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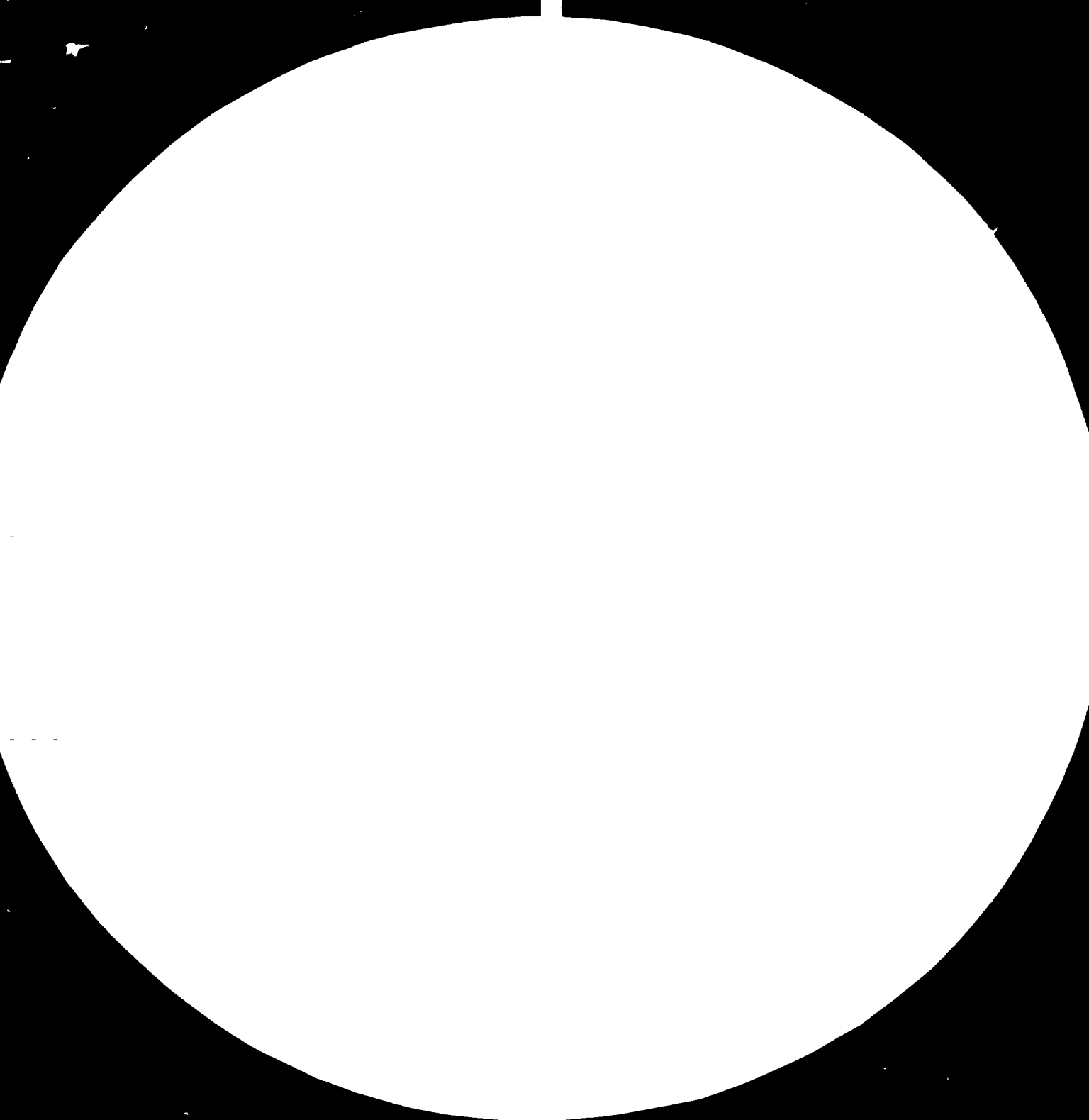
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English

MOBILE UNIT OF PHARMACEUTICAL AND
ESSENTIAL OILS INDUSTRY TO THE
LEAST DEVELOPED COUNTRIES IN AFRICA
6 - 31 JANUARY 1980

T A N Z A N I A

RP/RAF/79/005

Terminal Report*

Prepared for the Government of the United Republic of Tanzania

Based on the work of

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900009

Experts of the United Nations Industrial
Development Organization

United Nations Industrial Development Organization
Vienna

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Summary

Within the framework of the UNIDO assistance programme for the industrial valorization of the medicinal plants and their use in medicine in the least developed countries, UNIDO charged the Joint UNIDO/Romania Centre with the task of sending a mobile unit to certain African countries including Tanzania.

The main objectives of the mobile unit were to collect data about medicinal and aromatic plants, to carry out chemical determinations on active principles and to examine the prospects of processing them locally, in order to be used for the preparation of pharmaceuticals.

Six Romanian experts equipped with laboratory equipment, materials and two cars undertook a mission in Tanzania from 6 to 31 January 1980.

This was the second phase of the UNIDO programme which, in its first phase consisted of an exploratory mission which visited Tanzania in December 1977 under the project RP/RAF/77/015

The activity of the mobile unit was carried out in the laboratory of the "Traditional Medicine Research Unit" under the coordination of the Muhimbili Medical Centre.

The experts prepared 15 pharmaceutical products, carried out 9 determinations of essential oils, 2 quantitative determinations of essential oils, 2 quantitative determinations of total alkaloids and 4 demonstrations on the identification of the active principles in herbs mixtures used in the traditional medicine.

The present report refers to the activity of the mobile unit, the findings and the recommendations of experts for the setting up of a small scale pharmaceutical industry based on

medicinal plants.

The recommendations on further UNIDO assistance refer to the training of the local personnel, international experts and equipment of active principles extraction and distillation pilot unit as well as complementary equipment for laboratory.

2. Introduction

The United Nations Industrial Development Organization (UNIDO) has a very important assistance programme for the development of a pharmaceutical industry based on the medicinal plants available in certain developing countries. Several programmes have been designed for different developing countries and some of them are already under implementation.

The utilization of medicinal plants has been always known in the developing countries and the largest part of the population make use of extracts or dry herbs for curing many tropical and epidemic diseases. Taking into account the increased demand for medicines in the world and in the developing countries too, a particular attention started to be focussed on the possibility of medicines production on a more economic basis such as the utilization of medicinal plants which many developing countries are rich in.

The Tanzanian flora is very rich in medicinal and aromatic plants and therefore it is advisable to process them in order to obtain the active principles and the essential oils useful in the pharmaceutical industry.

In this respect an exploratory mission visited Tanzania in December 1977 to collect information on the medicinal plants available in the spontaneous flora as well as the laboratory facilities necessary for the activity during the second phase -

the mobile unit.

After the exploratory mission the experts recommended to UNIDO to supply certain laboratory equipment, reactivities and solvents for an amount of U.S.\$ 4500. These materials granted by UNIDO arrived in Tanzania during the mission.

The experts were received at the Ministry of Industry, which showed a particular interest to develop a pharmaceutical industry based on the natural resources and to improve the medical assistance of the people.

The representatives of the Ministry of Industry indicated as counter partners of UNIDO experts, the specialists of the Botanical Department of the University from Dar-es-Salaam and recommended the laboratory of the "Traditional Medicine Research Unit" - Muhimbili Medical Center to be the place where the laboratory activity could be implemented.

Both the "Botanical Department" of the University and the "Traditional Medicine Research Unit" have a herbarium whose collections are steadily increased by more samples of plants.

The laboratory of the "Research Unit" placed in the premises of the Faculty of Pharmacy is fitted with certain apparatus and glassware but not enough to develop the research activity in the future. The personnel of this laboratory is not sufficient (the director and senior research fellow, a chemist and a technician).

It is foreseen that the laboratory of the "Research Unit" will move to a new building in the near future. In this case it will be more difficult to cooperate with the other specialists of the other laboratories of the Faculty of Pharmacy. This Faculty is fitted up with a laboratory of pharmacognosy and a laboratory of microbiology.

The activity of the "Research Unit" is focussed on the research of remedies used by the local healers, a long and vast activity.

The persons met by the experts during their activity in Tanzania are indicated in Appendix I.

3. Considerations on the spontaneous flora

Tanzania has a vast territory consisting in savanna, hills and mountainous regions covered by a rich flora and various cultures.

In the spontaneous flora is growing a big variety of medicinal and aromatic species but the majority is not chemically studied though they are used in the traditional medicine.

