Idimum, P. O. Box 5323, Ikeja.

Production Process:

The minerals are ground with hammer mill and sieved to fine particle size. Alixed with ground stone. Then powdered soap/detergent is added as cleansing agent. All the raw materials are then charged into a blending mixer machine to obtain a homogeneous material which is then packed for sale.

Production capacity : 600 MT per annum

Manpower requirement : 5.

3.2 Liquid Soap Manufacture

Introduction:

Liquid soap is commonly used for laundry and for cleaning utensils, floors, tiles, walls, toilet, etc. in both domestic and industrial sectors. It is also used as lubricant for machines in beer and soft drinks factories. Liquid soap is cheaper because it is obtained from synthetic sources. However, it is as effective as other forms of soap/detergent.

Raw Materials:

Raw material is synthetic jelly – like concentrates and packaging materials. Vegetable oil, caustic soda, soda ash, sulphuric acid and water can also be utilized.

Production Process:

Caustic soda and soda ash solutions are made in dry clean plastic containers and gauged to a specific concentration by a hydrometer. The solutions are added to vegetable oil. Sulphuric acid is then added to the mixture. Seven units of raw materials yield 13 units of liquid soap. The soap is packaged and marketed.

Machinery and Equipment:

Hydrometer
Weighing Scale
Plastic tanks.

Source of Machinery and Equipment:

(a) Federal Institute of Industrial Research, Oshodi,
P.M.B. 21023, Ikeja.

(b) Indev Nig. Ltd.,
276 toyin Street,
Ikeja, Lagos.

Production Capacity: 900 MT per annum

Manpower Requirement: 4.

3.3 Vegetable Oil Production From Palm Oil

Introduction:

Vegetable oil ('ororo') can be produced from palm oil or palm kernel oil. Palm oil is abundantly produced in the southern zone of Nigeria. Most of it get rancid before they could be consumed or sold. Conversion to clear vegetable oil is a profitable means of preservation as well as producing added value. The clear vegetable oil has a golden colour. It is also odourless.

Raw Materials:

Palm Oil

Production Process:

1. Palm oil is digested in boiler/mixer
2. Transferred to decolourising tank;
3. filtered over activated charcoal or special clay
4. Oil is charged into decodorizing tank with vaporizer unit to eliminate the odorous volatile components;
5. Clear vegetable oil (ororo) is cooled and packed into containers.

Equipment and Machinery:

1. Boiler
2. Decolourizer
3. Decodourizer unit.

Source of Machinery and Equipment:

Indev Limited,
276, Toyin Street,
P.M.B. 21121,
Ikeja, Lagos.

Production Capacity: 3,000 MT per annum

Manpower Requirement: 4 people are required.

3.4 Candle Production

Introduction:

Candle is used to illuminate the house, chapels, hotels and restaurant. It gives a very warm and welcoming atmosphere. It is also believed to have some spiritual applications in the religious institution. Candles come in straight cylindrical shape and in a variety of fascinating shades and imaginative figures.

Market Potential:

Candles are widely used for illumination of household, hotels, restaurants as well as churches and other religious places. It can also be exported especially the decorative ones.

Raw Materials:

Paraffin wax, stearic acid, dyes and wick.

Production Process:

Paraffin wax and stearic acid are melted in a steel or aluminum vessel kept on coal or wood furnace. If desired, dye is stirred at the mixture. Wick is inserted in the candle molding machines and the mixture poured into it. Cold water is allowed to circulate round the candle moulds. The candles cool and set and are ejected from the machine. The wick is cut and candles are packed for the market.

Equipment and Machinery:

Steel or aluminum vessel and molding machine.

Source of Machinery and Equipment:

(a) Federal Institute of Industrial Research,
Oshodi,
P. M. B. 21023, Ikeja.

(b) Techo-quip Limited, 15 Olushola Ikare Street,
Off Ogidan Street,
Ikoturu Road, Alake Bus Stop,
Idimu, P. O. Box 5323, Ikeja.

Production Capacity:	50 to 60 metric tones
Manpower Requirement:	6.

3.5 Garri Processing

Introduction:

Garri is a main staple food of most Nigerians. It is produced from cassava. It is also eaten as snack with sugar and milk when soaked in water.

