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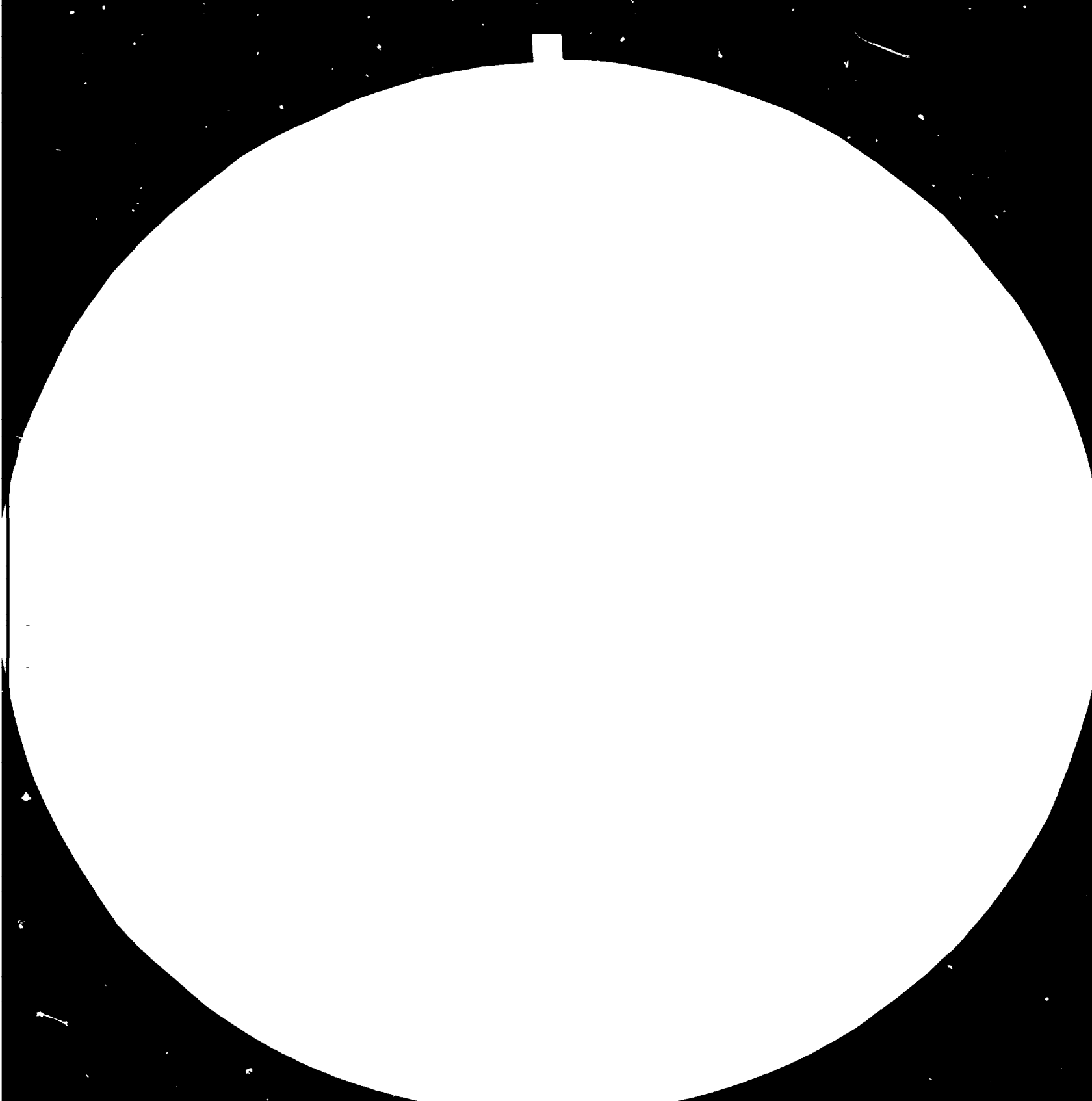

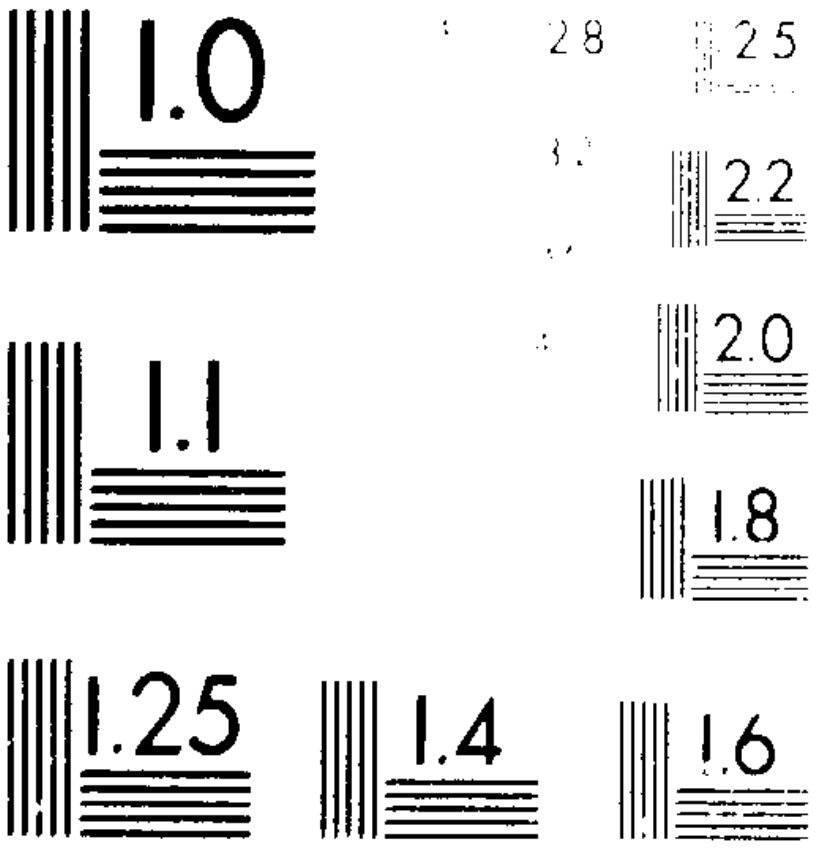

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DP/ID/SER.B/464
22 June 1984
ENGLISH

Afghanistan.

ASSISTANCE IN THE ESTABLISHMENT OF A FACILITY FOR EXTRACTION OF LIQUORICE ROOT AND SIMILAR INDUSTRIAL NATURAL PRODUCTS IN AFGHANISTAN

SI/AFG/82/801

AFGHANISTAN

Terminal report*

Prepared for the Government of Afghanistan
by the United Nations Industrial Development Organization,
acting as executing agency for the
United Nations Development Programme

Based on the work of Ram Dev Chaudhri,
Adviser in pharmaceutical technology

2241

United Nations Industrial Development Organization
Vienna

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9. Production costs and international prices of some products

The projects are commercially viable (i. e. processing of liquorice root at Baghlan Beet Root Sugar Factory to Soft Extract Liquorice and the Multi-purpose Phytopharmaceutical Plant at Kabul for the manufacture of Dry Ext. Glycyrrhiza, monoammonium glycyrrhizinate, Sodium glycyrrhizinate; Glycyrrhetinic acid, De-glycyrrhizinated liquorice (DGL); and processing of other medical plants to powder, extracts (standardised) and essential oils.

10. Production capacity

A very large production capacity is available at Baghlan (up to the processing of 49 tons beet root per day) and hence no additions may be needed for a very long time to come. The Kabul Plant has the capacity to process 180 tons per year. This is considered sufficient to start with. The plant can be expanded later if there is enough demand for it. The Afghanistan Plants Co. has earmarked 10,000 sq. meters land for this purpose and there is enough space for expansion.

11. Movement of the project (1985 - 1987)

The Baghlan Beet Root Sugar Factory could start the production of Liquorice soft extracts in March 1986; the Multi-purpose Phytopharmaceutical Unit in Kabul could start the production in January 1987.

FOREWORD

1. Scope of the Project

This is set out in UNIDO document SI/AFG/82/801/11-01/32.1.F. as per relevant abstract. See Annexure "II" to this Report.

2. References

These may be seen in Annexure "III-A" General References and Annexure "III-B", Technical References for Liquorice and its derivatives only.

3. Programme of Action

A Programme of Action was drawn up in order to complete the Project and is set out in Annexure "V". This programme was followed more or less with slight modifications/ additions here and there.

4. Other medicinal plants

Lists of medicinal plants exported by Afghanistan Plants Co. may be seen in Annexure "VI-A".

5. Specifications and testing methods of some of the products to be made from Liquorice

May be seen in Annexure "VII-A", "VII-B", "VII-C" and "VII-D".

6. List of laboratory equipment and books

May be seen in Annexure "VIII-A" and "VIII-B".

7. List of processing chemicals

See Annexure "IX".

8. List of plant and machinery for which enquiries sent

See Annexure "X".

9. List of wages in Government enterprises

Afghanistan Plants Co. is such a one). See Annexure "XI".

10. Status of this Report

Inspite of my best efforts, it has not been possible to complete the Project comprehensively and to my satisfaction because of the very short time at my disposal. Hence the Project estimates presented may be considered as tentative and ad hoc on account of the following grounds:

(i) Quality of Liquorice - main raw material for processing

No reliable data on % of Glycyrrhiezin exists here. There is reference to it in the Afghanistan Government's Export Promotion Document of December 1980 (see Annexure III-A; No. 5) but the data is not based on any testing done here. I have sent a sample of liquorice here to Amsar Private Ltd., Indore 452 006, India, but its report may not be available before 20th of February.

(ii) Costs of chemicals used in processing

May not be available before 20/2/84. Hence I have taken the rates as prevalent in India in November, 1983.

(iii) Quotations for plant and machinery

Not yet received but expected by 20/2/84. Hence I

have taken estimates based on rates of these in India around November 1983. If the data on these three could be obtained accurately before writing this Report, the Project estimates would have been more accurate and practical and not tentative, but it needs time.

However, based on my previous experience of over 40 years in this field, I have tried to do my best to give as reasonable estimates as possible subject to the above limitations.

Kabul
30 January 1984

R. D. Chaudhri

I. INTRODUCTION

The background to the mission has been amply set out in UNIDO Project Document No. SI/AFG/82/801, as per reference in Annexure III-A, No. 8, and hence need not be elaborated here.

As may be further seen with reference to Annexure III-A, Liquorice root (root of Glycyrrhiza glabra fam. Leguminosae) is now widely used not only as a flavouring agent in the tobacco industry, in foods and drugs, but its value has been recognised as a domestic remedy for coughs and bronchitis, as an anti-inflammatory agent (esp: in De-glycyrrhizinated form i. e. DGL), as a mineralocorticoid and as a natural sweetener. The Annexure III-B also gives the latest references with regard to other Liquorice derivatives like monoammonium glycyrrhizinate, Disodium glycyrrhizinate, Glycyrrhetinic acid and De-glycyrrhizinated Liquorice, as well as numerous references to its other uses. Its use is daily widening and growing.