The richness of the spontaneous flora was particularly noted during the travel of the mobile unit within the country in order to collect samples of medicinal plants along the routes Kabanga - Mwanza - Seronera - Serengeti - Arusha - Moshi - Dar-es-Salaam (1560 km), as well as on other directions towards Morogoro (100 km), Korogwe - Leshoto - Amani - Muheza (600 km) or in the Mereobants of Dar-es-Salaam.

Further information on the medicinal and aromatic plants was obtained from the specialists of the Botanical Department of the University and of the "Traditional Medicine Research Unit" provided with herbaria. The herbarium of the "Research Unit" has a collection of 1000 species, from approx. 1100 species described in the specialized works, which are used by the local healers for the treatment of approx. 100 affections.

On the occasion of the trips in the field the botanist of the mobile unit made demonstrations in front of the Tanzanian specialists on the methodology of quantitative evaluation of medi

cial and aromatic plants which could be harvest yearly without disturbing the balance of the ecological system every year.

In Tanzania there are some limited preoccupations to collect and export certain medicinal species recognized by the pharmacopoeia like the seeds of *Elettaria cardamomum* from spontaneous flora and the bark of *Cinchona succirubra* but there is not a specialized unit to coordinate the gathering of a large range of medicinal and aromatic plants growing in the spontaneous flora.

Large cultures of *Agava sisalana* are located in Tanga region. This species is used as a textile plant but also as a source of hecogenine; the concentrated extract is exported. The multitude of medicinal and aromatic species growing in the spontaneous flora or in cultures could be divided into two main groups.

One group comprising 18 species listed in Appendix II includes medicinal and aromatic species growing in sufficient quantities and recognized by the majority of pharmacopoeia.

Therefore they can be used for the local preparation of medicines without any other research works or high investments in production equipment.

In the same situation are some aromatic plants for the extraction of essential oils necessary in cosmetics and especially in the soap industry.

The most part of medicinal and aromatic species used in the traditional medicine are less or not at all tested for their chemical and therapeutical characteristics.

Among those species growing in big quantities by adequate research works, one may find valuable species that can be used in the production of pharmaceuticals.

Appendix III lists 45 main medicinal and aromatic species which could surely offer the chance to identify useful active principles. In the same Appendix the useful parts of plants as well as their actual application in the traditional medicine are indicated.

A particular attention has to be focussed on the *Solanum* sp. and *Balanites aegyptiaca* species growing in the spontaneous flora in big quantities as solasodine source in the preparation of steroid hormones.

Catharantus roseus (*Vinca rosea*) though not signaled in the spontaneous flora, is cultivated as an ornamental plant and it has very favorable conditions of growing in Tanzania.

This species is used in preparing a medicine for the treatment of leukemia.

Another very important species is *Cananga odorata* whose flowers can be a source of a high quality essential oil for the soap industry.

However for the development of an own pharmaceutical industry and for the enlargement of a range of pharmaceutical products based on local resources it would be advisable to introduce in cultures and acclimatize new species of medicinal and aromatic plants.

This development is all the more so because Tanzania has large area available even not cultivated and the necessary labour power.

In this respect the UNIDO experts handed over to the experimental station in Lushoto seeds for 20 medicinal and aromatic plants brought from Romania to be tested in the local pedoclimatic conditions.

Appendix IV presents these species as well as the main elements of cultivation.

4. Laboratory activity

The laboratory activity of the mobile unit was carried out in the laboratory of the "Traditional Medicine Research Unit" which was fitted up with a part of the necessary laboratory glass ware and apparatus. In order to prepare some pharmaceutical products the samples of medicinal plants were analysed. For instance the content of alkaloids was determined in the leaves of *Datura stramonium* and in *Cortex Cinchonae*; the results are indicated in Appendix V para.A.

From the powder of *Datura Stramonium* it was prepared tincture of *Stramonium* and from *Cortex cinchonae*, it was prepared tincture of *Cinchonae*. Other tinctures were prepared from the fruits of *Capsicum*, the leaves of *Eucalyptus globulus* and the seed of *Elettaria cardamomum*.

The results of the chemical analyses of these tinctures are presented in Appendix V para.B.

The content of essential oils from the samples of aromatic plants is indicated in Appendix V, para.C.

The high content in essential oils is noted in *Eucalyptus globulus* and *Elettaria cardamomum*.

The traditional medicine uses a great variety of plants which are less or not at all checked from a therapeutical point of view.

Besides the above mentioned chemical determinations, the UNIDO experts demonstrated to the Tanzanian specialists an identification methodology of active principles in plants with an unknown chemical composition (See Appendix VI).

The experts carried out, as demonstration, identifications of active principles in the following species : *Cissus*

which quadrangularis/ belongs to the Vitaceae family and it is used by the traditional medicine as an antileprous remedy. The powder has a green colour and it is obtained from leaves and the coronas of the young branches.

Hatanka is a mixture of fine powdered plants and it is used to relief the abdominal pains of "any kind".

Solanum incanum is growing in big quantities in the spontaneous flora. The dry fruits were comminuted and the experts determined the groups of active principles.

The results of the chemical identifications are indicate in Appendix VII.

The good results obtained by chemical determinations have led to the favourable conclusion of 'setting up an extraction and distillation unit for the medicinal and aromatic plants growing in Tanzania.

5. Guidelines for the establishment of a pharmaceutical and essential oils industry

The representatives of the Ministry of Industry showed a particular interest in actual setting up a pharmaceutical industry based on medicinal plants.

So far Tanzania has not had a production of medicines using the local resources of the spontaneous flora.

On the contrary, there is in operation at Dar-es-Salaam a factory "Keko Pharmaceutical Plant" which produces tablets, capsules and apoules using only imported raw materials and substances.

Another factory for the conditioning of medicines is under construction in ARUSHI expecting to start up in June 1980 and other project in Zanzibar scheduled to be put in operation with the UNIDO assistance.

This project is expected to be in operation by 1982 having the following profil and capacity in 1985:

- tablets 500 million
- capsules 20 "-
- oral liquids and galenicals - 250,000 litres
- ointments - 10,000 kg.
- sterile powder, injection - 2 million
- sterile liquids (ampoules) - 2 million
- sterile liquids (vials) - 2 million
- intravenous fluids - 250,000 litres

The last two factories will also operate with imported raw materials.

The development in the future of a pharmaceuticals production based on medicinal plants at an industrial scale can be grafted on one of the above mentioned projects using some of their utilities.

But the first step, namely the setting up of a pilot unit of extraction and distillation has to take place within the "Traditional Medicine Research Unit".

Due to the interest shown by the local authorities the "Research Unit" has to move in the near future to another building separately from the Faculty of Medicine and therefore will have no longer access to some existing laboratory equipment owned by this faculty.

In view of the above, it will be advisable to fit up the "Research Unit" with the laboratory equipment indicated in Appendix IX.

During the consultations between the UNIDO experts and

the management of the "Research Unit", the experts emphasized the necessity of studying the medicinal plants currently used in the world therapeutics and growing in Tanzania, along with the other species used in the traditional medicine.

Based on the first category of plants it will be possible even for this "Research Unit" to prepare some products and make them available immediately for hospitals.

For instance, it is unreasonable to import some tinctures which can be locally prepared. Having in mind this idea, the experts considered both categories of plants, those ones recognized by the international pharmacopoeia and others which still arise question marks concerning the kind of alkaloids, the pharmacodynamical effects, the toxicity and the side effects.

After the consultations with the specialists of "Research Unit" and based on the medicinal and aromatic plants available in the spontaneous flora, the experts prepared 15 pharmaceutical products listed in Appendix VIII.

A pharmacist of the "Keko Pharmaceutical Plant" in Dar-es-Salaam participated in these demonstrations considering the useful co-operation in the future between the "Research Unit" and the factory for the conditioning of medicines.

The experts explained in detail to the representative of the "Keko Pharmaceutical Plant" a general methodology to obtain tinctures and extracts at the industrial scale.

At the same time, for a better understanding of the technology, the experts drew up a flowsheet of apparatus currently in use, their operation and their connections.

The experts consider that a future production unit to process the medicinal plants could be placed along with the condi-

tioning factory - "Keko Pharmaceutical Plant" - Dar-es-Salaam - in order to incorporate the vegetal extracts in pharmaceutical forms like syrups, tablets or ointments.

- Checking up the list of imported medicines it was found that Tanzania imported some simple medicines which could be locally prepared with minimum of equipment and using the local available raw materials.

As an example the compound tincture of Cardamon is imported but Tanzania exports Fructus cardamomi.

The preparation of this tincture by the UNIDO experts aimed to demonstrate the possibility of replacing some imports by products based on the medicinal plants growing in the spontaneous flora.