Raw Material:

Cassava and palm oil (optional)

Production Process:

Cassava tubers are peeled, washed and milled. Then the milled cassava is put in bags overnight and pressed to get the water out as well as ferment off the cyanide in the raw cassava. The relatively dry cassava is fried over medium heat with or without oil as required. Gari is aired cooled and packed for the market.

Equipment and Machinery:

1. Disc mill
2. Oven (local)
3. Giant frying pan and spoon

Source of Machinery and Equipment:

(a) Federal Institute of Industrial Research,
Oshodi,
P. M. B. 21023, Ikeja.

(b) Addis Engineering Nigeria Limited,
25, Abimbola Street,
Isolo Industrial Estate,
P. O. Box 2645, Lagos.

(c) NOVA Technologies Ltd.,
Ajibode Bus Stop,
Between VI and NISER Gates
Ibadan.

Production Capacity:	3000 MT per annum
Manpower Requirement:	5.

3.6 Bricks Production

Introduction:

Bricks are used as substitute for cement blocks in building. Bricks are very beautiful and require no painting or plastering. Brick blocks come in a variety of designs used for fence construction to replace fancy blocks. The demand for bricks is increasing because of the inherent insulating quality, the beauty and the low cost.

Raw Material:

Laterilic clay

Production Process:

The laterite is cleaned to remove any stone and other hard objects. It is pulverized and kneaded to a fine smooth paste. It is then moulded and fired in open fire or a furnace. It is cooled and packed for the market

Equipment and Machinery:

Kilns, moulds, vibrating screens, hand press and furnace.

Source of Machinery and Equipment:

Nigerian Building and Road Research Institute, Abuja.

Production Capacity:
Plant produces at a capacity of 8,000 MT of bricks per annum

Manpower Requirement: 6.

3.7 Grains Milling

Introduction:

Grains are consumed in large quantity in the country especially in the north where it is eaten as tuwo. Different types of grain are utilized such as rice, maize, millet, etc. Maize flour is also used for biscuit making and other confectioneries.

Raw Material:

The raw materials required are grains (maize, millet, etc.)

Production Process:

The grains are cleaned of chaff and stones and ground in a hammer mill. Ground grains are then sieved to obtain fine four. The flour is packaged in polybags of containers. Residue are either re-milled or used for animal feed formulations.

Equipment and Machinery:

Hammer mill and packaging machine.

Source of Machinery and Equipment:

(a) African Regional Centre for Design and Development,
Ibadan, Oyo State.

(b) Akkray Limited,
Old Airport Road,
(former Hankouri Pharmacy),
P. O. Box 2645, Minna, Niger State.

(c) NOVA Technologies Ltd.,
Ajibode Bus Stop,
Ibadan.

Manpower Requirement: 6.

3.8 Classroom Chalk

Introduction:

Classroom chalk is used for writing on boards in all our primary, secondary, tertiary and research institutions as well as in informal institutions and occasions.

Market Potential:

The current mass literacy campaign has increased the national demand for chalk. ECOWAS regional market can also be explored.

Raw Material:

The raw materials required are plaster of paris, a product obtained from gypsum.

Production Process:

1. Required quantity of gypsum is mixed with china clay;
2. Additives are added to the mixture to obtain the required colour;
3. Slurrification of mixture using water;
4. Slurry is poured into moulds and allowed to set;
5. chalk is formed, dried and packed.

Equipment and Machinery:

1. Aluminum mould;
2. Weighing balance
3. Dryer

Source of Machinery and Equipment:

(a) Federal Institute of Industrial Research,
Oshodi,
P. M. B. 21023, Ikeja.

(b) Techo-quip Limited, 15 Olushola Ikare Street,
Off Ogidan Street,
Ikoru road, Alake Bus Stop,
P. O. Box 5323, Ikeja.

(c) Natural Research Institute
for Chemical Technology
(NARICT), Zaria.

Production Capacity: 3000 MT per annum
Manpower Requirement: 5.

3.9 Oil Extraction from Oil Seeds

Introduction:

Two types of oils can be extracted from oil seeds. These are edible oils and essential oils used in pharmaceutical and cosmetic production. Oil seeds which can be used include groundnut melon, soyabean, castor, palm kernel, etc.

Market Potential:

There is high demand for essential oils in the fast growing pharmaceutical and cosmetic companies. Every home consumes edible oil both for direct cooking and other preparations.