As far as other plants are concerned, these are now becoming increasingly popular for medicinal use. An interesting article "Pros and Cons of Herbal Medicines" appeared in Pharm. Jour, October 1981 and there is growing interest all over the world now in herbal drugs. Hence the UNIDO Report No: SIS/AFG/77/804 dated 25th June 1979 (Reference No. 4; Annexure III-A) recommended the establishment of a phyto-pharmaceutical industry in Afghanistan.

So there is an attractive possibility for the production of solidified extract of liquorice for export and also other Liquorice derivatives as detailed in Annexure "V", para 4, as well as extracts of other medicinal plants.

The medicinal plants now exported from Afghanistan are given in Annexure VI-A and those which are important from the view-point of the international market (in addition to Liquorice) are detailed in Annexure VI-B.

II. OBJECTIVES OF THE MISSION

These are set out in Annexure II and are summarized as follows:

1. Evaluate existing raw materials (i. e. liquorice and other medicinal plants).

2. Finalise a short list of raw materials that could be used for the production of extracts for local and export purposes.

3. Advise on (a) Suitable technology; (b) Manpower; and (c) Equipment needs, for liquorice products manufacture and the processing of other medicinal plants.

4. Advise on training needs and develop suitable proposals for meeting the needs of the Project.

III. PROJECT STRATEGY AND METHODOLOGY

To achieve the above objectives, a Programme of Action was drawn up (Annexure V) and after consideration of reports on Baghlan Beet Sugar Factory (Annexure IV-A and IV-B), and identifying other important herbs (Annexure VI-B), the following strategy was planned:

1. Processing of liquorice into extract

Facilities available at Baghlan Sugar Factory are recommended to be used for reasons given in Annexures IV-A and IV-B, employing the use of only one of the diffusion extractors, enabling the processing of 3.5 tons (approx.) of liquorice per day. The total quantity to be processed per year has been estimated at 125 tons of extract/year and this will need 400 to 500 tons of liquorice root per year dependent on the quality of liquorice and the final extract.

If the demand for the extract increases, there is scope for its increase up to 49 tons liquorice root a day for eight months in a year.

2. Liquorice derivatives

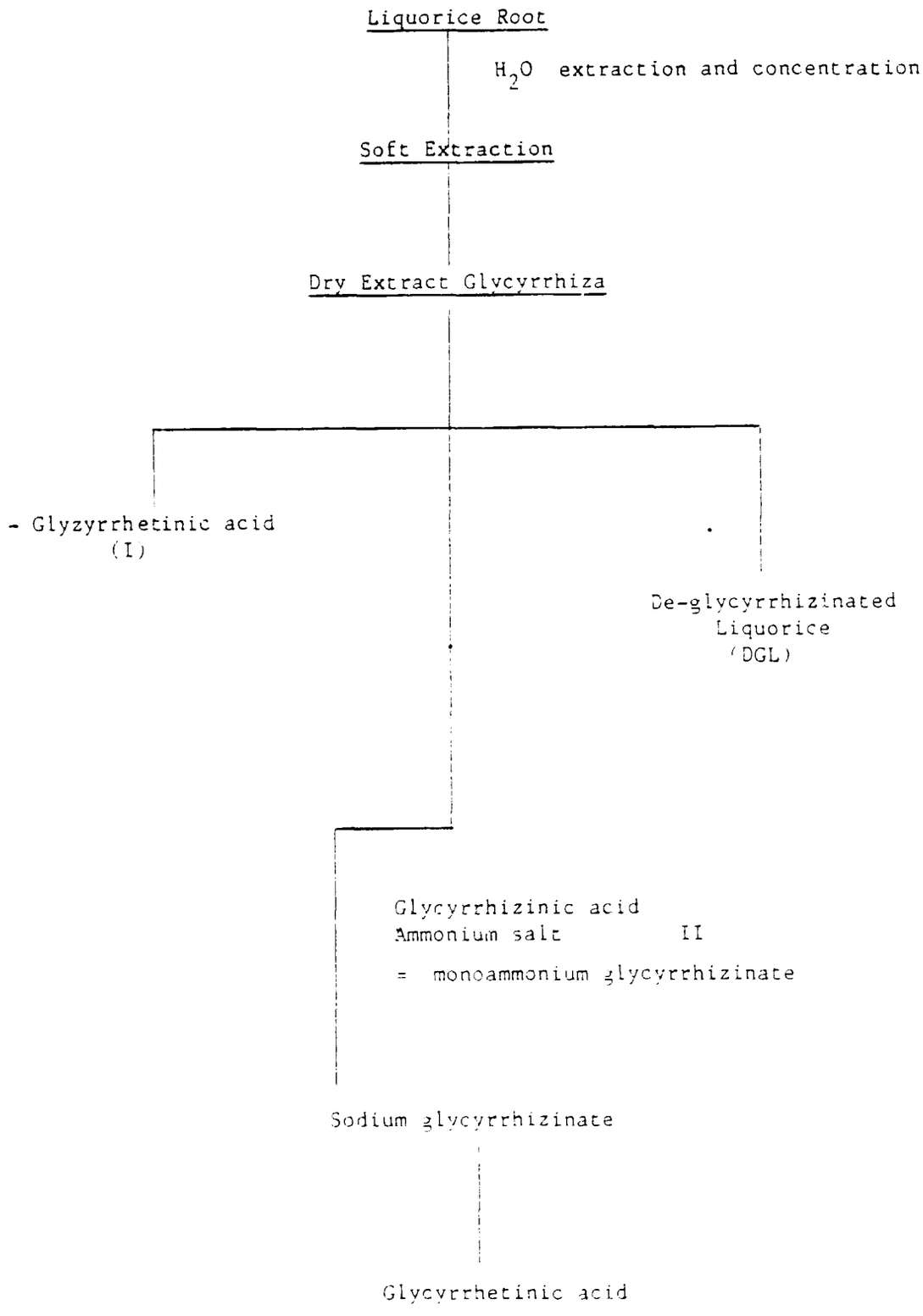
These are as follows:

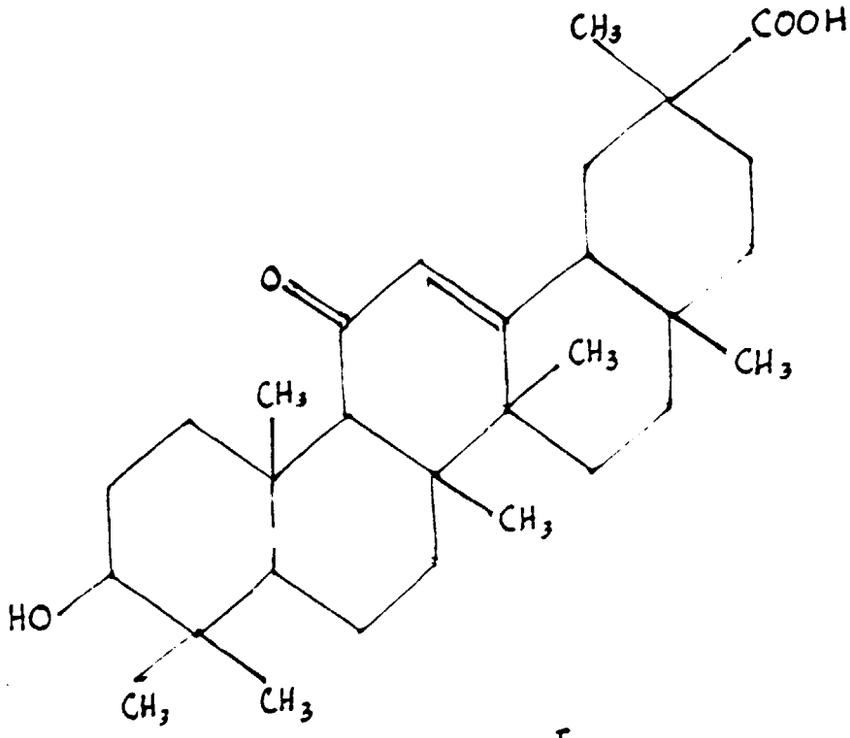
(a) Dry ext. liquorice,
(b) Monoammonium glycyrrhizinate,
(c) Disodium glycyrrhizinate,
(d) Glycyrrhetinic acid,
(e) De-glycyrrhizinated Liquorice (DGL),

(see Annexure V; ixx 4; (ii), (iii) and (iv).

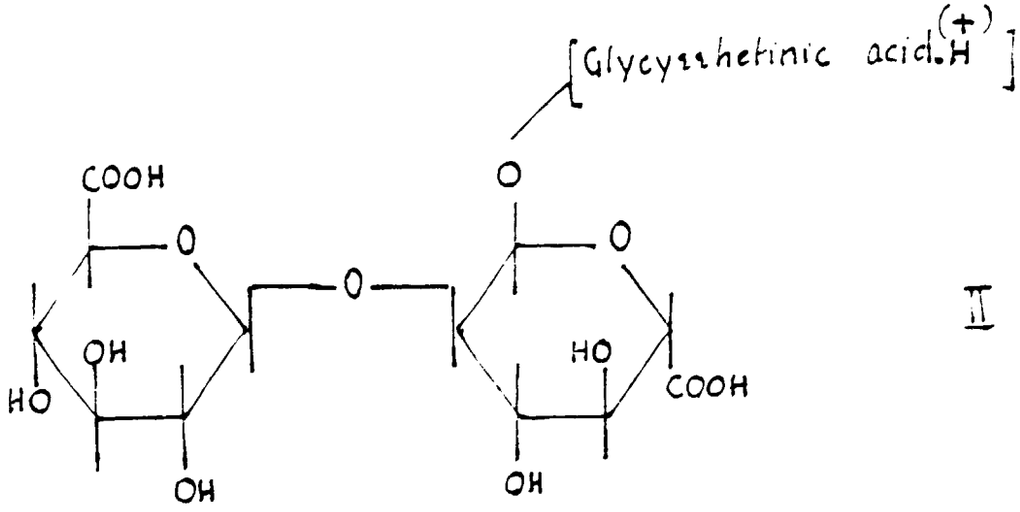
Specifications of some of these products in 1 and 2 may be seen in Annexures VII-A, B, C and D.

Products from Liquorice




CH3
COOH
O
CH3
CH3
CH3
CH3
HO
CH3
CH3

I


[Glycyrrhetinic acid.H(+)]
O
COOH
O
O
O
OH
HO
HO
COOH
OH
OH

II

3. Other medicinal plants

These are listed in Annexure VI-B with the following justification in the cases specified below:

(i) Atropa belladona

For production of its leaf and root extract for manufacturing of galenicals and manufacturing Belladonna plaster; manufacturing of Belladonna tablets with other drugs.

(ii) Berberis spp.

For manufacturing of standardised Berberis Dry Extract and isolation of Berberine whose uses are listed vide Annexure III-B; (6) on page 11, (1); page 18, XVIII; (1):

(iii) Datura innoxia or D. metel leaf

For extracts rich in Hyoscine and then for isolation of pure Hyoscine.

(iv) Ephedra spp.

For making extracts of Ephedra standardised for total alkaloids calculated as Ephedrine and then isolation of pure Ephedrine.