Taking into account the rich spontaneous flora in medicinal plants and the possibility to develop cultures for some valuable species, it appears necessary and useful to set up, as a first step, a pilot unit for the distillation and extraction of active principles in order to organize locally the production of some pharmaceutical preparations with all advantages for the benefit of a country like Tanzania.

6. Findings

- 6.1. Tanzania has a very rich spontaneous flora and some cultures of medicinal and aromatic plants but there are not reliable data about their quality and an evaluation of the quantity which could be harvested yearly as a material basis for industrial purposes. At present there is no local production of medicines based on medicinal plants.
- 6.2. The traditional medicine is actively used to cure some specific diseases and in this respect many herbs and mixtures are prescribed by the local healers but they have not been checked up for their chemical composition and therapeutical effects.
These research works need time and adequate technical means. The "Traditional Medicine Research Unit" has just started such a kind of research.
- 6.3. There is an organization which collects seeds of Elettari cardamom and the bark of Cinchonae for export but there is not an organization to control the gathering of other species of medicinal and aromatic plants.
- 6.4. There are not organized preoccupations to acclimatize and to introduce in culture valuable species of medicinal plants to enlarge the range of natural resources.
- 6.5. The laboratory of the "Traditional Medicine Research Unit" is partially fitted up for some chemical determinations of active principles but in the future it is advisable to complete the equipment.
- 6.6. The personnel of this "Research Unit" is not sufficient and, as priority, it is necessary to organize the training in the field of medicinal and aromatic plants processing,

taking into account the intention of the local authorities to have a production of medicines.

- 6.7. There is not a pharmacodynamical laboratory to check the pharmaceutical products which are to be produced in the near future.
- 6.8. Although the Ministry of Industry and others local authorities showed interest in a production of medicines as soon as possible based on the medicinal plants recognized by the international pharmacopoeia, at present the activity of the "Research Unit" is focussed mainly on the remedies prescribed by the healers which use plants generally not accepted by the international pharmacopoeia. Therefore, it will be difficult and it takes some time until such plants will be scientifically checked up and become reliable for an industrial production.

7. Recommendations

Taking into account the rich spontaneous flora and the possibilities to develop cultures of medicinal and aromatic plants as well as the interest of the Governmental authorities to set up a pharmaceuticals production based on these plants, the UNIDO experts submit the following recommendations :

7.1. The Botanical Department of University and the "Traditional Medicine Research Unit" with international assistance have to elaborate a programme to identify the medicinal and aromatic plants growing in the spontaneous flora including an evaluation of the quantity of plants which can be harvested yearly without disturbing the ecological system for each region.

7.2. The setting up of a specialized organization to control and to collect the medicinal and aromatic plants useful for pharmaceutical preparations or for export.

This organization could organize the setting up of experimental stations in favourable zones (Arusha, Lushoto, Amani, Morogoro a.), study the acclimatization and the introduction in culture new valuable species.

In order to help the workers who will collect the medicinal plants it would be advisable to issue leaflets describing in the vernacular tongue and through drawing the part of the plants to be collected and their conditioning.

7.3. Taking into account the use of a large range of herbs in the traditional medicine it is necessary that the "Traditional Medicine Research Unit" should go further with the scientific screening of these herbs and select those which are really useful and reject those which present risks of toxicity.

- 7.4. In order to assure the necessary local skilled personnel it is absolutely urgent to select at least three Tanzanian specialists to be trained in the frame of UNIDO training programme in the field of medicinal and aromatic plant processing, as fellowship-holders. The selected candidates should be : botanist or agronomist, analyst (pharmacist or chemist) and technologist (pharmacist). This training programme should be organized in a country with a large experience in the processing of medicinal plants.
- 7.5. Assistance of international experts to train locally the Tanzanian specialists and to develop the research and the production activity in the field of manufacturing pharmaceutical products based on medicinal and aromatic plants.
- The following experts are suggested :
- one botanist for 3 months - preferable period: May-Sept.
 - one phytochemist for 3 months, in the same period, as the botanist. Both experts have to go to Tanzania after the delivery of the laboratory equipment mentioned in Appendix IX.
 - one technologist for 3 months - He should go to Tanzania after the delivery of the equipment for distillation and extraction pilot unit mentioned in Appendix IX.
- The technologist has to supervise the installment of the equipment and to assist the local specialists to start up the production of the medicines.
- 7.6. In the near future, it is advisable to set up a pharmacodynamical laboratory with the assistance of an expert to assure the control of more sophisticated medicines in view of the development of a pharmaceutical industry.

7.7. In order to organize a small scale production of medicines based on medicinal and aromatic plant it is necessary to complete the laboratory equipment available at the "Traditional Medicine Research Unit" and to set up a pilot unit for distillation and extraction of active principles.

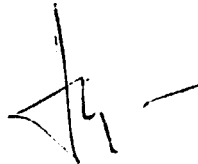
The necessary equipment is indicated in Appendix IX.

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During the mission the experts drew up a project proposal concerning the further assistance to Tanzania as mentioned above based on the discussions held with the representatives of the Ministry of Industry and the management of the "Traditional Medicine Research Unit".

The draft of project proposal is presented in Appendix X and the assistance is estimated at U.S.\$187,000.-

Lucas 

List

of persons met by the UNIDO experts

1. Mr.S.K.Henein -
Assist. of UNDP Rez.Rep.
2. Mr.Kimf. Forss
Programme Officer UNDP/UNIDO
3. Mr.F.S.Mujuni
Director of Industrial Operation at the Ministry of Industry
4. Mr.Mchomvu
Director in the Ministry of Industry
5. Mr.Lars Thede
Adviser in the Ministry of Industry
6. Mr.E.N.Mshiu
Director and Senior Research fellow
Traditional Medicine Research Unit (TMRU)
7. Mr.Dr.K.Mtotomwema
Director of Department of Botany
University of Dar-es-Salaam
8. Mr.Boniface Mhoro
Botanist - University of Dar-es-Salaam
9. Mr.R.L,A. Mahunnah
TMRU
10. Mr.Dr.S.C.Chhabra
TMRU
11. Mr.Dr.Ahmed Hassanae
TMRU
12. Mr.Emmanuel B. Katenga
Pharmacist, production manager at "Keko Pharmaceutical Plant"
13. Mr.Ramadhan S.Sombi
Chemist
Chemist for quality control at "Keko Pharmaceutical Plant".

List

of medicinale and aromatic plants recognized by
international pharmacopoea and growing in sufficient
quantities in Tanzania

No.	Botanical name	Quantities	Part used	Composition	Therapeutic effects
1.	Acacia senegal	big quantities spontaneous	gum	arabinose	-
2.	Agave sisalana	big quantities cultivated	leaves	hecogenine	-
3.	Capsicum frutescens	- " -	fruits	capsaicine 0.22 %	antirheumatics
4.	Cinchona succirubra	sufficient quantities cultivated	bark	alkaloids 2-9%	antimalaria
5.	Chenopodium ambrosioides	big quantities spontaneous	herb	essential oil 1 %	antihelminthic
6.	Cola nitida	sufficient quantities cultivated	seeds	coffeine 1.2-2.4%	-nervous stimulant -cardiotonic
7.	Citrus aurantium	-	leaves fruits bark	essential oil 0.2 - 0.3%	-psychodepressor -antispasmodic
8.	Cymbopogon citvatus	-	hores	essential oil	-
9.	Datura stramonium	sufficient quantities spontaneous	-"	alkaloids 0.2-0.3%	-depressor -antiparkinson
10.	Eucalyptus globulus	Sufficient quantities cultivated	-"	essential oil 1.6 - 6%	antibronchitis
11.	Eugenia caryophyllata	-"	buds	essential oil 16-21% eugenol 90%	analgesic
12.	Foeniculum officinale	sufficient quantities cultivated	fruits	essential oil 2 - 4%	carminativ
13.	Gomphocarpus frutiasus	sufficient quantities spontaneous	seeds summits	glucosides -cardiotonics.	cardiotonic
14.	Ocimum basilicum	big quantities spontaneous	herb	essential oil 0.1- 0.8%	carminativ

No.	Botanical name'	Quantities	Part used	Composition	Therapeutic effects
15.	Phytolacca dodecandra	sufficient quantities cultivated	roots	alkaloids	laxative antihelmintic
16.	Punica granatum	-	bark roots	alkaloids 0.3-0.7%	taenifuge
17.	Rawolfia vomitoria	sufficient quantities spontaneous	roots rhizome	alkaloids 0.5-2%	nervous sedative cardiofonic
18.	Ricinus communis	big quantities spontaneous and cultivated	seeds	fat oil	purgative rubefiant

Medicinal and aromatic plants growing in big quantities in the spontaneous flora and used in the traditional medicine but enough tested for their chemical and therapeutical characteristics