Raw Materials:

Raw materials required are any of the above mentioned oil seed.

Production Process:

This involves simple extraction of the oil followed by distillation for high grade pharmaceutical oils, then separation and cooling.

Equipment and Machinery:
Extractors
SeparatorsCoolers

Source of Machinery and Equipment:
(a) Federal Institute of Industrial Research,
Oshodi,
P. M. B. 21023, Ikeja.

(b) Indev Limited,
276 Toyin Street,
P.M.B. 21121,
Ikeja, Lagos.

Production Capacity: 2,000 metric tonnes

Manpower Requirement: 4.

3.10 Production of Dyes for Textiles

Introduction:

Dyes are used for colouring textiles as well as leather, plastics, paper, paints, inks, chalks, crayons, etc. They come in different colours and shades.

Raw Material:

The growing textile market inclusive for dyes is presently not being met locally. There is need for more dye production locally.

Raw Materials:

Copper sulphate, climethylaniline, sodium chloride, sodium hydroxide, phenol sulphuric acid, sodium sulphate, sulphamillic acid, formaidehyde, urea, ammonium chloride and sulphur are the raw materials required.

Production Process:

Methylvyiolet dimethylalaine is oxidized in stages with the aid of sodium chloride, copper sulphate to obtain triphenyl methane dye base. The dye base may also be formed from local plant. The paste formed from the dry base is dried, pulverized and packed.

Auramine O. Tetraethyl base is formed from Dimethylaniline by condensation with formaldehyde. The base is then treated with sulphur, urea, ammonium salt to form the dye base. The dye base is dried, pulverized and packed.

Equipment and Machinery:

1. Reactor vessel
2. Lead line acidification tanks
3. Filter press
4. Baby boiler
5. Tray dryer
6. Evaporation pan
7. Micro pulveriser
8. Centrifuge 5.5 bucket types
9. Laboratory equipment.

Source of Machinery and Equipment:

(a) National Research Institute for Chemical Technology, Zaria.

(b) Akkray Limited,
Old Airport Road,
(former Hankouri Pharmacy)
P. O. Box 2526, Minna, Niger State.

Production Capacity: 30 MT methyl violet 30 MT Auramine 'O'

Manpower Requirement: 4.

3.11 Fruit Squash Production

Introduction:

Fruit squashes, supplies the body with the necessary mineral salts and vitamins while still serve as a beverage. It can also be utilized by soft drinks manufactures as concentrate in place of synthetics.

Raw Material:

Fruit (e.g. Mangos, sugar, citric acid, potassium metal bisulphate (food grade) water.

Production Process:

Selected mangoes are washed and passed through a fruit extractor and pulpar. These are mixed with other nngredients and can be mixed together (apart from mango juice) and heated to dissolve any undissolved solute before cooking and filtration. This is then blended with the fruit juice and bottled.

Source of Machinery and Equipment:

INDEV Limited,
276 Toyin Street,
P.M.B. 21121,
Ikeja, Lagos.

Production Capacity: 30 MT/Annum

Manpower Requirement: 8 workers.

3.12 Production of Soya Snacks

Soya bean has been one crop that can be utilized in so many ways. It is a crop that can be put into many uses out of which snack is one. One can extract oil, ogi, milk to mention a few from soya beans. It is highly nutritious. The fat and protein content is high.

Soya snack is one of the products that can readily contribute to Nigeria's agricultural development.

Raw Materials:

Soya beans, sugar, vegetable oil and ancillary items.

Production Process:

After the collection of soya beans, they are subjected to a very high temperature. They are now fed in a grinder where they are processed into snacks. They are two fried after adding all other additives.

Machinery and Equipment:

Extruder or grinding machine, frying pan, fork and spoon.

Source of Machinery and Equipment:

(a) Federal Institute of Industrial Research,
Oshodi,
P. M. B. 21023, Ikeja.

(b) Techo-quip Limited, 15, Olushola Ikare Street,
Off Ogidan Street,
Ikotun road, Alake Bus Stop,
Idimu, P. O. Box 5323, Ikeja.

Production Capacity: 20 MT/Annum

Manpower Requirement: 4.