(v) Eleaginous augustifolius leaf

According to Dr. Shafique Younus, it contains 30 % Tannins and can form an important source of Tannins for commercial use.

(vi) Hyoscyamus muticus leaf

An excellent source of Hyoscyamine.

(vii) Iris germanica root powder

Its uses are listed in Annexure III-B; (6) on page 32; No. 10.

(viii) Colchicum spp.

For manufacturing of Dry Ext. Colchicum, BP. (If abundant quantity is available, later even Colchicine itself can be isolated.)

(ix) Cumin seed

For manufacturing of Cumin oil, BP.

(x) Alfa alfa grass

Source of Chlorophyll.

NB: Gum tragacanth and Asafoetida do not need processing; these are sold as such.

4. Processing of phytopharmaceuticals at Kabul

(i) In order to process liquorice extract into liquorice chemicals, a plant for processing 400 kg liquorice per day may be set up in Kabul (equivalent to 2 to 2.4 tons chemicals per year); DGL is a by-product and its quantity is not inclused in this figure. For processing other medicinal herbs, a plant to handle 200 to 240 kg herbs per day may also to be set up in Kabul.

(ii) Both liquorice derivatives and processing of other medicinal plants should be carried out in Kabul as it needs sophisticated technology as well as regular monitoring by the Department of Pharmacy, Kabul University, for the first 2 to 3 years.

(iii) A facility for manufacturing of Liquorice Dry Extract, starting from the soft extract of Liquorice to be produced at Baghlan Sugar Factory, can also be located in Kabul. This can be made according to the market needs; the required quantity of dry extract can be processed by conversion of the soft extract of Liquorice in accordance with needs.

IV. EVALUATION OF EXISTING RAW MATERIALS

1. For Liquorice

Reference is made to No. 4 in Annexure III-A and III-B. However, no reliable data regarding the quality of Liquorice could be gathered here and hence the sample has been air freighted to a laboratory in India for analysis (Amsar Private Ltd., Post Box 80, INDORE 452 004 - INDIA). The results are awaited.

2. Available production facilities

Reference is made to Annexure IV-A and IV-B.

V. RAW MATERIALS LOCALLY AVAILABLE THAT COULD BE PROCESSED FOR EXPORT PURPOSES

Chapter III.3. refers.

However, the quality of all these materials has to be reascertained; this may be carried out at the Department of Pharmacy, Kabul University and a further assessment could be obtained from some laboratory outside Afghanistan.

VI. TRAINING NEEDS AND SUITABLE PROPOSALS FOR MEETING NEEDS OF THE PROJECT

(i) <u>For Liquorice processing at Baghlan into Soft Extract</u>

The Chief Engineer and Chief Chemist of this factory (at Baghlan) may be considered for suitable In-Plant training at an appropriate institution in a developing country that already has the necessary expertise; there are possibilities, e. g. in India; however, this could be considered through bilateral arrangement, possibly involving the agency of UNIDO.

(ii) <u>For Dry Extract Liquorice (from Soft Ext. from Baghlan), Liquorice derivatives and processing of other medicinal plants</u>

A similar arrangement is possible as above and this being sophisticated technology may take a minimum of six months, depending upon the aptitude of the persons sent for training. Training of the following personnel would be needed:

1. Chemists/Pharmacists (2 Chemists would be sufficient but if an R&D person is also required to be trained, then an extra Chemist may be sent, giving a total of three.)	3
2. Engineer (mechanical-electrical)	1
	4

	4
3. Repair and maintenance operations. One Mechanic and one Electrician (with certificate)	2
4. Operators (non-graduate with science subjects)	4
5. Packer	1
Total:	11

(iii) Regular boiler attendants

I feel the same can be trained by Baghlan Sugar Factory for oil-fired or coal-fired boilers as the case may be. The Mikro-Rayon in Kabul can also train persons for condensate-fired boilers and hence these need not be sent for training abroad.

(iv) Estimated cost of training

(Assuming training in a neighbouring country, e. g. India)

(a) For Baghlan Sugar Factory

Chief Mechanical Engineer and Chief Chemist - one month

	US $
2 Airfares Kabul - return	800
Monthly expenses allowed by Afghanistan Government for training for this class 2 x $ 1,050 =	2,100
Incidental expenses for two $ 200 =	200
Training charges	5,000
Engineering consultation fees	1,900
Total:	US $ 10,000

(b) <u>For proposed Multi-purpose Phyto pharmaceutical Plant</u> (Section 4)

2 Chemists, 1 Engineer, 2 Repair Maintenance Men, 4 Operators and 1 Packer: Ten trainers for 6 months = 60 man/months.

	US $
10 Return airpassages 400 x 10	4,000
Expenses for 6 months 750 x 6 x 10	45,000
Incidental expenses 10 x 100	1,000
Training charges for 10 for 6 months	30,000
Engineering consultation expenses	10,000
Total:	US $ 90,000

Estimated total expenses spent for both projects for training of personnel - including their travel and stay expenses, training fees and fees for engineering consultancy for their respective projects.

US $ 90,000 plus 10,000 i. e. US $ 100,000

VII. OUTLINES OF RECOMMENDED TECHNOLOGY

1. Technology for production of Liquorice Soft Extract and block Liquorice from Liquorice root

A detailed discussion is included in Annexures IV-A and IV-B, and also in Section III. The Beet Root Sugar Factory at Baghlan can be used for this work with a few essential modifications as the technology of extraction of beet sugar and liquorice is very similar, viz.

(i) Size reduction

i. e. reducing the pieces of raw Liquorice root by means of a disintegrator to a coarse powder (10 mesh). For this process, a disintegrator has to be installed at the factory.

(ii) Extraction with hot water

The process is similar to extraction of Beet root and can be carried out in the diffusion battery at the Baghlan Sugar Factory.

(iii) Sedimentation

This can be carried out easily in mild steel storage tanks at Baghlan or high density polyethylene tanks may be provided for this purpose according to needs. These are relatively cheap.

(iv) Filtration

Can be carried out in the filter press at Baghlan, if necessary.

(v) Concentration

The filtered water extract can be easily con-

centrated to a syrupy mass of about 60 % total solids in the triple effect evaporators at the sugar factory site.

(vi) Finishing to required total solids

This can be done in steam-jacketted stainless steel vessels with anchor stirrer. This has to be additionally installed at Baghlan. This piece of equipment will help in maintaining uniform quality of concentrates obtained from evaporators. The soft extract may be to the specifications as per Annexure VII-A. In order to produce block liquorice, the moisture content (loss on drying) is further reduced to 12 % by heating in an anchor stirred steam-jacketted pan and so the Glycyrrhizin content is also raised to 24 % and above.

2. Technology recommended for the proposed Phytopharmaceutical Plant at Kabul

(a) Dry extract Glycyrrhiza

The soft extract from above is dried in a vacuum tray drier; then pulverised and several powders mixed in a powder mixer to get a uniform quality. It may conform to the specifications for Glycyrrhiza extract, NF*, and also the Glycyrrhizin content determined by the Garratt Method would be around 25 %. (Pulverisation is done in pulveriser, contact parts stainless steel and up to 80 Mesh as may be demanded by the customer; in general, most of them are satisfied with 60 Mesh powder.)

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* National Formulary, USA

(b) Monoammonium glycyrrhizinate "MAG"

This is one of the most important natural sweeteners for formulation in both modern as well as traditional medicine. As such it is in great commercial demand. For processing of MAG a plant able to handle 400 kg Liquorice root per day is proposed. A product as per specifications vide Annexure VII-B is suggested. 400 kg Liquorice roots are disintegrated to 10 mesh and extracted with hot water in a stainless steel extractor. (This is a stainless steel steam-jacketted pan of 100 litres with a stainless steel chute which allows the liquid to drain but retains the spent marc. The powdered root is stirred while being heated to facilitate extraction. The material is first extracted with 5 times its quantity of water (after maceration with an equal quantity of water for 8 hours); then extracted twice again similarly but the second and third extracts are used for extraction of a fresh batch of powdered root and for soaking. The extraction time in the first instance is 2 hours and then one hour each time afterwards. The extracted material (i. e. water extract from first boiling) is passed through a stainless steel 80 mesh sieve and concentrated in a steam-jacketted stainless steel pan, till the volume of extract in litres is equal to approximately twice the weight (in kilograms) of root extracted i. e. for example, from 400 kg of root the volume of extract should be 800 litres. To this liquid 4 litres of 1.84 Spr. Gr. Sulphuric acid is added, slowly at a time, with constant stirring (time taken is about 20 minutes). After all the acid has been added, the liquid is kept for 24 hours preferably at 15° C. The clear liquid is decanted off and reserved for processing into De-glycyrrhizinated Liquorice - DGL.

The PRECIPITATE settled at the bottom, after decantation is washed free of acid with cold water. (Two washings with 70 litres each time may suffice.) The precipitate is about 80 kg after washing. The precipitate is suspended in five times its volume of 80 % Methanol i. e. 400 litres. Twenty-seven bottles (each of 450 ml) of liquor Ammonia Fort (25 %) is added with constant stirring, slowly, bottle by bottle, till the precipitate goes into solution. (Final pH at this stage is 8 to 9.) The resulting solution is allowed TO STAND FOR AT LEAST 16 - 18 HOURS. After decanting off the clear liquid, it is passed through a Nutsche filter at a vacuum of 15 to 20 inches. The SEDIMENT is once again washed with 134 litres of 80 % Methanol and 7 bottles of liquor Ammonia Fort (25 %) followed by filtration. Both filtrates are combined and the residue rejected. From the filtrate, Methanol is recovered by distillation, leaving about 55 to 60 kgs THICK PASTE. (Recovery of Methanol is about 80 %). The THICK PASTE is boiled with an equivalent quantity of Acetic acid, glacial (i. e. 55 to 60 litres) in a closed system (reaction kettle) for 5 minutes only i. e. there is complete boiling for five minutes. The liquid is drained off and cooled till it attains room temperature. It is placed in a crystalliser at - 15 degrees C to - 20 degrees C, overnight. Crystals are centrifuged and washed with Acetic acid, glacial in the basket centrifuge, using 2.7 litres Acetic acid, glacial (3 times). After this, crystals in the centrifuge are washed with Acetone (3.4 litres; only once). These crystals are now dried in a fluid bed drier for 25 - 30 minutes at 60 degrees C. About 16 kg of CRUDE MAG can be obtained with the quantities specified.

For further purification 16 kg crude MAG is added slowly to 130 litres of 80 % Ethanol, in a reaction vessel,

and heated to 60 - 90° C with constant stirring. Now 15 kg activated charcoal are added and the mixture refluxed for four hours and FILTERED, WHILE HOT, THROUGH NUTSCHE FILTER. The filtrate is colled and WHEN COOL, kept in the crystalliser OVERNIGHT. The crystals are separated in a centrifuge, washed with Alcohol (90 to 95 %), twice, with 2.7 litres Alcohol each time. Then the crystals are dried in a fluid bed drier at 60° C for 30 minutes. 8.6 kg PURE "MAG" can be expected. Alcohol is recovered from the mother liquor.