No.	Botanical name	Part of the plant used	Utilization in therapeutics
1.	<i>Aloe flexilifolia</i>	sap	swelling of the testicles
	<i>Aloe graminicola</i>	leaves	stomach diseases; malaria
	<i>Aloe rabainensis</i>	"	enlarged spleen
2.	<i>Asparagus africanus</i>	roots	sore throat and coughs
	" <i>racemosus</i>	"	indigestion and gonorrhoea
	" <i>setacens</i>	fruits, leaves	pneumonia and coughs
3.	<i>Balanites aegyptiaca</i>	roots	purgativ
4.	<i>Calotropis procera</i>	"	snake bite
5.	<i>Cassia abbreviata</i>	"	fever and malaria
	" <i>absus</i>	"	stomach troubles
	" <i>afrofistula</i>	roots, leaves	colic
	" <i>alata</i>	leaves	skin diseases (ringworm)
	" <i>floribunda</i>	"	eliminate of the placenta
	" <i>italica</i>	leaves, roots	gonorrhoea, purgative
	" <i>obtusifolia</i>	herb	stomach troubles
	" <i>senna</i>	roots, bark	constipation
6.	<i>Centella asiatica</i>	herb	syphilis
7.	<i>Dioscorea astericus</i>	leaves	sore eyes
	" <i>dumetorum</i>	roots	bilharzia
	" <i>quartiniana</i>	"	plague and lever
8.	<i>Eucalyptus bicostata</i>	leaves	chicken-pox
9.	<i>Euphorbia candelabrum</i>	stems	after childbirth to clear out the afterbirth
	" <i>hirta</i>	leaves	asthma
	" <i>obovalifolia</i>	wood	stomach pains in child-birth
	" <i>tirucalli</i>	roots	snakebite and sterility
	" <i>usambarica</i>	"	children's diseases
10.	<i>Gloriosa superba</i>	"	abortion
11.	<i>Hypericum peplidifolium</i>	roots, bark	indigestion
12.	<i>Iboza multiflora</i>	roots	bilharzia, pneumonia, indigestion
13.	<i>Lobelia anceps</i>	leaves	swellings of the body
	" <i>holstii</i>	roots	coughs
14.	<i>Passiflora edulis</i>	"	earache
15.	<i>Pelargonium alchemilloides</i>	leaves juice	sore eyes
	" <i>quinquelobatum</i>	roots	diarrhoea in children
16.	<i>Pimpinella kentensis</i>	roots, leaves	orchitis
17.	<i>Polygala erioptera</i>	-	babies' diseases
	" <i>paniculata</i>	roots	aphrodisiac
	" <i>stenopetala</i>	leaves	affected eyes
18.	<i>Rhus vulgaris</i>	fruits, roots, leaves	diarrhoea, gonorrhoea, infertility

No.	Botanical name	Part of the plant used	Utilization in therapeutics
19.	<i>Scilla indica</i>	bulb	earache
20.	<i>Solanum aculeastrum</i>	roots	bronchitis
	" <i>incanum</i>	"	abdominal pains, dyspepsie, fever
21.	<i>Straphanthus eminii</i>	"	worms, febrifuge
22.	<i>Strychnos spinosa</i>	"	earache
23.	<i>Tamarindus indica</i>	twigs	diarrhœa and dysentery

List

of medicinal and aromatic plant species recommended to be introduced in culture.

The seeds of these species were brought by the UNIDO exports from Romania.

The main elements of cultivation technology.

No.	Botanical name	Previous culture	Fertilisers			Ploughing depth cm	Soil works Before sowing	Sowing	Sowing	Sowing	Sowing	Sowing	Sowing	Sowing	Harvest			Productivity
			P ₂ O ₅ kg/ha	K ₂ O a.s.	N										Quantity kg/ha	Distance cm	Depth cm	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1.	<i>Atropa belladonna</i>	vegetables cereal not after solanaceae	20-30	70-80	45-55	90	28-30	disk harrow roller	XI XI	4-6	60-15	1.5-2	hood wooded thinned	leaves roots in 2nd year.	manual 1-2 harvests	at shadew t° max. 50-60°C	dried leaves (6-7:1) dried roots (4-5:1)	500 600 700 1000
2.	<i>Colendula officinalis</i>	plants with annual hoeing	60-80	-	40-50	20-25	disk harrow	III	6-7	30	2-3	hood wooded	flowers	manual	at shadew t° max. 40-50°C	dried flowers (8:1)	1200	
3.	<i>Carum carvi</i>	plants with annual hoeing cereal	40-50	60-70	45-50	28-30	disk harrow roller	III	10-12	50	1.5-3	" "	when 35-40% of fruits are yellow	" "	dry- ing and se- lec- tion	fruits	700 1000	

APPENDIX

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
<i>Coriandrum sativum</i>	-plants with annual hoeing cereal	-	40-50	30-35	60-70	20-25	-disk harrow	III	15-18	50- or 25	4-5	hoed weeded	when 50-70% of fruits are yellow	mechanical means	drying and selection	fruits 1500
<i>Cynara scolymus</i>	-plants with annual hoeing	-	60-70	50-65	70-80	28-30	-disk harrow	V	4-5	70	3-5	-"	green leaves	manual	at shadow	dried leaves 1500 3000 t° max. (6-7; 50-60°C.1)
<i>Datura innoxia</i>	-plants with annual hoeing with manure; not after solanaceae	-	60	60	120	28-30	-"	IV	10-12	50	4-5	-"	herbs when appears first fruit	manual	at shadow	dried herbs 2500 3000 t° max. (6-9; 60-70°C.1)
<i>Digitalis lanata</i>	-plants with annual hoeing	-	40-80	-	45-50	20-25	-disk harrow roller before and after sowing	III	3-4	50	1-1.5	-"	when the leaves have 3 months	manual	at shadow	dried leaves 1000 2000 t° max. (5-6; 35-40°C.1)
<i>Foeniculum officinale</i>	-cereal not to be sowed in fields with <i>Cuscuta</i> sp.	-	40-50	-	60-70	28-30	-disk harrow	III	8-10	60	2-3	-"	when the fruits are yellow-brown	manual or with mechanical means	dry- ing selection.	fruits 600 1000

APPENDIX

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
9.	Lavandula angustifolia	It will be planted besides crop-rotation	40-50 at the beginning.	45-70 each year	150-200	85-100	45-60	leveling disk harrow	shoot XI-XII plantation X-XI	-	100 x 50	-	hood-weeded	when 50% of flowers are open	manual weeding with 12 cm stem	by dis-tillation	green in-ros-cence	
10.	Matricaria chamomilla	plants with very short vegetation period	-	40-50	45-50	40-50	15-20	leveling disk harrow roller	VIII-IX	4-5	25	0.3-0.5	weed-ed	when major-ity of flowers are hori-zontal	ma-jor-ity of flowers are hori-zontal	at sha-dow (5:1) max. 30-35°C	at dried in-ros-cence (5:1) max. 30-35°C	600-800
11.	Osimum basilicum	plants with annual hoeing/very clean	-	40-50	30-40	50-70	20-25	disk harrow roller	IV	4-6	50	1.5-2	hood-weed-ed	at com-ple-to bloo-ning of main in-flo-res-cence	with sick-les	at sha-dow (5:1) max. 30-35°C	at dried herbs (5:1) max. 30-35°C	150-200
12.	Pimpinella anisum	plants with annual hoeing very clean	-	50-60	-	70-80	20-25	disk harrow	III	10-12	50	2-3	hood-weed-ed	when 50% of fruits are yellow-	with sick-les	dry-ing loc-tion	fruits its	150-200

APPENDIX

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
13.	Plantago lanceolata	plants with annual hoeing besides crop-rotation.	-	50-60	30-40	60-80	20-25	-disk -harrow -roller	XI	5-6	50	0.5-1	-hoed -wooded	when the leaves have 12-14 cm	with sickle	at shadow	dried leaves (6:1)	2000
14.	Salvia officinalis	plants with annual hoeing cereal besides crop-rotation	-	50-60	40-50	60-70	28-30	-disk -harrow	XI	6-8	70	3-4	-hoed -wooded	leaves during blooming	manual	at shadow	dried leaves (4:1)	600-800
15.	Saponaria officinalis	plants with annual hoeing cereal	-	50-60	30-40	40-50	28-30	-disk -harrow	III	8-10	50	2-3	-"	roots	-"	at sun	roots (4:1)	800-1200
16.	Sinapis alba	plants with annual hoeing	-	50-60	-	60-80	20-25	-disk -harrow	III	10-12	25	2-3	-wooded	when the plants are yellow	with sickle	dry- ing	seeds	1000-1500
17.	Solanum laciniatum	plants with hoeing cereal	-	40	30	80-90	28-30	-disk -harrow -roller	III	4	60	3-4	-hoed -wooded	when the first fruit appears on stem	with sickle at 20 cm high	at shadow	dried herbs (7-8:1)	2000-2500
18.	Tagetes patula	plants with hoeing clean	-	50-60	-	70-80	20-25	-disk -harrow -roller	III	4-8 manual,	50	1-15	-hoed -wooded	when the flowers are completely	manu- al	at shadow	dried ligule (7:1)	250-350