3.13 Dried Spices Production

Spices are employed in food industry to impart flavour and poignancy to food. Hotels, restaurants, schools, food seasoning manufacturers, etc. are some of the guest users of spices. In some areas in Nigeria, spices are consumed naturally but efforts are now shifting away from this traditional use to a more refined ways. In Nigeria, spices market are various brands of spices (imported) powdered including ginger, curry, thyme and so on. The market will continue to expand.

Raw Materials:

These are ginger, onions, chilly, garlic, nutrient aniseed, curry and thyme.

Production Process:

Spices are washed in clean chlorinated water. Some of them require peeling and slicing (e.g. ginger). They are blended in boiling water for a few minutes before drying. The drying is carried out at temperatures that will ensure that particular spices do not lose their flavour. After attaining a moisture content of about 8-13 percent, the hydrated spices is cleaned and graded.

Machinery and Equipment:

Washing tank, prolong and slicing devices, currying unit, dryer, hammer mill, grading table unit, bagging facilities.

Source of Machinery and Equipment:

Aseesan Engineering Company,
15 Onabola Street,
Pedro – Bariga,
P. O. Box 110, Shomolu, Lagos.

Production Capacity: 20 MT/Annum

Manpower Requirement: 10 workers.

3.14 Banana Flour Production

Banana is a very popular fruit in Nigeria. It contains about 21% sugar and also vitamins A, B & C. It is highly grown in the southern part of Nigeria. It can be consumed in raw forms but it has storage problem. It can be converted to other products such as figs and flavour for storage. The powder is a source of food flavour for bakery, confectioneries, and beverage producers who presently import.

Raw Materials:

Ripe banana, sodium bicarbonate, citric acid, sulphur.

Production Process:

Ripe and fresh banana are cut into halves and soaked in 1% sodium bicarbonate for 15 minutes after which is washed in 0.05% citric acid. They are then kept in wooden chamber containing burning sulphur after which is dried. The dried fruit is pulverized into powder.

Machinery and Equipment:

Cross flow tunnel dryer (mansory) sulphur house, boiler, pulveriser and other miscellaneous equipment.

Source of Machinery and Equipment:

(a) Federal Institute of Industrial Research,
Oshodi,
P. M. B. 21023, Ikeja.

(b) Aseesan Engineering Company,
15 Onabola Street,
Pedro – Bariga,
P. O. Box 110, Shomolo, Lagos.

Production Capacity: 5 MT/Annum

Manpower Requirement: 10 workers.

3.15 Roofing Tiles Production

Inward looking for building materials is one of the few gains Nigeria recorded with the Structural Adjustment Programme. Building materials including imported roofing tiles are now expensive. They are beyond the reach of common citizens. Nigeria with a population of over 100 million people, the production of roofing tiles will be met with a ready made market. In fact, it is at least 10% cheaper than the conventional roofing sheets.

Raw Materials:

Bitumen, cellulose pulp from newspaper, hardwood wastes or saw dusts, clay, water and cement.

Production Process:

Shredding of papers or saw dusts into grits. This is followed by pumping of saw dusts or paper grits before sitting of clay material and mixing with cement and bitumen in weighed proportion. The mixture is blended with the pulp to semi-pasty mass in the blender till homogenous mass is obtained. The pasty mass is poured into mokling gray where the mass is allowed to set and then pressed to form sheets or tiles. The mould is then dismantled and the sheet formed is transferred into the drying chamber for curing.

Machinery and Equipment:

Grater, pulping, kettle, sand mixer, blender, molding tray, drying chamber.

Source of Machinery and Equipment:

Nigerian Building and Road Research Institute

Production Capacity: 2,400 sheets per annum

Manpower Requirement: 15.

3.16 Smoked Fish Production

Introduction:

Fish of various types are available in the country. The aqua cultural of Nigerians is improving by the day. Nigerian waters are filled with various types of fish. There are artificial lakes and fish ponds where raw materials for the proposed project can be sourced. The market for the products is inexhaustible as well. Fish is a very good source of protein and many people prefer fish to meat because of its soft nature and high nutritional content.

Raw Materials:

Fishes and salt.

Production Process:

Fishes are prepared, soaked and dried. The dried fishes are then smoked and packaged.

Machinery and Equipment:

Smoking shed, cola chamber, tripod stove and salting tanks.