SUMMARY

Liquorice used 400 kg
Sulphuric acid used 4 litres (say 8 kg)
Methanol pure (after recovery) USED UP 100 litres
Alcohol (Ethanol) 90 - 95 % (after recovery) USED UP 40 litres Acetic acid, glacial 67 litres
Acetone 3.4 litres
Activated charcoal 1.5 kg YIELD OF MAG 8.6 kg

(c) Disodium glycyrrhizinate, "NA GLY"

Disodium glycyrrhizinate is made from MAG and is also a natural sweetener more soluble in water than MAG. The specifications may be seen in Annexure VII-C. The process of its manufacture is as follows: 10 kg MAC are added to 50 litres hot water; to this are added 10 litres of 10 % Caustic soda solution, and the mixture is heated (but not to boiling) i. e. 80 - 90° C, with constant stirring. The heated mixture is passed over an ACTIVATED CHARCOAL BED (made by boiling 1 kg activated charcoal in 4 litres water and then passed through Nutsche filter to create the bed). The FILTRATE FROM BED is concentrated to 20 litres; 100 litres pure Methanol is added and the

solution ALLOWED TO STAND OVERNIGHT in a CRYSTALLISER at temp - 10 to - 15° C. The CRYSTALS are separated by centrifugation. They are dried at room temperature for 15 minutes in fluid bed drier; THEN the temperature is raised to 50° C for 15 minutes and finally to 80° C for another 15 minutes in the fluid bed drier. 9.0 kg of product (FIRST CROP) may be expected. The MOTHER LIQUOR from the above is concentrated for obtaining the second crop after adding 10 litres of Methanol and the process being repeated as above. A SECOND CROP of 1.0 to 1.4 kg may be obtaines. A Na-Gly 10 to 10.4 kg is obtained by combining both crops.

NB: Methanol after use is recovered.

SUMMARY

MAG 10 kg
Methanol (after recovery) 10 litres
Caustic soda flakes 1 kg yield 10 to 10.4 kg of Na-Gly

(d) Glycyrrhetic acid/Glycyrrhetinic acid "GTA"

This is used for manufacture of "Carbenoxylon BP" and is also the "Enoxylon" of the EP.* 400 kg liquorice root is extracted by the method discussed under MAG and concentrated to 600 litres. To this are added 600 litres of Methanol and 60 litres of Sulphuric acid (Sp Gr. 1.84) and the whole refluxed for 10 hours. Half the quantity at a time may be used so that a smaller reflux assembly can be used and process done in 2 lots). Methanol is recovered by

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* BP = British Pharmacoporia.
EP = Extra Pharmacoporia: Martindale.

passing LIVE STEAM through the solution. Recovery is about 520 litres out of 600 litres used. The solution obtained after Methanol recovery is cooled to room temperature and crude GTA is filtered through Nutsche filter. The residue is washed with water till free of acid. The precipitate is suspended in water at 20° C; 6 kg Sodium carbonate anhydrous are added with slow heating for half an hour. The solution is extracted with Chloroform in a liquid-liquid extracter (1,600 litres used; 1,540 litres recovered; time 4 hours). The Chloroform extract is rejected.

The alkaline solution is then neutralised with Sulphuric acid (1.84 Sp. Gr) to pH 6 (Qty used 4 litres; say 8 kg), and this neutralised solution is re-extracted with Chloroform in a liquid-liquid extractor (used 1,600 litres; recovered 1,540 litres; time 4 hours). The residue from the Chloroform extract (after removal of solvent) is taken into 40 litres Methanol, refluxed with 2 kg, activated charcoal, boiled and passed through Nutsche filter. To the filtrate 40 litres of water is added till turbidity forms. It is allowed to stand for crystallisation. The crystals are filtered; washed with 10 % cool Methanol; dried in vacuum at 60° C for 2 hours. The expected YIELD is 8.4 kg GTA.

SUMMARY

Liquorice 400 kg
Sulphuric acid pure 64 litres (say 120 kg)
Chloroform (after recovery) 120 litres
Methanol 120 litres
Sodium carbonate anhydrous 6 kgs.
Activated charcoal 2 kg
GTA 8.4 kg
(Specifications of GTA: See Annexure VII-C)

(e) De-glycyrrhizinated Glycyrrhiza dry extract (DGL)

This product is employed in the treatment of gastric and peptic ulcers. For specification, see Annexure VII-D. The "Solution" referred to (Section VII 2(b)), is neutralised with Sodium carbonate anhydrous, mixed with Lactose as a drying aid and dried in a vacuum tray drier. It is powdered to 60 or 80 mesh as required and mixed in a powder mixer. For 2 tons DGL we need 2 tons Sodium carbonate anhydrous and 700 kilos Lactose; the rest of the raw materials are by-products from MAG manufacturing (vide VII, 2 (b)).

(f) Extracts of medicinal herbs

(i) Cumin. Its essential oil is the most important commercial product and is made by hydro-distillation of Cumin in the Volatile Oil Distillation Plant. The Cumin is first soaked in water for 5 to 6 hours and then steam-distilled; time is about 4 to 6 hours.

(ii) Iris Germanica Root. Its powder of 80 mesh is generally demanded; hence the herb is first subjected to disintegration in the dis-integrator, then fine grinding in the pulveriser, then sieved to 80 mesh and packed. Its moisture content should not be more than 10 %; ash: not more than 7 %; petroleum ether extractives 40 - 60: about 2 % and 70 %; alcohol extractives: about 15 %.

(iii) Belladonna; Berberis; Datura metel; Hyoscyamus muticus; Ephedra and Colchicum. SOFT EXTRACTS of these herbs are made by solvent extraction in a

Soxhlet-type plant or Vortex solvent extractor. The herb is first soaked in the solvent to be used for 4 to 8 hours; solvent i. e. MENSTRUM to be used is selected with reference to any pharmacopea containing an extract, liquid, solid or dry of the relevant herb. After extraction, solvent is recovered (time 6 to 10 hours) and soft extract is taken out, standardised in terms of its active constituents by pharmacopeal methods and packed. To see that extraction is complete, colour of the solvent flowing through Soxhlet overflow is a good guide; when almost colourless, extraction may be considered complete. DRY EXTRACTS are made by drying soft extracts in a vacuum tray drier; DRYING AIDS like Lactose, Starch, DiCalphos and even Aeorsil are useful in faster drying of soft extracts and can be mixed from 10 % up to 20 % of the soft extracts to be dried but the minimum quantity must be used. After drying, it is pulverised to 60 mesh, mixed to get uniform quality, standardised and packed.

(iv) Elaginous augustifolius leaf is said to be rich in Tannins and hence in this case, the first extraction should be carried out using Acetone, followed by purification of the extract with water and then drying. % Tannins can be estimated by USSR. Pharmacopoeia assay.

(NB. I have not yet got this material analysed in my laboratory as according to the Pharmacy Department here, its season is over. The process suggested is one based on data obtained from this Department.)

(v) Alfa alfa grass is a rich source of Chlorophyll; its sample has been sent to India for investigations and when results are known in three months, something definite can be said about it. However, the unit processes suggested to be established in the Multi-purpose Phytopharmaceutical Plant in Kabul will be able to process this material also, once "Process Know-How" from locally available material is established.

Generally speaking, Menstrum used for extraction are Alcohol, Methanol, in some cases Acetone and for defatting: Petroleum ether. Chloroform is used for extraction of pure alkaloids from these concentrates at a later stage.

VIII. MANPOWER NEEDS

1. For manufacturing of Liquorice soft extracts at Baghlan

For this staff is already there, no additions are needed. The cost of training of personnel for this work is already discussed in chapter VI.

2. For Multi-purpose Phytopharmaceutical Unit at Kabul

The recommendation is made that this be established at the Afghanistan Plants Co., Pule Charkhe Kabul (a Government enterprise). After discussions with this factory, the following list of additional staff has been considered as necessary for the purpose envisaged.

Three working shifts

(a)	Manager-cum-Chief Chemist	1
(b)	Chemists (B. Pharms.) (1 at each shift i. e. 3; 2 in the laboratory)	5
(c)	Engineer	1
(d)	Packing Supervisor	1
(e)	Workers	
	(i) Skilled	14
	(ii) Semi-skilled	6
	(iii) Unskilled	20

The total salary bill for this staff, including pre-requisites and 6 % contribution to Pension Account of the Government, has been estimated by the Afghanistan Plants Co. at US $ 2,100 per month.

As the capacity of proposed plant is 15 tons herbs processing per month, the cost in wages per kilo of herb processed, will be US $ 0.14.

IX. EQUIPMENT NEEDS

1. Additional equipment for Liquorice extraction at Baghlan Beet Root Sugar Factory

			Cost Estimate US $
(i)	Disintegrator 10 - 15 HP; capacity 250 kg Liquorice hour (price based on Batliboi and Co., Ltd., Forbes Street, Bombay, India)	ONE	3,000
(ii)	Settling (sedimentation tanks) high density Polyethylene (based on M/S Sinter Plast, Kalol, Gujrat State, India) with supports; 10 tanks of 6,000 litres each		25,000
(iii)	Stainless steel steam-jacketted pans with anchor stirrer (based on Quassar Engineers, 53/A Industrial Area, Sanwer Road, Indore, India), 500 litres capacity	TWO	7,000
(iv)	Moulds and shelves (both of mild steel)		2,000
Add	Unforeseen expenses 5 %		1,800
	Erection and electricals 10 %		3,600
			US $ 42,400
			Say US $ 45,000

The Sugar Factory has its own workshop and hence no charges have been provided for making connections and minor

installations in order to equip the Plant suitably for liquorice extraction.

2. Equipment needs for Multi-purpose Phytopharmaceutical Plant at Kabul

It is foreseen that this will process 15 tons of herbs per month out of which 10 tons will be Liquorice for making Liquorice chemicals and 5 tons per month of other herbs for making extracts of other medicinal herbs.