APPENDIX

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
19.	Thymus vulgaris	- plants with hoeing - cereal besides crop-rotation.	-	60-80	-	80-100	28-30	-disk -harrow -harrow	shoot III. plan- tati- on : X	0.4 Kg/100m ²	20 * 59 x 20 with 2-3 shoot	0.5-1	-weeded -water- ed -hoed -weeded	at the ope- ning of first flow- ers.	-manu- al with sickle	at sha- dow t max. 30- 35°C	at herbs (4:1)	20 25
20.	Valeriana officinalis	- plants with hoeing - cereal - very clean	-	60-70	50-60	35-40	28-30	-disk -harrow -roller	X-XI	4-6	50	0.5-1	-hoed -weeded	at the end of vege- ta- tion	manu- al with sick- le	at sha- dow t max. 35- 40°C	at roots (4-5: 1)	12 15

Results of the chemical analysis

A/ Quantitative determinations of alkaloids

No.	Botanical name	Part used	Content in alkaloids		Total ash	
			Indicated in literature	Existing	Indicated in literature	Existing
1.	Cinchona succirubra	cortex	min. 6,5 g%	6,62 g%	max. 6 %	4,85 g%
2.	Datura Stramonium	folium	min. 0,25 g%	0,242 g%	max. 20 %	18,5 g%

B/ Analyses of tinctures

No.	Denomination	Content in alkaloids		Alcohol concentration		Dried residue	
		Indicated in literature	Existing	Indicated in literature	Existing	Indicated in literature	Existing
1.	Tincture-cinchonae	0,30-1.10 g%	0,83 g%	63-66 %	63 %	-	-
2.	Tincture-stramonii	0,025-0,028 g%	0,025 g%	63-67 %	64 %	-	-
3.	Tincture-capsici	-	-	63-67 %	64 %	min 4 g%	4,12 g%
4.	Tincture-Eugalypti	-	-	63-64 %	63 %	min. 2,5 g%	3,2 g%
5.	Tincture-Cardamomi comp.	-	-	52-57 %	55 %	Content of glycerine	
						Indicated	Existing
						4,5 - 5,5 g%	4,5 g%

C/ Quantitative determinations of essential oils

No.	Botanical name	Part used	Content indicated in literature	Content existing	Observations
1.	Eletaria Cardamomum	semen		6,64 %	dried seeds
2.	Eucalyptus globulus	folia	min. 1.5 %	3,9 %	dried leaves
3.	Eucalyptus globulus	folia		2,2 %	green leaves
4.	Eucalyptus citriodora	folia		2,85 %	semidried leaves
5.	Cimbopogon citratu	herba		1,8 %	dried herb
6.	Ocimum bazilicum	herba		1,19 %	"-
7.	Ocimum gratissimum	herba		2 %	"-
8.	Cananga odorata	flores		1,44 %	fresh flowers

TABLE IV

QUALITATIVE ANALYSIS OF URIC ACID (CONTINUED)

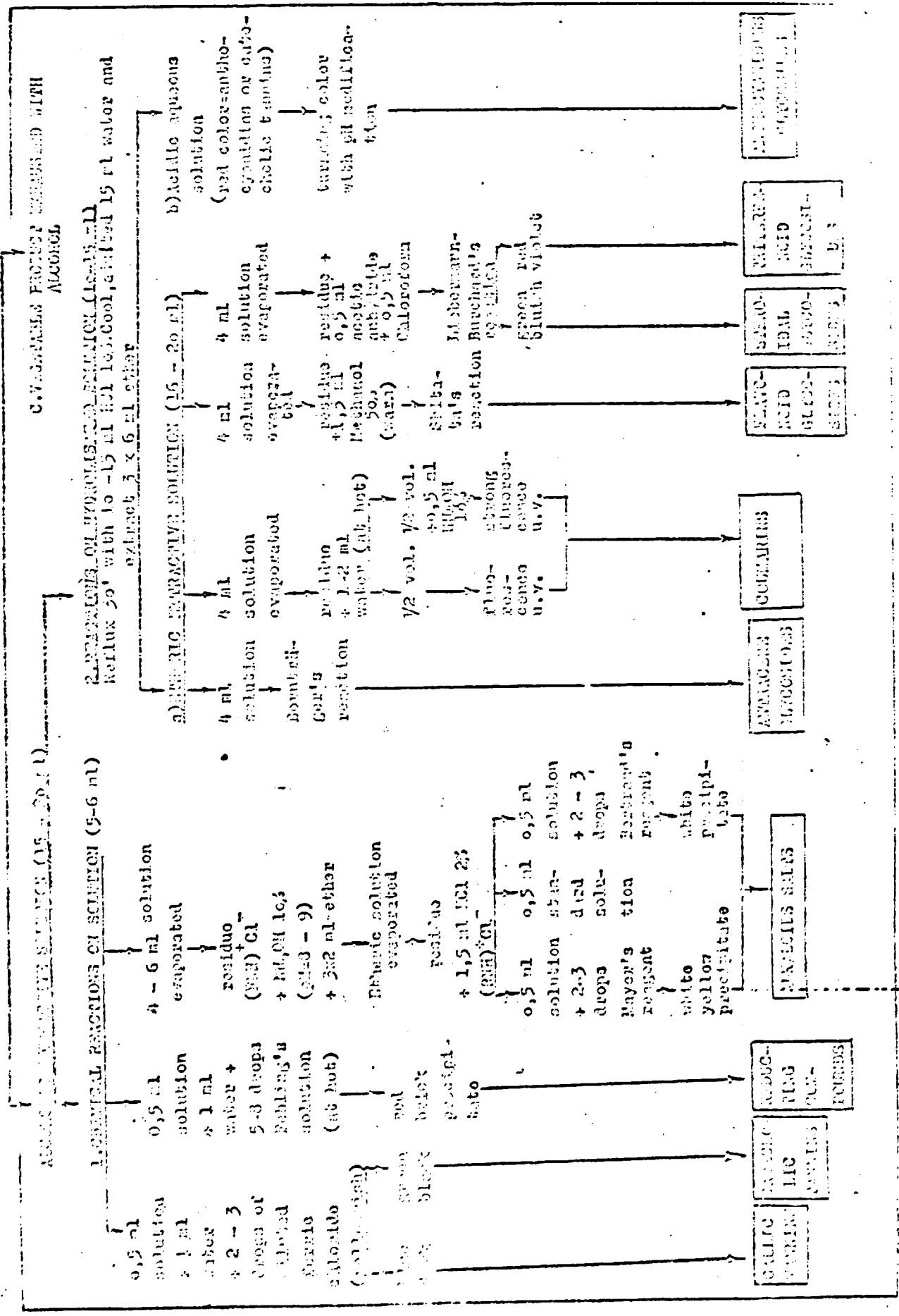
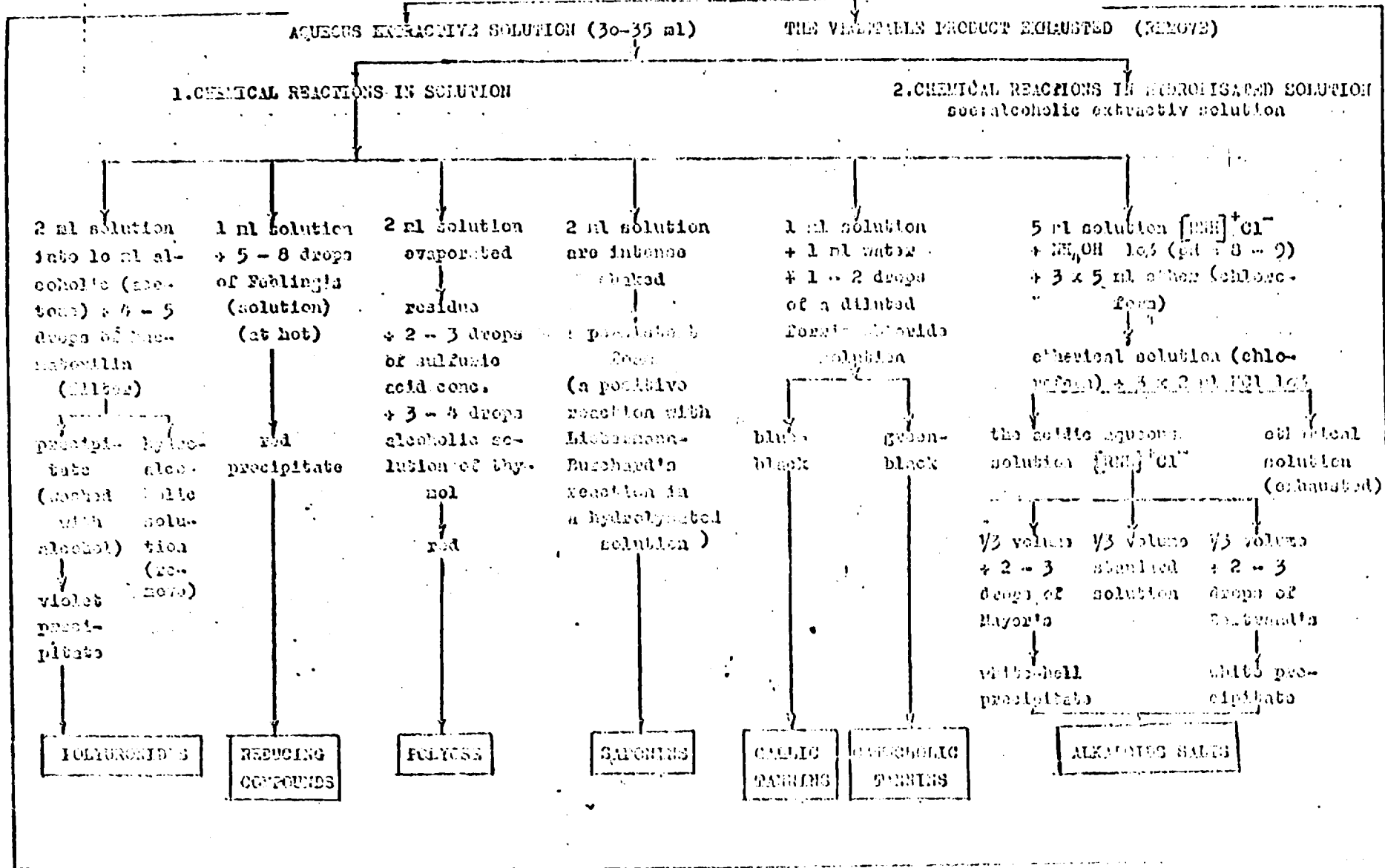