Source of Machinery and Equipment:

Nigerian Institute for Oceanography and Marine Research,
Bar Beach,
Victoria Island,
Lagos.

Production Capacity: 10 MT/Annum

Manpower Requirement: 5.

3.17 Pottery Production

Introduction:

The demand for the products from clay which is a major raw material in the pottery industry makes the project very viable. Such products as pots, cups, flower vases, lamp-holders, etc. are in high demand in Nigeria.

Raw Materials:

Clay, traditional colourants.

Production Process:

The clay is obtained and appropriately mixed with water for easy moulding into various shapes. The moulds are then heated to harden them.

Machinery and Equipment:

Grinding machine, slurry arch, hand operated filter press, pug mill, digger and jolly machine, kiln, plunger and staggers.

Source of Machinery and Equipment:

(a) Project Development Institute (PRODA),
Enugu.

(b) FOBA Engineers Limited,
Km 9, Old Lagos Road,
P. O. Box 2118, Ibadan.

Production Capacity: 3,000 products of different kinds in a year.

Manpower Requirement: 5.

3.18 Zobo Drink Production

Introduction:

Zobo drink is produced from red kenaf fruit (zobo). It is reputed to have anti-hypertensive properties. The drink is reddish in colour and it is very refreshing especially when refrigerated.

Raw Materials:

The raw materials for zobo production are red kenaf fruit (zobo), water, sugar, ginger, strawberry or vanilla flavour.

Production Process:

The fruit and ginger are boiled in water for 15 minutes. It is left to cool for a few hours. It is diluted with water to minimize the concentration. Sugar and flavour are then added to taste.

Machinery and Equipment:

Cooker, cooking pot and sieve.

Production Capacity: 20,000 litres per annum

Manpower Requirement: 2.

3.19 Kuli-Kuli Production

Kuli-kuli is produced from groundnut. It is the cake from oil extraction of groundnut to produce groundnut oil. It is a rich proteinous snack eaten alone or eaten with biscuits, gari and other carbohydrate based snacks.

Raw Materials:

Groundnut seeds is the only raw material required.

Production Process:

Groundnut is roasted and ground. Ground groundnut is transferred into the filter press where the oil is extracted. The residue is moulded and roasted to obtain kuli-kuli.

Machinery and Equipment:

Grinder, filter press/extractor.

Source of Machinery and Equipment:

Federal Institute of Industrial Research, Oshodi,
P. M. B. 21023,
Ikeja.

Production Capacity: 300 MT per annum

Manpower Requirement: 2.

3.20 Modern Soap Production

Soap was the first surface active agent used in very crude form. The use of soap or some natural soap like cleaning agents has always been associated with man's inherent instinct to keep his body, clothes and other washable belongings clean. The important natural agents used either were wood ash, rice stack and some saponaceous alkaline.

Market Potential:

The consumption of soap and the market potential is high because it is an essential commodity required daily for domestic and industrial use in the laundry service sector and for cleaning utensils – toilets, floors and industrial plants.

Raw Materials:

The raw material used are oils such as coconut oil, palm kernel oil, palm oil, olive, soybean and cotton seed oil.

Production Process:

The science of soap production is a simple one of saponification which involves neutralization reaction of alkali and the acid components. The neutralization process forms the basis for soap quality control testing. The neutralization process can be represented by the general basic foundation depicted.

Machinery and Equipment:

These include boiler with either manual or motorized stirrer, gas burner sifter, blowing/drying tank, grinder, weighing scale, hydrogenator, caustic preparation vessel and buckets.

Source of Machinery and Equipment:

Federal Institute of Industrial Research, Oshodi,
P. M. B. 21023, Ikeja.

Production Capacity: 10 tonnes per annum

Manpower Requirement: 6.

3.21 Kunu-Zaki Processing

Introduction:

Kunu-zaki is produced from millet. It is a popular drink in the Northern part of Nigeria. However, the demand for it has spread to the south. It is presently being served at parties, homes, hotels and restaurants.

Market Potential:

Kunu-zaki is available all over the market. Potential is there because people go for it especially during the hot season. It can however be consumed at any time of the day or during any weather.

Raw Materials:

The major raw material is millet, sugar, pepper, water and other flavouring materials.