(a) General services

			US $
(i)	Boiler: working pressure 15 kg/sq. cm., Steam generation 300 kg/hour, THERMAX model ST-03; oil-fired Based on estimates from M. D. OZA and Co., 5 Maharani Road, Indore, India; Oil consumption 30 litres/ hour. One to serve as stand-by and may also be used when more steam is required occasionally	TWO	25,000
(ii)	Scales: one for 300 kg; one for accurate weighing 30 kg Based on Avery India Ltd., Calcutta,India $ 1,071 and $ 1,730, say	TWO	3,000
			28,000

			US $
			28,000
(iii)	Storage vessels: stainless steel; 300 litres (Quassar, Indore, India)	FOUR	2,200
(iv)	Sieves: stainless steel, 600 mm diameter, hand-operated	TWO	500
(v)	Centrifugal pumps: contact parts, stainless steel, 400 litres/hour	TWO	2,000
(vi)	Disintegrator: (Batliboi, India), small size, 100 kg/hour	ONE	1,000
			US $ 33,700
			Say US $ 34,000

(b) For processing 400 kg Liquorice/day for use in isolation of Liquorice chemicals and to this end

			US $
(i)	Soaking tanks HDEP (Sinterplast, Kalol, India), 1,000 kg	TWO	840
(ii)	Settling tanks as above	TWO	840
(iii)	Stainless steel extractor, 1,000 litres volume, verticle		
			1,680

			US $
			1,680
	cylindrical, top open, dished bottom; having a suitable chute; the extractor has a gate agitator driven by 10 HP, 3 phase, 440 volts electric motor, revolved through suitable worm reduction gear unit; extractor is steam-jacketted; will have one 50 mm diam. nozzle as bottom outlet fitted with ball valve flanged fitted and suitable hose-nipple. (Based on Quassars, Indore, India)	ONE	6,000
(iv)	Filter press, 24" x 24" size, with 24 plates and 24 frames; contact parts stainless steel	ONE	2,100
(v)	Single effect forced circulation evaporator complete with vacuum arrangements; contact parts stainless steel; evaporation capacity 100 litres water/hour; steam consumption 115 kg/hour plus 80 kg for steam injector for vacuum system. (Based on Technoman, D/11-A Ghatkopar Industrial Estate,		
			9,780

			US $
			9,780
	L. B. S. Marg. Ghatkopar, Bombay, India)	ONE	21,000
(vi)	Stainless steam-jacketted pan with anchor stirrer, 500 litres (with 5 HP, 440 volts, AC motor)	ONE	3,500
			US $ 34,280
			Say US $ 35,000

(c) For Liquorice dry extract
(from soft extract sent from Baghlan)

			US $
(i)	Vacuum shelf drier: 48 trays, 400 x 800 x 30 mm, of stainless steel, steam-operated/hot water/ hot oil also can be used for heating. With condenser, vacuum pump and receiver. (Quassars, Indore, India)	ONE	17,500
(ii)	Pulveriser: contact parts, stainless steel, 25 kg/hour. (Quassars, Indore, India)	ONE	1,250
(iii)	Powder mixer: (200 litres; stainless steel), with 2 HP, 3 phase, 440 volts motor	ONE	1,750
			Say US $ 20,500

(d) For other medicinal plants and Liquorice chemicals

			US $
(i)	Stainless steel solvent extraction plant: (Soxhlet-type, improved design, or Vortex-type). (Based on Quassar, Indore, India.) 100 kg herbs capacity	ONE	30,000
(ii)	Solvent recovery-cum-volatile oil distillation plant: contact parts stainless steel, 500 litres, herb holder 100 kg	ONE	3,300
(iii)	Reaction-cum-Reflux assembly: stainless steel (200 litres)	ONE	12,000
(iv)	Nutsche filter vessel: 500 litres, with vacuum pump (Quassar, Indore, India)	ONE	2,000
(v)	Basket centrifuge: contact parts stainless steel; size 25 kg charge (Quassar, Indore, India)	ONE	5,000
(vi)	Crystalliser: electric-operated, 200 litres with tanks (V. Krishna and Co., Bombay, India)	TWO	6,000
			58,300

			US $
			58,300
(vii)	Glass lined reactor: 300 litres (Glass lined Equipment Co., Umreth, Gujrat State, India)	ONE	15,000
(viii)	Fluid bed drier: 10 kg (Alliance, Bombay, India)	ONE	1,700
(ix)	Mixer largest size	ONE	1,000
		Subtotal US $	76,000
Total for (a), (b), (c) and (d)			$ 165,500
Unforseen expenses 5 %			$ 8,275
Erection and electrical installation 10 %			$ 16,550
		Total: US $	190,325
		Say US $	191,000

NB: In all these estimates, rates based on personal experience of the undersigned are taken as current rates. (Current rates could not be obtained due to lack of time, though enquiries were sent.)

Total estimate of plant and machinery for entire Project

	US $
Baghlan	45,000
Kabul	191,000
	236,000

	US $
	236,000
Add cost of testing laboratory	20,000
Add approx. cost of shipping equipment to Kabul and its at site clearance (10 % of $ 255,000)	25,500
	US $ 281,500

Grand total cost of whole equipment needs

(to cover all risks) Let us take $ 300,000

NB: This does not include import duty on the equipment in Afghanistan but being a Government enterprise, it is suggested it may be exempted from it, on account of Government interest in the Project and hence the estimates may be taken as correct.

X. ADDITIONAL INFORMATION

1. Cost of extra buildings to be constructed at Afghanistan Plants Co., Kabul, for the Project

This is an approximate cost based on per square meter data given by Afghanistan Plants Co.

			US $
(i)	Solvent Store 150 sq. meter	US $ 110/sq. meter	16,500
(ii)	Factory buildings 400 sq. meter floor area	US $ 80/sq. meter	32,000
			US $ 48,500
			Say US $ 50,000

XI. COST OF PROCESSING PER KILO OF HERB

1. At Baghlan

Please refer to Annexure IV-B where the Chief Engineer there has given it as 2 AF/kg of beet root processed.

For Afghanistan Plants Co., the costs will have to be negotiated between Afghanistan Plants Co. and Baghlan Sugar Factory. This will be possible as both Departments of the Government, Ministry of Commerce and Ministry of Mines and Industries of Afghanistan, are AGREEABLE to this proposal.

This being a high bulk production plant, cost of processing per kilo will always be low (at level indicated, it is approx. $ 0.04/kg of root processed). Probably for this work, the cost to be agreed upon by parties is (?) US $ 0.1/kg of Liquorice processed.

2. At Kabul

As envisaged, this is to be a Multi-purpose Pilot Phytopharmaceutical Project, processing 15 tons of herbs i. e. 15,000 kg herbs per month.

Processing cost per kilo of herb is arrived as under:

		US $
(i)	Monthly labour costs	2,100
(ii)	Power, 4,000 units (computed by Afghanistan Plants Co.)	60
		2,160

	US $
	2,160
(iii) Condensate 720 x 25 = 18,000 litres Let us take 20,000 litres	1,400
	US $ 3,560

3,560/15,000 or 0.238, say $ 0.24 per kilo of herb processed.

This is naturally higher than in No. 1 as the above is a bulk production plant with manufacturing of one product only by a simple process while Kabul is a multi-purpose plant with sophisticated equipment.

Cost of packing

According to Afghanistan Plants Co., local packing and forwarding cost should be taken as US $ 0.05 per kilo of material packed.

XII. PRODUCTION COSTS AND APPROXIMATE CIF INTERNATIONAL PRICES OF SOME PRODUCTS

		US $
1. Liquorice extract		
Liquorice 4 kg; at Baghlan calculated at US $ 0.22/kg		0.88
Processing; at Baghlan calculated at US $ 0.1/kg		0.40
Packing		0.05
	US $	1.33/kg
CIF Europe Price (Polycom, Italy; dated 12 January 1984)		2.45 to 2.60/kg
2. Glycyrrhiza dry extract, NF		
Cost of 4 kg Liquorice ext. from Baghlan 4 x $ 1.33		5.32
Cost of transport from Baghlan		0.03
Cost of processing 4 kg at Kabul 4 x US $ 0.24		0.96
		6.31
package 3 kg		0.15
	US $	6.46
Cost per kilo at Kabul	US $	2.15
Price CIF Europe	US $	3.45

US $

3. Monoammonium glycyrrhizinate (MAG)

Taking min. yield at 2 % though actually it is 2.2 %	
Cost of 50 kilos Liquorice Kabul	14.00
Processing 50 kg, calculated at US $ 0.24/kg	12.00
Processing chemicals	20.05
Packing	0.05
	US $ 46.10

Price CIF Europe US $ 60.00/kg

NB: In this we get DGL by-product, calculated at 10.00/kg, by very little extra expenses. For every kg of MAG, we get 8 kg of DGL. The cost of making 1 kg DGL (material cost) is $ 1.00; processing $ 0.24. So let us say, for 1 kg MAG, we get 8 kg DGL giving us $ 10.00, minus say $ 1.5, i. e. $ 8.5/kg.

So the cost of MAG can be reduced to the extent we can sell DGL. No margin for this is made in MAG cost. Higher profit will depend upon how much DGL we can sell.

4. Glycyrrhetinic acid

CIF Europe price US $ 150.00

US $

Cost:	
50 kg Liquorice	14.00
	14.00

	US $
	14.00
Chemicals for processing	65.00
Mfg., 50 x 0.24	12.00
Packing	0.05
Total cost	US $ 91.05

5. Cost of other products

Can be fixed similarly by taking:

Cost of raw material
add cost of processing chemicals consumed
add processing cost
at US $ 0.24/kg
add packing cost
at US $ 0.05/kg

The total COST OF PRODUCTION.

NB: These costs do not take into consideration the following expenditure:

(i) Interest
(ii) Depreciation
(iii) Insurance
(iv) License fees and other Government levies which cannot be charged from consumers
(v) Overhead

XIII. MOVEMENT OF THE PROJECT IN TIME AND FINANCE

1. Baghlan Sugar Factory for liquorice extraction

Let us start from 1985 as 1984 may be taken up in approval of the Project by UNIDO and different Government agencies.

		US $
(i)	1. 3. 85 to 31. 4. 85 In-plant training of personnel to commence in March (since factory closes in January)	10,000
(ii)	Ordering of machinery by end March 1985; shipping by 30. 6. 85; cost, unforeseen and miscellaneous	41,400
(iii)	Reaching factory site 30. 12. 1985 Clearance charges	5,000
		US $ 56,400
1986		
Erection: January 1985		3,600
	Total:	US $ 60,000

Start-up:

Factory closes for beet root in January; one month is necessary for cleaning and adaptation for Liquorice extraction. Start-up from March, 1986.

The cycle may be as follows:

March - September:	Liquorice extraction
October - January:	Beet root extraction

2. Kabul-Multi-purpose Phytopharmaceutical Plant

		US $
1985		
(i)	Training of personnel 1. 4. 85 to 30. 9. 85	90,000
1986	Machinery ordered by 30. 9. 85	
(i)	Shipment of machinery by 31. 3. 1986 Cost, unforeseen and miscellaneous plus laboratory	213,000
(ii)	Shipment to site by 30. 9. 86 Expenses	20,500
(iii)	Erection 3 months 1. 10. 86 to 30. 12. 86	16,500
		US $ 340,000

Starting-up from January 1987.

SUMMARY

Year	Training	Machinery etc.	Shipment	Erection	Total
1985	100,000	41,400	5,000	3,600	150,000
1986	...	213,000	20,500	16,500	250,000
			Total 1985 and 1985		400,000

Starting-up:
Baghlan Factory for extraction of Liquorice root: from March 1986

Kabul Multi-purpose Phytopharmaceutical Plant: from January 1987

Note: Additional buildings at Kabul to be provided at Afghanistan Plants Co., at Kabul by 31. 3. 86 at cost of US $ 50,000.