TABLE 7

C. THE VEGETABLE PRODUCTS EXHAUSTED WITH WATER AND ALCOHOL.
It is exhausted with water.



MACROSCOPIC EXAMINATION

The plant's organ	Radicis, Rhizoma, Tubera, Cormus, Bulb, Radix, Caulis, Flos, Fructus, Semen, Lignum, Mucilago, Gummiferum, Resin, Gummi, Latex, Laticium, Sassafras, Cortex, Lignum, Mucilago, Gummiferum, Resin, Gummi, Latex, Laticium	Cortex (bark)	Folium (leaves)	Flos (flowers)	Herba (stem, leaves, flowers)	Fructus (fruit)	Semen (seed)
Appearance (aspect)	<ul style="list-style-type: none"> - Transversal section (determination of the organ relation between the tissues). - The form - Decorticated or not - The fracture (fibrous, clear, smooth, granular, lacinious) - The consistence 	Transversal section (relation between the tissues, mechanical elements). <ul style="list-style-type: none"> - The form - With or not with suber - The external surface (area) (striates, lenticels, lichens). - The internal surface (striates or flat surface) - The fracture - The consistence 	<ul style="list-style-type: none"> - Leaves with or out hairs, thin or thick, with petioles or sessiles. - The material of the leaf. - The form - The border - The nervation (this leaves). 	<ul style="list-style-type: none"> - Isolated or in inflorescence (inflorescence type) - Stage of development - Complete or not - The material of the flower. - The floral analyse. 	Characterisation of every organ (Caulis, Folium, Flos, Fructus) <ul style="list-style-type: none"> - The material of the organ - The disposition of the leaves and flowers on the stem 	<ul style="list-style-type: none"> - The type - The form - The consistence - The transversal section (relation between the tissues). - The presence or absence of the seeds. 	<ul style="list-style-type: none"> - The form - The consistence - The transversal and longitudinal section (relation between segment, endosperm and embryo).
Dimensions	<ul style="list-style-type: none"> - length - breadth (width) - diameter 	<ul style="list-style-type: none"> - length - breadth - thickness 	The material of the organ. <ul style="list-style-type: none"> - thin leaves - thick leaves - length - breadth (width) 	The diameter after moistening	See every organ	<ul style="list-style-type: none"> - length - breadth - diameter 	<ul style="list-style-type: none"> - on millimeter paper (length, breadth)
The colour of the dried material	By external and internal after tearing;	The external and internal surface	The dorsal and ventral surface	For the corolla	For every organ	Inner and outward	Inner and outward
Smell and taste	AFTER THE BREAK UP OF THE MATERIAL OR "DECOCTUM"						

TABLE II

MICROSCOPIC EXAMINATION

The plant's organ	Roots, Rhizome, Stem, Branches	Cortex (bark)	Leaf (leaf)	Flowers (flowers)	Herb (stems, leaves, flowers)	Fruit (fruit)	Flower (seed)
Transverse, longitudinal, radial and tangential sections.	<ul style="list-style-type: none"> -Structure type -The disposition of xylem and liber phloem -Characteristic elements and tissues (starch, calcium oxalate, lignified tissues, fibres, stone cells, secretory apparatus, etc). 	<ul style="list-style-type: none"> General aspect (medullary rays, lignified tissues, fibres, stone cells, calcium oxalate, starch, etc). 	<ul style="list-style-type: none"> -The structure of the limb -The fasciole type -Pericycle nature -The secretory apparatus (purses, canals, cells, glandular hairs, latex vessels) -Epidermal trichomes 		For every organ	<ul style="list-style-type: none"> -Meri carp structure (mechanic tissues, secretory canals, latex vessels, etc) - For the fruits with seed see Semen 	<ul style="list-style-type: none"> -The teguments' structure (spermatophyta, mechanical tissue, coloured tissue) -The endosperm's structure -The cotyledons' structure (col- lular inclusion)
Power and cleared "concisium" preparate	<ul style="list-style-type: none"> -Common elements and tissues (fragments of large xylem vessels, reticulate vessels, round bordered pits, sclerified vessels, fragments of cork, fragments of parenchyma) -Characteristics elements and tissues (simple fibers or together with crystals, stone cells, fragments of parenchyma, calcium oxalate, starch) 	<ul style="list-style-type: none"> -Common elements and tissues (fragments of phloem parenchyma, cortical parenchyma, cork) -Characteristic elements and tissues (simple fibers or together with crystals, stone cells, fragments of parenchyma, calcium oxalate, starch) 	<ul style="list-style-type: none"> -Common tissues (fragments of chlorophyllian tissue, spiral vessels, annular, ring, reticulate, small vessels, epidermal fragments) -Characteristic elements and tissues (type of stomate, striated cuticles, epidermal trichomes and glandular, simple fibers or with crystals) 	<ul style="list-style-type: none"> -Common elements and tissues (fragments of tissues, papilla, pollen, xylem vessels, epidermal fragments) -Characteristic element (hairs glandular hairs, calcium oxalate, fibers, stone cells, pollen's membrane) 	For every organ	<ul style="list-style-type: none"> -Common tissues (fragments of epicarp, small vessels, fragments of mesocarp with volatile oil, fat oil) -Characteristic elements (fibers, stone cells, hairs, calcium oxalate, starch, pigmentary cells) 	<ul style="list-style-type: none"> -Common tissues (fragments of cotyledon, of endosperm with fat oil and aleurone, small vessels) -Characteristic elements (fragments of pigmentary tissues, fibers, stone cells, calcium oxalate, starch)

Results of the chemical identifications
of active principles.-

Botanical name	Cissus quadran- gularis	Ximenia cafra (Mtun- dui)	Hataoka	Solanum incanum
Part used	Herb	Root	Mixture of plants	Fruit
<u>Identified active prin- ciples</u>				
-Essential oil	-	-	-	-
-Alkaloids(bases)	-	-	-	-
-Fat acids	-	-	-	-
-Coumarins derivateves	-	-	-	-
-Flavone aglicones	-	-	++++	-
-Emodins	-	-	++++	-
-Carotenoides	+++	-	-	-
-Sterols	+++	+++	-	++++
-Triterpenes	-	-	+++	-
-Gallic tannins	-	-	-	-
-Catecholic tannins	+++	++++	++++	++++
-Reducing compounds	++	+++	++	+++
-Alkaloids salts	-	-	-	-
-Antracenosides	-	-	++++	-
-Coumarins	-	-	-	-
-Steroidal heterosides	+++	+++	-	+++
-Triterpenoid heterosides	-	-	+++	-
-Flavonosides	-	-	+++	-
-Antocianosides	-	-	-	-
-Starch	+++	-	-	++
-Polyoses	++	++	+++	+++
-Saponosides	-	-	+	-
-Gallic tannins	-	-	-	-
-Catecholic tannins	-	+++	-	+++
-Alkaloids salts	-	-	-	-

List

of the pharmaceutical products prepared by the UNIDO

1. Cardamom tincture

contains :

- Fructus cardamomi - 200 gr.
- Alcohol aethylicus 70° q.s. ad. 1000 ml.