Production Process:

Millet is soaked in water for 10 to 12 hours. It is then ground in hammer mill with ginger and pepper to form a thick paste. Boiled water is poured into a larger container containing the paste to form pap. The pap is covered for another 8 to 10 hours. It is then sieved to obtain a fine milky drink. Sugar and flavours are added to required taste. It is bottled and refrigerated, ready to serve.

Machinery and Equipment:
Cooking stove, giant pots or tank, hand made kunu-zaki, grinder, container, boiler.

Institute of Origin:

Federal Institute of Industrial Reseach, Oshodi, FIIRO; Ahmadu Bello University, ABU, Zaria.

Production Capacity: 20,000 litres per annum

Manpower Requirement: 3.

3.22 Snail Production

Description:

A viable bioenterprise that is amenable to small, medium to large scale operation. Snail production can be an effective tool against poverty.

Production Derivable:

A highly nutritive meat that has general acceptability, both locally and worldwide.

Capacity for Local Production:

Capacity for production is available at National Biotechnology Development Agency and some other institutions. Capital requirement is low, while production skills can be easily acquired.

Raw Material:

The enterprise is very economical in the use of resources. Production inputs are mostly vegetables and supplements, which are readily available.

Institute of Origin:

NABDA and some other Nigerian institutions.

Other Information:

Snail has ready market in Nigeria. The meat is reputed to be of very high quality.

3.23 Honey Bee Keeping

Description:

Production of honey from bees kept in controlled hives. This is a very lucrative bioenterprise.

Products Derivable:

Main product is honey. Valuable by-products are bee wax and propolis. All have ready markets.

Capacity for Local Production:

Bee keeping is low capital intensive and can be quite viable even at small scale. The production skill can be easily acquired.

Raw Materials Availability:

Mostly hives that are easy to construct. Other production gears are available in Nigeria.

Institute of Origin:

NABDA and some other Nigerian institutions.

Other Information:

Both local and export markets abound.

3.24 Production of Autoclavable Bioreactors

Description:

The baker's yeasts used in the Food Processing Industry (e.g. bread and some pastries) in Nigeria are all imported at great foreign exchange cost. Protein supplements to our diet are in short supply. Enzymes are required as feedstock in our industries. A bioreactor is the obligate tool for the culturing of yeasts, proteins and enzymes.

Product Derivable:

(a) Baker's yeast
(b) Enzymes
(c) Other single cell proteins especially for use in feedstock.

Capacity for Local Fabrication:

The capacity for the local production of bioreactors has been demonstrated by using the facilities at SEDI, Enugu, to build a prototype.

Institution of Origin:

National Biotechnology Development Agency (NABDA), Abuja.

Raw Materials Availability:

The culture substrates are readily available and the operating conditions for fermentation easily attainable.

Other Information:

A bioreactor is a versatile tool for the generation of research and industrial inputs.

3.25 Mushroom Production

Description:

Mushroom is a highly nutritious delicacy consumed all over Nigeria. Its consumption is limited mostly by the existence of some highly poisonous types. Through easily controllable production, it is possible to produce only the desited edible types.

Products Derivable:

Fresh whole mushroom; dry whole mushroom; ground dry mushroom.

Capacity for Local Production:

The capacity to produce exists at the National Biotechnology Development Agency (NABDA) and some other institutions in Nigeria.

Institute of Origin:

NABDA.

Raw Material Availability:

The raw material for production is available. For some special types, the strains may be imported.

Other Information:

The local market for mushroom in Nigeria is quite large. Potential for export is also high.

3.26 Grasscutter Production

Description:

Grasscutter is highly cherished bush meat all over Nigeria. It is generally harvested from the wild by local hunters. Faced with increasing population of consumers and diminishing habitats, the supply has started to dwindle. Domestic production is now possible with little capital endowment.

Products Derivable:

Delicious “bush” meat.

Capacity for Local Fabrication:

Domestication and management of grasscutter is not a complicated process. It has been introduced in a number of locations and production can be designed to meet various scales of production.

Institution of Origin:;

National Biotechnology Development Agency (NABDA), Abuja.

Raw Materials:

Grass, feed grains and supplements that are readily available.

Other Information:

Grasscutter meed commands a very high price in the Nigerian market.