ANNEXURE I

List of organizations and persons contacted in Kabul in connection with this Project

1. Afghanistan Plants Co.	(i)	Mr. Abdur Fatah Rahim, President
	(ii)	Mr. Faquir Moh'd Taj, Vice President Throughout my stay here he has been working with me as my interpreter, whenever needed, in my meetings with persons/organisations in Kabul.
2. Avicenna Pharmaceutical Factory		Dr. Kohistany, President
3. Consultative Committee of the Afghanistan Government for this Project		This consists of:
	(i)*	Dr. K. Shafique Younus, Professor of Medicinal Plants and Head of Pharmacology Department, Faculty of Pharmacy, Kabul University.
	(ii)*	Dr. Mohammad Hassan Kishteyar, President of Forests.
	(iii)*	Mr. Mohammad Ahmad Sayee, Ex-President of Afghanistan Plants Co.
	(iv)	One Officer of the Planning Department.
	(v)	President, Afghanistan Plants Co.
	(vi)	One Officer from Avicenna Pharmaceutical Factory.
4. President, Forests		Dr. Mohammad Hassan Kishtyar
5. President, Chamber of Commerce		Mr. Mehr Chand Verma

* Were members of Study Tour on this same Project.

6. Dr. Shafique Younus	Head, Department of Pharmacy, Kabul University
7. Commercial Attaché, USSR Embassy	Mr. Vassily Markin
8. Polytechnic	Director
9. Technical School	Director
10. Public Health Laboratory	Director, Drugs Control
11. Afghanistan Hoechst	Managing Director
12. Jangalak Engineering Factory	President
13. Baghlan Beet Root Sugar Factory	Mr. Yousuf Abdullah, Ex-Chief, Chemist and Ex-Vice President of the Factory, met him at his residence in Kabul
14. Chemist, Planning Commission	Miss Nazifa Ghaffar, B. Pharm.
15. President, Export Promotion Council	Mr. Ziauddin Zia
16. Minister of Commerce	Mr. Jallaler
17. President, Ministry of Mines and Industries	Mr. Hafizullah Nawabi
18. President, Monopolies Petroleum Products	Mr. Hussaini
19. Chief Engineer, Micro-Rayon	Mr. Mohammad Kabir
20. Deputy Minister, Mines and Industries	Mr. Abdullah Aziz
21. President, Coal	Mr. Sayed Abdullah
22. Corporation, Kabul	Construction Engineer
23. Afghanistan Insurance Company	Marine and Fire/Accident Insurance Departments

24. President, Ministry of Light Industries (Mining and Industries Ministry)	(i)	Engineer Yakub
	(ii)	Engineer Rahmani, Chief Engineer, Beet Root Sugar Factory, Baghlan

ANNEXURE II

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

20 May 1983

Request from the Government of the Democratic Republic of Afganistan

INTERNAL

JOB DESCRIPTION

SI/AFG/82/801/11-01/32.1.F

Post title	Adviser in Pharmaceutical Technology
Duration	Two months
Date required	As soon as possible
Duty station	Kabul
Purpose of project	The Government has decided that Afganistan would need assistance in the setting-up of a facility for processing plant material that is locally grown into extracts for pharmaceutical use, particularly the extraction of Glycyrrhiza glabra for the production of liquorice extract on a commercial scale.
Duties	The adviser will be required to briefly assess the present competence within the country for the production of liquorice extract on a commercial scale, and to undertake similar activities with respect to other medicinal plants. Specifically the adviser will be required to : 1. Evaluate existing raw materials and production facilities; 2. Finalize a short list of raw materials locally available that could be used for the production of extracts for local and export purposes; 3. Advise on suitable technology, manpower and equipment needs for liquorice production and the processing of extracts of other plants; 4. Advise on training needs and develop suitable proposals for meeting the needs of the project. The adviser will also be expected to prepare a final report, setting out the findings of the mission and recommendations to the Government on further action which might be taken.

..../..

Applications and communications regarding this Job Description should be sent to:

Project Personnel Recruitment Section, Industrial Operations Division
UNIDO, VIENNA INTERNATIONAL CENTRE, P.O. Box 300, Vienna, Austria

Qualifications

Chemical technologist with experience in the extraction of liquorice and other medicinal plants on a commercial scale.

Language

English.

Background information

Bearing in mind the importance of the development of local industries utilizing indigenous raw materials, the Government of Afghanistan has advised that the Afghan Medicinal Herbs Company would require assistance in acquiring and installing equipment for the extraction of plant material that could inter alia be used for the Extraction of Glycyrrhiza glabra for the production of extract liquorice, on a commercial scale.

The Government attaches particular importance to the production of the Extract Liquorice and as an initial measure UNIDO was responsible for organising a study-tour for Afghan officials to visit Italy and France to study production techniques and market problems. At present Afghanistan exports around 4 tons of Liquorice roots for a value of between $500-550. A single metric ton of "Solidified Extract" of Liquorice root costs around $2.500-3000. There is a very distinct advantage to the processing of Liquorice in Afghanistan. It is a landlocked country with difficult terrain and no railroads and presents formidable problems of transportation. Accordingly, it is far more economical to transport high value, processed material for export, rather than the crude plant material. The same could apply to a variety of medicinal plants currently available in the country. A UNIDO mission visited Afghanistan in 1978 to study and report on the Pharmaceutical and Essential Oils Industry in the country. The mission recorded that several species of industrially utilisable plant material grew abundantly in Afghanistan and the following species were exported in the crude form :

Glycyrrhiza glabra
Ziziphus vulgaris
Eremurus stenophyllus
Ferula asafoetida
Astragalus gummifera
Centaurea behen

ANNEXURE III-A

General References

1. Indian Pharmaceutical Codex 1953.
Published by: Council of Scientific & Industrial Research, New Delhi, India

2. Glossary of Indian Medicinal Plants 1957 and its Supplement.
Published by: Council of Scientific & Industrial Research, New Delhi, India

3. UNIDO Final Mission Report Phase II - Afghanistan and Nepal - "Mobile Unit of Pharmaceutical and Essential Oil Industry to the least developed countries" (RP/RAS/78/012 of 1979)

4. Report No. SIS/AFG/77/804 UNIDO, dated 25 June 1979, page 18; 126 C; 127 - 128 D; 144 - 149, 180 - 183 and 193, "Development of Pharmaceutical Industry in Afghanistan"

5. Export Potential Studies Series No. 10, Export Promotion Department, Ministry of Commerce, Kabul, Afghanistan, December 1980

6. Letter No: RS/lm dated 13/3/1981 from POLYCOM, dl ruggero sciama; 20144 MILANO, via Boni-8 ITALY; Points 1, 3 and 4 about quality, price and yearly offtake of Liquorice Block Ext.

7. Report of Negotiations and Discussions of Afghan Mission to Austria, Italy and France under UNIDO Programme (4th to 26th July, 1982)

8. UNIDO Project Document No. SI/AFG/82/801 Programme Component Code 32.1.D of 1981

9. UNIDO Job Description, SI/AFG/82/801/11-01/32.1.F, Internal, dated 20 May 1983

10. Medicinal and Aromatic Plant Abstracts
Published by: Council of Scientific and Industrial Research, New Delhi, India

11. List of Medicinal Plants produced and exported by Afghanistan given by Afghanistan Plants Co., in December 1983 and other important Medicinal Plants

12. Practical Manual on the Industrial Utilisation of Medicinal Plants Methodology of Analysis of Vegetable Drugs, UNIDO, Romania, 1982

13. Problems of Pharmaceutical Techniques with Plant Extracts, F. Crippa, Milano, Italy, 1978

14. The Pros and Cons of Herbal Medicines; Pharm. Jour; October 1981

ANNEXURE III-B

References pertaining to Liquorice and its Derivatives only

1. Pharmacognosy of Ayurvedic Drugs - Kerala University, Trviandrum, India, 1951, Series No: 1, pp. 27 - 28

2. Pharmacognosy, Wallace; 1967, p. 386

3. Pharmacopea of India, 1966, reprint 1978, p. 278, category: Demulcent

4. Herbal Pharmacology in the People's Republic of China, 1975, p. 157, "Antitissive, Antibacterial, Anti-inflammatory and Aphrodisiac"

5. Medicinal Plants of India, Indian Council of Medical Research, New Delhi 1976, pp. 430 - 441, "tonic; cooling; demulcent; expectorant; diuretic; emmonagogue; mild laxative; antidiuretic (in high doses); cortisone like action (mineralocorticoid)"

6. "The Liquorice Story" in Herbs that Heal, by Dr. William Charles, A. R. Thomson; Publishers: Adam and Black Ltd., London, 1976, pp. 55 - 66

7. Introduction to Phytopharmacy, Ross & Brain; Publisher: Pitman, 1977, p. 165

8. Medical Botany, Walter H. Lewis, 1977, p. 275

9. Encyclopedia of Natural Products, Leung 1979, p. 221, Biological Action; Pharmaceutical, Cosmetic and Folk Medical Uses

10. Health Plants of the World, 1979, p. 103

11. Pharmacognosy, Taylor, 7th Education, 1979, p. 87

12. New Natural Products; Wagner, 1979, pp. 178 - 180

13. British Herbal Pharmacopea; 1979, Part II, p. 89

14. Herbal Medicine, Din Dian Buchman; 1980, pp. 95 - 96

15. Pharmacognosy, Trease 1980, p. 490

16. Journal of Research in Ayurvedic Medicine (India), March 1980, pp. 21 - 26 for Conjunctivitis

17. Traditional Chinese Medicine in Pneumonia of Children; Glycyrrhiza glabra Clin. Med. J., 94, (9); 601 - 606, 1981

18. Pharmacognosy Shah and Quadry (India), 1982, p. 104

19. Extra Pharmacopea, Martindale; 28th Edition, 1982, pp. 691 - 692. Flavouring; Domestic remedy for cough and bronchitis (esp. with Linseed, as deoction); anti-inflammatory; and Mineralocorticoid; due to presence of Glycyrrhizin and hence occasionally used in place of corticosteroids. Sweetener.

20. B. M. Lawrence: Review "Liqucrice and its Extracts", August 1983

21. Phytochemistry, 1983, pp. 573 - 576; Anti-Microbial

For Glycyrrhizin and its Salts (Ammonium) (mono) and Sodium (di)

1. Introduction to Phytopharmacy; Ross and Brain, 1977, p. 166

2. Trease Pharmacognosy, p. 443

3. Herbs That Heal; William A. R. Thomson, 1976, p. 58

4. Extra Pharmacopea Martindale; 28th Edition, 1982, p. 692

5. Merck Index; IX Edition

6. Natural Plant Production; Chaudhri, Amsar P. Ltd., Indore, India, 1983, pp. 39 - 40; 4, 5 and 6

For Glycyrrhetinic Acid

1. Extra Pharmacopea, Martindale, 28th Edition, 1982, under heading ENOXOLONE, p. 494

2. Merck Index, IX Edition

3. Natural Plant Products; Chaudhri (India) 1983, Part XXVII, pp. 26 - 27; No. 5

De-glycyrrhixinated Liquorice (DGL)

Please refer to 17 references detailed under heading "XI-ANTIPEPTIC ULCER", on page 12, ser. No. 12 (continuing to page 13), in NATURAL PLANT PRODUCTS by Chaudhri, Amsar Private Ltd., Indore, India, 1983

ANNEXURE IV-A

RAM DEV CHAUDHRI

UNCA Staff House
Room No. 6
c/o UNDP,
Post Box 5
Kabul

10 January 1984

PROJECT: SI/AFG/82/801/11-01/32.1.F

Ref: My Note dated 25/12/83 "Programme of Action"

In para. VIII of the above Report under the heading "Facilities Available", the possible use of the Beet Root Sugar Factory in this country for manufacturing Liquorice Root Extract was mentioned as it was suggested by the Vice-President of the Afghanistan Plants Co., Mr. Faquir Mohammad. During discussions on the subject, Mr. Faquir Mohammad told me that: (i) the Baghlan Sugar Factory is just 30 km from the Main Power Station and hence there was adequate electrical power. Besides, the Sugar Factory also has its own generator; (ii) the coal supply for its boilers is just 30 km away; (iii) Baghlan is also one of the main collection centres for Liquorice in Afghanistan; (iv) the Plant is generally operated for 3 to 4 months a year (100 tons Beet root processing/day), then cleaning and repairs last for 1 to 2 months after which it remains closed for at least 6 months of the year. It has a well equipped laboratory, qualified staff and trained workers who are idle for at least 6 months in the year when the plant is closed. Hence, if this plant could be used for this purpose during this period (or even a part of it), the country would have adequate Liquorice extract facilities without much extra capital investment and this would also entail use of the idle staff of this factory during the "Off Season".