Indications: Light carminative, flavouring and rectifying the taste and the odour of various preparations.

Contraindications: none

Dose : 5 ml.

2. Compound Cardamom tincture

contains :

- Fructus Cardamomi - 14 gr.
- Fructus Carumgarvi - 14 gr.
- Cortex Cinamomi - 2 gr.
- Cochineal - 7 gr.
- Glycerinum - 50 ml.
- Alcohol aethylicus 60° q.s. ad. 1000 ml.

Indications: Carminative and stimulator in the treatment of chronic and inflammatory dyspepsias.

Contraindications: none

Dose : 2 - 5 ml.

3. Cinchonae tincture

contains :

- Cortex Cinchonae - 200 gr.
- Acidum hydrochloricum dilutum 10 ml.
- Alcohol aethylicus 70° q.s. ad. 1000 ml.

Indications: Internal : bitter tonic. before meals.

External : Capillary lotion by vessel dilatation.

Contraindications: pregnancy, nurse period, haemolytic anaemia.

Dose : Adults : 2 - 5 gr./day

Children: 3-5 years - 0.5 gr/day

6-10 " - 1 gr/day

11-15 " - 2 gr/day

4. Capsici tincture

contains:

- Fructus Capsici - 100 gr.

L i s t

of the pharmaceutical products prepared by the UNIDO

1. Cardamom tincture

contains :

- Fructus cardamomi - 200 gr.
- Alcohol aethylicus 70° q.s. ad. 1000 ml.

Indications: Light carminctive, flavouring and rectifying the taste and the odour of various preparations.

Contraindications: none

Dose : 3-6 ml.

2. Compound Cardamom tincture

contains :

- Fructus Cardamomi - 14 gr.
- Fructus Carum Carvi- 14 gr.
- Cartex Cinamomi - 28 gr.
- Cochineal - 7 gr.
- Glycerinum - 50 ml.
- Alcohol aethylicus 60° q.s. ad. 1000 ml.

Indications: Carminctive and stimulator in the treatment of chronical and immflammatory dispepsies.

Contraindications: none

Dose : 2 - 5 ml.

3. Cinchonae tincture

contains :

- Cartex Cinchonae - 200 gr.
- Acidum hydrochloricum dilutum 10 ml.
- Alcohol aethylicus 70° q.s. ad. 1000 ml.

Indications: Internal : bitter tonic. before meals.

External : Capillary lotion by vesseldilatation.

Contraindications: pregnancy, nurse period, hoemolitical anaemia.

Dose : Adults : 2 - 5 gr./day

Children: 3-5 years - 0.5 gr/day

6-10 " - 1 gr/day

11-15 " - 2 gr/day

4. Capsici tincture

contains:

- Fructus Capsici - 100 gr.
- Alcohol aethylicus 70° q.s. ad. 1000 ml.

Indications: Internal : carminative

External : revulsive for rheumatic and neurologic pains.

Contraindications: Internal : gastric inflammations.

Dose : Internal : 0.5 gr/once and 1.5 gr/day.

5. Colae tincture

contains :

- Semen Colae - 200 gr.
- Alcohol aethylicus - 70° q.s. ad. 1000 ml.

Indications : Stimulus of the central nervous system for infectious diseases, tiredness, depression dispositions.

Contraindications: Children under 3 years.

Dose: adults : 2 - 10 gr/day

children: 3 - 5 years - 1 gr/day

6 -10 years - 1.5 gr/day

11 -15 years - 2 gr/day

6. Eucalypti tincture

contains:

- Folium Eucalypti - 200 gr.
- Alcohol aethylicus 70° q.s. ad. 1000 ml.

Indications: - light disinfectant, anaesthetical and astringent effects on mucous membranes.

- internal : Antiseptic for breathing apparatus, and for the uro-genital ways.

Contraindications: none.

Dose: adults : 2 - 10 gr/day.

children: 0.2 gr/year age.

7. Stramonii tincture

contains :

- Folium stramonii - 100 gr.
- Acidum sulfuricum - 10 ml.
- Alcohol aethylicus q.s. ad. 1000 ml,

Indications : Asthma emphizem, neuroses, spasms of non-striated muscles.

Contraindications: Costiveness, glaucoma, prostatic affections, atrial fibrillation.

Dose : 0.5 ml/once but 1.5 ml/day.

max. dose : 1 ml/once and 3 ml/day.

8. Coffee tincture

contains:

- Coffee - 200 gr.
- Aqua distillata - 600 ml
- Alcohol aethylicus - 500 ml

Indications: stimulus of the central nervous system during convalescence.

Contraindications: - gastric ulcer or gastritis with hyperacidity.
- children under 3 years old

Dose : adults : 5 - 15 gr/day
children : 3 - 5 years : 2 gr/day
6 - 10 years : 3 gr/day
11 - 15 years : 4 gr/day.

9. Tonic tincture

contains :

- Cinchonae tincture - 50 ml
- Collae tincture - 50 ml

Indications: Bitter tonic and light nervous stimulus.

Contraindications: Children under 3 years old, pregnancy, during nurse period.

Dose : 1 coffee spoon in a glass of water, twice a day.

10. Tonic

contains :

- Natrium phosphoricum - 15 gr
- Cinchonae tincture - 30 ml
- Coffee tincture - 30 ml
- Glycerinum - 50 ml
- Wine q.s. ad. 1000 ml

Indications: Bitter tonic for light digestive disturbances.

Contraindications: Children under 15 years old

Dose : 1½ coffee spoon in ½ glass of wine, one hour before meals.

11. Antirheumatic solution

contains :

- Capsici tincture - 10 ml
- Methylum salicylicum - 3 ml
- Ammonium hydricum solutum - 5 ml
- Alcohol aethylicus - 50 ml
- Aqua distillata q,s, ad. 1000 ml

Indications : Rheumatological affections of joints, chronic and evolutive polyarthritis. Revulsive with analgesic and local antiinflammatory effect

Contraindications: It is not used on irritated skin.

Dose : Light embrocation on painful sides.

12. Sedative syrup

contains :

- Natrium chromatum - 2.5 gr.
- Calcium bromatum - 2.5 gr.
- Stramonii tincture - 2 ml.
- Natrium benzoicum - 2 gr.
- Syrupus simplex - 30 ml.
- Aqua distillata q.s. ad. 100 ml.

Indications: Sedative and antispasmodic for children with restlessness, insomnia, tooth disorders or whooping cough.

Contraindications: none.

Dose : 1 year - 1 coffee spoon/day

2 years - 1½ " "

3 " - 2 " "

4 " - 1 spoon

13. Disinfectant of bucal cavity

contains:

- Acidum benzoicum - 3 gr.
- Mentholum - 0.5 gr.
- Oleum Eucalypti - 0.5 gr.
- Eucalypti tincture q.s. ad. 100 ml

Indications : Antiseptic of the bucal cavity in the treatment of pharyngitis, stomatitis.

Contraindications: It is not recommended for children.

Dose : 10-15 drops in ¼ glass of water - twice gargles per

14. Antispasmodic and antacid powder

contains :

- Folium stramonii (0.25%) - 4 gr.
- Bismuthum Carbonicum basicum - 50 gr.
- Calcium carbonicum praecipitatum - 20 gr.
- Magnesium oxydatum - 15 gr.
- Kaolinum - 15 gr.
- Oleum citronellae - 15 drops

Indications: Ulcer- it acts as a gastric binding with antispasmodic and antiaacid effect.

Contraindications: Costiveness.

Dose : 1 spoon in $\frac{1}{2}$ glass of water twice/day.

15. Tablets with analgesic and antifever effects, as well as cardiotoxic effect.

contains :

- Cinchonae pulvis - 0.10 gr.
- Acidum aethylsalicylicum - 0.30 gr.
- Coffeinum - 0.04 gr.
- Amylum - 0.04 gr.
- Talcum - 0.02 gr.