3.27 Bioprocessing of Plantain/Banana

Description:

Plantain/Banana are common crops in the farming system of most of Southern Nigeria. They are highly perishable and lots of the produce are lost to spoilage after harvest. Through post harvest processing, they could be converted into wine, alcohol, malt, juice, flour and chips that have longer shelf lives.

Products Derivable:

Products derivable from the process include wine, alcohol, juice, malt, flour and chips.

Capacity for Local Fabrication:

Production capacity is simple and the requisite equipment can be locally fabricated from locally available expertise.

Institution of Origin:

National Biotechnology Development Agency (NABDA), Abuja.

Raw Materials Availability:

Propagation of the crops through tissue culture and other improved techniques are enhancing productivity and would soon lead to high wastage, if post harvest processing is not advanced.

Other Information:

There is a good market for the products of this process in Nigeria.

3.28 Production of Pancreatic/Fungal Bate for Use in Leather Manufacture

Project Description:

The project involves the scaling up to pilot scale production and commercialization of a composite bate powder developed. The enzyme product is one of the essential auxiliaries in modern leather industry. Feasibility reports showed that the project is technically and economically feasible.

Process Technology:

The production of the bate powder involves the blending of active fungal and pancreatic enzymes using cheap local fillers. The resulting wet mixture is then dried at low temperatures before finally milling it into powder form.

Machinery Required:

Tray dryer, motorized stainless steel cooking vessel, meat mincer, autoclave, deep freezers (2), Incubators (2), aluminium trays, gas cylinders (2).

Raw Materials Required:

Cassava flour, wheat/rice bran, cattle pancreas, assorted mineral salts, two species of fungi.

Capacity of Project:

10,000kg Bate product per year.

Manpower Required:

Factory Manager	-	1
Quality Control Officer	-	1
Production Supervisor	-	1
Plant Operator	-	2
Clerical Officer/Accounts Clerk	-	1
Labourers	-	4.

Institution of Origin:
National Research Institute for Chemical Technology, Zaria.

3.29 Lacquers from Cashewnut Shell Liquid

Project Description:

Cashewnut shell is a byproduct of the cashew processing factories in the country that is presently being underutilized as a cheap source of fuel in the factories. This project aims at extracting the shell oil and converting it to many useful products as in the developed countries where the oil is used in brake lining, rubber compounding, termite insecticides, varnishes and paints, etc. Already the lacquer produced has been successfully used as a component of gun bullets by the Defence Industry in the country.

Process Technology:

Cashewnut shell oil or liquid is extracted either by solvent extraction or mechanical expeller. The oil mixed with an organic solvent is nitrated at a controlled temperature with continuous stirring until the reaction is completed.

Machinery Required:

Pilot size oil mill, motorised stirrer, reaction vessels, soxhlet extractor.

Raw Materials Required:

Cashewnut shell, organic solvents, organic salts.

Capacity of Project:

10,000 kg Lacquer per annum.

Manpower Required:

Biochemists	-	2
Laboratory Technologists	-	2
Laboratory Assistant	-	1
Unskilled workers	-	5.

Institution of Origin:

National Research Institute for Chemical Technology, Zaria.

3.30 Production of Biocides for Hides, Skins and Leather Preservation from Natural Plants

Project Description:

This project aims at developing import substitution antimicrobials and insecticides through screening of indigenous natural plants which can be used as preservatives primarily for hides, skins and leathers. Such preservatives could also be found usable in other areas of product preservation and medicine.

Process Technology:

(a) Maceration and blending of potential plant material using blender.
(b) Solvent extraction of active agents from the blended material.
(c) Microbial sensitivity tests of extracts using *in vitro* culture plates
(d) Laboratory and field tests for the assessment of antimicrobial effectiveness
(e) Formulation and packaging of recipes for the effective application of the antimicrobial material.

Machinery Required:

Tannery machine, grinding mill, blender, soxhlet extrator, weighing balance, assorted glasswares and petri-dishes, incubators.

Raw Materials Required:

Minimum of 10 different plants with significant antimicrobial properties, organic solvents, e.g. ethanol, methanol and chloroform.

Capacity of Project:

10,000 litres of antimicrobial solution per annum.

Manpower Requirement:

Biochemists	-	3
Technologists	-	2
Laboratory Assistant	-	1.

Institution of Origin:
National Research Institute for Chemical Technology, Zaria.