This appeared to be a useful idea and I decided to pursue it further. I requested Mr. Faquir Mohammad to arrange a meeting with some technical person who has adequate knowledge and experience of this factory. He fixed a meeting for me on the evening of 9 January 1984 with Mr. Abdullah Yousuf, Ex-Chief Chemist and Ex-Vice President of the Baghlan Sugar Factory at his residence, Street No. 7; House No. 3, Karte Se, Kabul. Mr. Yousuf received his education in the USA and besides being qualified had a long training and experience

in the manufacturing of sugar from Beet root abroad and at Baghlan. After a lengthy discussion, the following facts emerged:

1. Outline of the process used for manufacturing, at this factory (given till STAGE USEFUL for the present Project):

(a) SLICING of beet root
(b) EXTRACTION by DIFFUSION (Battery system)
(c) Sedimentation
(d) Filtration
(e) Concentration of water extract in triple effect evaporators - The entire plant is said to be made of stainless steel
(f) Besides there are stainless steel steam-jacketted pans too.

There is a large boiler, capable of raising 25 tons/ steam per hour with consumption of 25 tons coal/hour, as well as smaller ones, generating 7 tons steam/hour with 16 tons per hour consumption of coal. Also a furnace oil-fired boiler 7 tons/steam per hour with 8 tons F-oil/hour, is available.

2. Adaptation for Liquorice extraction

Item (a) above will have to be replaced by a DISINTEGRATOR capable of crushing Liquorice root pieces to 10 MESH POWDER (i. e. COARSE POWDER).

Item (b) above remains the SAME but if necessary, in order to facilitate extraction, the coarse Liquorice powder can be soaked in equal quantity of water containing just 1 % Ammonia solution Fort for 8 hours before diffusion. This will fully ensure complete extraction if simple diffusion does not work very efficiently for Liquorice.

Additional equipment, if needed, will be High Density Polythene Tanks for soaking with 1 % Ammonia water.

(c), (d) and (e) above remain the SAME; in (f) only an ANCHOR STIRRER is to be added to the stainless steel steam-jacketted pan if it is desired to manufacture Block Liquorice from Liquorice soft extract. It may be noted that Liquorice soft extracts to pharmacopeal specifications also have an adequate market and are used by drug companies that prefer phamacopeal extracts. So for Block Liquorice manufacturing only additional equipment required is as follows:

(i) Anchor stirrer fitting to existing pan,
(ii) Block moulds

3. Capacity utilisation

Mr. Yousuf stated that 8 to 10 days after the Beet root season (for cleaning, etc.) it would be possible to start using the Plant for Liquorice extraction at a reduced capacity of 20 tons Liquorice per day till all the Extract expected to be sold for a year had been processed.

According to the following documents available to me, production should not be more than 125 kg tons of Liquorice extract/year to start with, as its sale is assured as follows:

(i) Polycom. dl ruggero Sciana, 20144 Milano, via Boni (Italy) - letter dated 13th March 1981 assuring a purchase of 120 tons Block Liquorice a year (with 12 % moisture and Glycyrrhizin, 24 % by Garratt method).

(ii) Report of negotiations and discussions of Afghan Mission to Austria, Italy and France under UNIDO Programme 4th to 26th July 1982 which has recommended a Liquorice processing of 2.5 tons/day only.

Hence it is recommended that we process at the Plant after Beet root season, 500 to 600 tons Liquorice (in 25 to 30 days) getting 125 to 150 tons Block Liquorice or Liquorice extract (this will be 150 to 200 tons). If international demand increases, we can work the Plant for a greater number of days as its large capacity is still only partly utilised.

Hence A GREAT DEAL OF ADDITIONAL CAPACITY IS STILL AVAILABLE IF REQUIRED.

4. Inspection of the factory

This was not possible so the next best step would be to discuss the matter with the present CHIEF OF THE TECHNICAL STAFF OF THE BAGHLAN SUGAR FACTORY and for this purpose he can be called to Kabul for discussion with me.

5. Conclusion

If after above discussion, the suggestion is found to be practical, the country will have ADEQUATE LIQUORICE EXTRACTION CAPACITY without much additional capital investment and besides the staff now idle at sugar factory will be utilised for more time. ALSO much of the transport costs of

Liquorice root to processing plant will be saved as Baghlan is said to be such a centre and there is apparently neither power, water, nor fuel problems there.

Epilogue

The Plant for manufacturing of LIQUORICE CHEMICALS and for processing other medicinal plants of importance will have to be located in Kabul, as it involves relatively sophisticated technology, and in the first two years will need monitoring by highly qualified persons like Dr. Shafique Younus of Pharmacy Department, Kabul. This Plant will also have a Liquorice extraction plant of 400 kg Root per day to get Liquorice extract for isolation of chemicals from it. It will only be for manufacturing of Liquorice chemicals 2 to 2.4 tons/year. As for PROCESSING OF OTHER MEDICINAL PLANTS (identified already in consultation with Dr. Younus and Dr. Kishtyar, President, Forests) 200 kg Herb processing/day. This will form the next stage of the Project, under the heading "SIMILAR ACTIVITIES WITH RESPECT TO OTHER MEDICINAL PLANTS".

R. D. Chaudhri

ANNEXURE IV-B

RAM DEV CHAUDHRI

UNCA Staff House
c/o UNDP
P. O. Box 5
Kabul,
January 26, 1984

PROJECT: SI/AFG/82/11-01/42.1.F

Subject: UTILISATION OF BEET ROOT SUGAR PLANT AT BAGHLAN FOR LARGE SCALE EXTRACTION OF LIQUORICE

Reference: Note dated January 10, 1984 (ANNEXURE No. IV-A)

Pursuant to note dated 10 January 1984 referred to above, a meeting was held in the office of Engineer Yakub, President of Industries, in the Ministry of Mines and Industry, at 2 p.m. on 25 January 1984 in which the following participated:

1. Engineer Yakub
2. Engineer Rahmani, Chief Engineer, Baghlan Sugar Factory
3. Mr. Faquir Mohd, Vice President, Afghanistan Plants Co.
4. R. D. Chaudhri

Mr. Rahmani is a Mechanical Engineer from Munich University and has a long experience of the above Plant. He brought with him details of the equipment available there as well as some data on the cost of processing Beet Root. At the outset, I explained to Mr. Rahmani that extraction of Liquorice to Soft Extract involved the following unit processes:

(a) SIZE REDUCTION (to Coarse Powder) (only 10 Mesh)
(b) SOAKING prior to extraction with water
(c) EXTRACTION WITH WATER
(d) SEDIMENTATION
(e) FILTERATION
(f) CONCENTRATION OF WATER EXTRACT BY EVAPORATION
(g) FINAL MIXING IN A STEAM-JACKETTED PAN WITH ANCHOR STIRRER

Mr. Rahmani told us that they have arrangements for (c) "Diffusion Battery" which extracts Beet Root at 65° C and this

can easily be used for extraction of Liquorice also. Then they have equipment for (e) and (f) which can also be used for Liquorice processing. Each diffusion battery takes 3.5 tons material at a time and is made of mild steel. Filter press is made of cast iron and triple effect evaporators of stainless steel. Hence the only additional equipment to be provided is:

For (a) DISINTEGRATOR: Capacity 250 kg Liquorice disintegration per hour (to get 3.5 tons material a day for extraction).

For (b) and (d) HIGH DENSITY POLYTHELENE TANKS (which are quite cheap)

For (f) A STAINLESS STEEL STEAM-JACKETTED PAN WITH ANCHOR STIRRER and, if Block Liquorice were to be made, then moulds of mild steel on shelves where these are allowed to cool at room temperature before removing the Block Liquorice from them.

He further told us that for 3.5 tons Beet root, 65,000 litres of water are fed per battery and they have 14 such diffusion systems for extraction of Beet root which means that up to 3.5 x 14 i. e. 49 tons of Liquorice can be extracted per day, if necessary.

They have three coal- and one oil-fired boiler. Cost of coal at their Plant site is 1,500 Af per ton.

They have a good Chief Chemist there who was trained in Germany for two years and their Laboratory is well equipped from the Beet Sugar Industry point of view.

From records of Mr. Rahmani, it was observed that cost of processing per kilo of Beet root at the plant was around 2 Afs/kg.

They have adequate stores, no power problem and trained staff who remain working for four months of the year at most (October - November - December - January).

Conclusion

From this meeting, as well as from the one with Mr. Yusuf Abdullah, Ex-Chief Chemist and Vice-President of Baghlan Sugar Factory (reported vide note dated 10/1/84), I am convinced that, without much expense or trouble the Baghlan Beet Root Sugar Factory Plant can easily be adapted for commercial extraction of Liquorice to Soft Extract during the

off season which is at least 8 months of the year. This observation is confirmed by Dr. Shafique Younus, D. Sc. Head of the Department of Pharmacy of Kabul University; he has seen this factory during the working season and has affirmed that, with slight modifications here and there, this Plant can easily be used for extraction of Liquorice and the testing laboratory could also be used for this work.

R. D. Chaudhri

ANNEXURE V

RAM DEV CHAUDHRI Kabul, 25 December 1983

PROJECT SI/AFG/82/801/11-01/32.1.F

PROGRAMME OF ACTION
(made in consultation with Afghanistan Plants Co.)

I. COLLECTION OF BASIC DATA

1. Quantity of Liquorice

   (i) Total quantity available for processing per year
   (ii) Distribution of above at various centres and their distance from Kabul

2. Cost at site

   (i) Basic price of Liquorice at different collection centres
   (ii) Freight per ton if brought to Kabul from these places
   (iii) Total cost at processing site.