Indications: Fever dispositions, migraines, influenza, rheumatism, cardiotoxic effect.

Contraindications: gastritis, ulcer, liver and kidney affections.

Dose : 2 - 4 tablets/day. In case of acute fever dispositions up to 6 tablets/day, 2 tablets each 3 hours.

Listof laboratory equipment for the "Traditional Medicine
Research Unit" - Dar-es-Salaam

<u>ITEM No.</u>	<u>DESCRIPTION</u>	<u>QUANTITY</u>
1.	Complete TLC Set	
	a) UV lamp (240 V. main)	1
	b) Set of laboratory spray gun	3
	c) Unoplan Leveller model SA MK 11	1
	d) Universal TLC Chromatank	4
	e) Multiple Plate Chromatank	2
	f) Chromajars	12
	g) Spotting jigs	4
	h) Chromaplate racks	6
	i) Universal Sheet Chromatank	2
	j) Ultraviolet Contrast control goggles	2
	k) Packets of Stainless Sheet wire clips	3
	l) Chromaklip	1 packet
	m) Dip tray (51 x 21 cm)	1
	n) TLC Plates-pre-coated (20 x 20 cm)	10 boxes
	o) Whatman Chromatography paper grade 1	2 boxes
	p) Grade 3 MM Whatman paper	2 boxes
2.	Rotavapeur	1
3.	Fraction Collector	1
4.	Vacuum Pumps	1
5.	Water Circulators (pumps)	3
6.	Freeze driers	1
7.	Cylinders (N ₂ , CO ₂ , H ₂ , Air)	12
8.	U.V. Spectrophotometer & accessories	1
9.	I.R. Spectrophotometer with hydraulic press	1
10.	p.H. meter	1
11.	Grinder	1
12.	Commercial blender	1
13.	Water cooler	1
14.	Colorimeter	1
15.	Glass-ware dryer	1
16.	Mechanical stirrer	4
17.	Vacustat	3
18.	Melting point apparatus	2
19.	Hot air dryer	1
20.	Heating Coils (different sizes)	6
21.	Dimmerstat	6
22.	Research Microscope with camera (Wickers)	1
23.	Dissecting microscope	1
24.	Microtome	1
25.	Flask Shaker	1
26.	Vortex Mixer	1
27.	Sieves (10 - 300)	One Set
28.	Sieve Shaker	1
29.	Sample divider	1
30.	Heating Mantles 1 lit, 3 lit, 5 lit, 10 lit	2 each
31.	Glassware washing machine	
32.	Autoclaves	1
33.	Double distillation water still	1
34.	Apparatus for determinations of essential oils	1

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TOTAL : 50,000 \$

Estimated cost: 43,500 \$

Transport 15% : 6,500 \$

Listof equipment for an extraction and distillation
pilot unit

No.	Denomination	Quantity pieces
1.	Percolater : 50 l Material : stainless steel	1
2.	Percolater : 30 l Material : Stainless steel	5
3.	Concentrater with heating jacket and vacuum pump - capacity : 50 l Material : Stainless steel	1
4.	Refrigerater - 2 m ³ Material : coil in stainless steel	1
5.	Vessel of sedimentation 50 l Material : stainless steel	1
6.	Collecting vessel 50 l Material : stainless steel	1
7.	Vessel for the preparation of syrups with heating jacket and stirring system. Capacity : 300 l Material : stainless steel	1
8.	Press filter-frame 20/20 cm	1
9.	Pump - H = 4 m	1
10.	Steam generator 1,5 t/h	5
11.	Collecting vessels 20 l Material : stainless steel	5
12.	Distillater with florentin vessel for essential oils Capacity : 150 l. Material : stainless steel	1
13.	Balance 5 - 100 Kg.	1

TOTAL estimation cost including transport :

85,000 ;

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Project Proposal

Part A.- Basic Data

Country: United Republic of Tanzania

Project No:	Project title: Assistance programme for
Scheduled start: May 1980.	the valorization of medi-
Scheduled completion: 1981.	cinal and aromatic plants
Origin and date of	in order to prepare medi-
official request:	cines.

Government counter-	UNIDO Contribution :
part agency:	Government contribution:
Proposed submitted	Currency required:
by :	For UNIDO input : 187,500 ;
Date of submission :	convertible : 187,500 ;
	Other :

UNIDO substantive	Chemical
backstopping section:	Industries
	Section

Programme component

Code :

x

x x

Part B.- Narrative 1. Background and justification

The development of traditional medicine based on available medicinal plants in developing countries is one of the very important programme of UNIDO..

Several programmes for different developing countries have been designed and some of them are already under implementation. The utilization of medicinal plants in the developing countries has always been known and the majority of the population of these countries are using extracts or dry herbs for treating many tropical diseases.

Due to the increase of medicines demand in the world and in the developing countries, it merits attention to explore the possibility of manufacturing pharmaceutical products, on a more economical basis, based on active principles of medicinal plants.

The flora of Tanzania is very rich in medicinal and aromatic plants and therefore it is worth to process these plants in order to get extracts and essential oils.

In December 1977 UNIDO organized an exploratory mission in Tanzania under the project RP/RAF/77/015 to collect information and data on the available plants and facilities for the setting up of a pharmaceutical industry.

Following this mission a mobile unit and UNIDO experts were sent to Tanzania in January 1980 to collect samples of medicinal and aromatic plants for quantitative and qualitative determinations of active principles as well as for the demonstration of the possibility of preparing locally pharmaceutical products based on these active principles in co-operation with the local specialists.

The activity of the mobile unit was carried out in the laboratories of the "Traditional Medicine Research Unit" belonging to the Faculty of Medicine - Muhimbili Medical Center and in co-operation with the specialists of the Botanical Department of the University Dar-es-Salaam.

The pharmaceutical products and the results obtained during the joint activity of the mobile unit and the local specialists, have proved the possibility of setting up of a small scale production of pharmaceutical products based on the raw materials available in Tanzania under the condition of a further assistance programme.

2. Objectives

2.1. Development objectives

The programme will lead to the establishment of a national level extraction and purification unit for plants which are locally available. Furthermore, the extracts of plants will be used to formulate pharmaceutical preparations which will be incorporated in the health programme of the country. The establishment of such a unit will lead to economic advantages and to the creation of a labour intensive industry which will be for the benefit of the farmers since these plants are not currently exploited.

2.2. Immediate objectives

- a/ Development of production technologies of medicines, based on medicinal plants;
- b/ Training of local personnel.

3. Project outputs

- Government policy on the development of a pharmaceutical industry based on medicinal and aromatic plants locally available.
- A survey on the quantity and quality of the natural resource in this field.
- Development of the research work on the medicinal plants and their use in the pharmaceutical industry.

4. Project activities

The main activities of the project are the following :

- 4.1. Training of the local personnel in the field of culture and processing of medicinal and aromatic plants in order to get medicines.

UNIDO will organize a training programme for 4 fellowship-holders (botanist, agronomist, phytochemist and technologist) in a country with a large experience in the processing of medicinal plants and their use in the pharmaceutical industry, during 1980.

- 4.2. International experts to train locally the Tanzanian specialists in this field. They have to contribute to the development of research and production activity in the field of manufacturing pharmaceutical products based on medicinal plants. Three experts : one botanist - 3 months (in the period May - September); one phytochemist - 3 months and one technologist - 3 months - to come in Tanzania after the fulfilment of the above mentioned two experts mission.

- 4.3. Supplying the necessary laboratory equipment and materials to develop the laboratory work at the "Traditional Medicin Research Unit" and the production equipment to set up a pilot unit of extraction and distillation of active principles.

5. Project inputs

- 5.1. The UNDP's contribution will be the following :

5.1.1. Fellowships for the local personnel to be trained abroad in 1980

Estimated
budget in US\$

- 4 fellowshipholders x 3000 \$

- 12,000.-

	<u>Estimated budget in US</u>
5.1.2. International experts to train Tanzanian specialist and to develop research and production activities in the field of manufacturing pharmaceutical products - Period : 1980 - 1981 - 3 experts x 3 months = 9 m/m	- 40,500.-
5.1.3. Supplying of laboratory equipment and of pilot unit equipment for extraction and distillation (See Appendix IX)	- 135,000.-

Estimated US; 187,500
assistance
cost

- 5.2. The Tanzanian Government will make available :
- Necessary space (room) for the setting up of pilot unit including the assemblage.
 - National personnel for the laboratory works and the operation of the pilot unit.
 - Raw materials (medicinal plants) and ingredients for the preparation of pharmaceutical products based on medicinal plants.