3. Quality

   (i) Methods adapted for estimation of Glycyrrhizin
   (ii) % Glycyrrhixin in Liquorice at different collection centres; to contact Dr. Younus

4. International prices of finished products to be made

   (i) Soft Extracts (i. e. SPISSUM)
      (a) Liquorice Extract, BPC/IP
      (b) Pure Glycyrrhiza Extract, USP
      (c) Extractum Glycyrrhiza Spissum, USSRP X

   (ii) Dry Extracts (i. e. SICCUM)
      (a) Liquorice Dry Extract, BP
      (b) Glycyrrhiza Extract (Dry) NF
      (c) Extractum Glycyrrhiza Siccum, USSRP X

   (iii) Monoammonium Glycyrrhizinate
      Disodium Glyrrhizinate
      Glycyrrhetinic Acid (Enoxolene)

   (iv) De-glycyrrhizinated Glycyrrhiza Dry Extract (DGL)

5. Social and national objectives
   For this project, by this country

6. Availability of qualified personnel

   (i) Technicians: To contact Technical School

   (ii) High level Scientists
   (a) B. Sc. with Chemistry and Botany
   (b) M. Sc. with Chemistry
   (c) M. Sc. with Botany
   (d) M. Sc. (Phytochemistry)
   (e) B. Pharm.
   To contact Kabul University

   (iii) Engineers (Mechanical and Chemical):
   To contact Polytechnic

7. Power Position

8. Fuel

   (i) Whether to use COAL, FURNACE OIL or DIESEL OIL for boilers - relative costs and supply

   (ii) WATER

9. Creation of technical base

   (i) Basic Testing Laboratory

   (ii) Basic Library for this work

II. PROCESS AND PRODUCT SPECIFICATIONS

1. Process Know-how: To be suggested by me based on above basic data

2. Specifications and testing methods of products to be made from Liquorice: To be given by me

3. Processing chemicals - availability and rates: List to be drawn up

III. PROJECT ESTIMATES

To be made when I, II are available completely.

IV. EMPLOYMENT POTENTIAL

1. Number of persons at each level

2. Salaries and prerequisite of persons at following levels:

   (i) Workers
   Skilled, semi-skilled and unskilled; Watchmen

   (ii) Technicians
   Boiler Attendants; Mechanics; Fitters; Electricians

   (iii) High level technical personnel
   Chemists; Engineers; Manager

   (iv) Office Staff
   Store Clerk; Stenotypists; Accounts Clerks; General Duty Clerks; Attendance and Wage Payment Clerks

V. COMMERCIAL VIABILITY/FEASIBILITY

To be made when full data available detailed above.

VI. DIVERSIFICATION FOR OTHER HERBS

"Undertake similar activities with respect to other Medicinal Herbs"

1. From List given to me, to identify plants with quantity available good enough for processing and which have international demand.

2. To make all the above studies for these "selected plants".

VII. FACILITIES AVAILABLE

1. To study as suggested by Afghanistan Plants Co., if the facilities available at Government Sugar Factory with some additions could be used to start a nucleus of the industry to save costs of equipment, personnel and to use sugar factory staff during off season.

2. To see if Government Engineering Factory (Jangalak) can fabricate any of the equipment required for this project.

VIII. MISCELLANEOUS

To undertake such other studies as may be suggested by UNDP and other Departments of Afghanistan related to this Project.

IX. DRAWING UP OF PROJECT REPORT

R. D. Chaudhri

ANNEXURE VI-A

December 1983

List of medicinal plants said to be exported by Afghanistan Plants Company, Post Box 122, Kabul

1. Liquorice Root (Glycyrrhiza glabra)
2. Cumin Seed (Cuminum Cyanum)
3. Poppy Seed White (Papaver Somniferum)
4. Alfa Alfa Seed (Medicago sativa)
5. Clover Seed (Trifolium pratanse)
6. Coriander Seed (Coriandrum sativum)
7. Alkanet Root
8. Althea Roses
9. Contaurea behea, red
   Contaurea behea, white
10. Mustard (Brassica Spp)
11. Asafoetida (Ferula asafoetida)
12. Tragacanth Gum

ANNEXURE VI-B

Other medical plants available and important but not exported

1. Atropa belladonna
2. Berberis spp.
3. Datura metel/innoxia
4. Ephedra spp.
5. Eleaginous suguatifolius leaf (said to be very rich in Tannins)
6. Hyoscyamus muticus
7. Iris germanica root
8. Colchicum spp.

ANNEXURE VII-A

1. Sample : GLYCYRRHIZA EXTRACT I.P, 55
(Made from Liquorice Root I.P. 66)

2. Category : DRUG

3. Supplier :

4. Batch No.

5. Date of receipt in laboratory

6. Date when test completed

7. PROTOCOLS OF TEST APPLIED	STANDARD TO WHICH COMPARED	ACTUAL RESULTS
1. Description	Thick brown paste with sweet taste of liquorice & peculiar faint odour.	
2. Identity	(i) On shaking with water, forms colloidal solution with copious foam. (ii) To 10cc of 1 : 10 solution, add 1cc of Sulphuric Acid : An abundant ppt soluble in Ammonia solution is formed.	
3. Loss on Drying (Method No. 1 overleaf)	Not more than 40%	
4. Water Extractives (Method No. 2 overleaf)	Not less than 50%	
5. Insoluble Matter (Method No. 3 overleaf)	Not more than 10%	
6. Crude Glycyrhizin (Method No. 4 overleaf)	Not less than 15% in original Soft Ext (not on dry basis)	

8. Opinion of Analyst : The sample conforms / does not conform to the standard compared.

TESTING OF GLYCYRRHIZA SOFT EXTRACT

1. LOSS ON DRYING : Weight about 1 g accurately in a tared beaker which is already dried to constant wt. Dry it at constant wt. at 105 degree C. From difference in weight, calculate % LOSS ON DRYING.

2. WATER EXTRACTIVES : See page 948 of IP 66 for this method, taking 1g sample.

3. INSOLUBLE MATTER : Take 1 to 2 g accurately weighed material. Dissolve it in 100 cc distilled water and filter it on a WEIGHED FILTER PAPER.

   Wash residue with water till washings are colourless and filterate has no sweet taste of Glycyryhiza. Dry and weigh residue with filter to constant wt. at 80 degree C. Increase in wt. of filter paper represents water insoluble matter.

4. CRUDE GLYCYRRHIZIN : Garratt Mathod 3rd edition Page 381-382, Weigh about 1 to 2.5 g accurately. Add 15 of hot distilled water, Keep the flask now on a water bath till ext is dissolved.

   Add 25 cc of 80% V/V alcohol, shake well and add 50 cc of 95% V/V alcohol, allow to settle.

   Filter on a filterpaper and wash with 80% V/V alcohol until washings are colourless. Transfer filterate and washings to dish and ovaporate alcohol further to a syrupy mass and transfer it to 50 cc stoppered cylinder, washing in with distilled water upto 30 cc.

   Add 3 cc of 10% V/V sulphuric acid, slowly with constant shaking. Allow to stand overnight at room temperature.

   Decant supernatant liquid into a filter paper; wash the pot 2 or 3 times with cold water passing the washing each time through filter paper.

   Dissolve the residue in the cylinder and on the filter paper with a little dilute alcohol (45%) adding 2 or 3 drops of AMMONIA (10%) to neutralise the acid.

   Evaporate to dryness in a tared beaker and dry to a constant weight at 105 degree C.

   Increase in wt. of beaker represents Crude Glycyrrhizin.

ANNEXURE VII-B

1. Sample : MONO AMMONIUM GLYCYRRHIZINATE / M. A. G.
(C_{42} H_{61} O_{16} NH_4)

2. Category : PHYTOCHEMICAL

3. Supplier :

4. Batch No.

5. Date of receipt in laboratory

6. Date when test completed

7. PROTOCOLS OF TEST APPLIED	STANDARD TO WHICH COMPARED	ACTUAL RESULTS
1. Description	Cream coloured powder; odourless; particular sweet taste	
2. Identity	Heat aquous solution with NaOH solution in a test tube : Ammonia Gas evolved	
3. Purity	(a) Dissolve 0.25 g. in 50cc of equal parts of water & alconol. Solution is almost colourless & clear. (b) Aq Solution is slightly acidic	
4. Solubility	(i) Water : Practically Insoluble (ii) Hot Water : Freely soluble; but gels on cooling (iii) Dilute Ethanol (50% V/V) - Soluble. (iv) Glycerin : Soluble; 1/10 (v) Chloroform & Ether : Insoluble	
5. Residue on ignition taking 1g. sample	Not more than 0.5%	
6. Loss on Drying : (With 1g sample, at 80 degree C, in Vacum, for 4 Hrs)	Not more than 8%	
7. ASSAY : Taking 100 mgms; making it to 250 ml. with 50% V/V alcohol; taking 10ml. out of it & making it to 100ml. with 50% V / V Alcohol & find the Absorbance of this solution at 252 nm using 50% V/V alcohol as blank. % is $\frac{AT}{133} \times 25000$	Not less than 95.0%	

8. Opinion of Analyst : The sample conforms / does not conform to the standard compared.

ANNEXURE VII-C

TECH: 77:X:3

DISODIUM GLYCYRRHIZINATE, PURE

1. Description: Cream coloured powder; intensely sweet; odourless

2. Solubility: Freely soluble in water and 50 % V/V alcohol

3. Identity: To 0.2 G sample, add 5 cc water and 3 cc HCl, reflux for 1 hour on a water bath, evaporate the liquid.

   To the RESIDUE: ADD solution of 2 : 4 Nitrophenylhydrazine (as given in IP 66): ORANGE RED PPT

4. Loss on drying: Not more than 7 %

5. Assay: Weigh accurately 100 mgms previously dried; dissolve in water to 250 ml; pipette 10 ml of the solution and add water to make 100 ml.

   Read Absorption of this solution at wave length 257.

   Percentage Disod Gly $\frac{\text{ABSORPTION}}{128} \times 25,000$

TECH: 78:VII:1

GLYCYRRHETIC ACID ENOXOLONE, E.P.

1. Description: Cream coloured odourless and tasteless crystallisable powder

2. Solubility: Freely soluble in Chloroform, soluble in Alcohol, Acetone and Pyridin; INSOLUBLE in Pet roteum Ether and water

3. Chloroform solution: Optically active and Dextrorotatory

4. Melting point: 293 to 295° C

ANNEXURE VII-D

1. Sample : PROCESSED GLYCYRRHIZA ROOT-DEGLYCYRRHIZINATED-DRY POWDER 6 : 1
   (Made from Glycyrrhiza Root I.P.)
2. Category : INTERMEDIATE
3. Supplier : AMSAR
4. Batch No.
5. Date of receipt in laboratory
6. Date when test completed

7. PROTOCOLS OF TEST APPLIED	STANDARD TO WHICH COMPARED	ACTUAL RESULTS
1. Description	Light brown powder Sweetish taste of liquorice	
2. Identity	(i) Test for Flavones See II (i), & (ii) overleaf (ii) Identity Test for Alkaloids See III (iii) overleaf	
3. Extractives by IP 66 method taking 1 g sample :		
(i) In water	Not less than 80%	
(ii) In 50% V/V Alcohol	Not less than 70%	
4. Acid Insoluble Ash IP Method taking 2 g. sample :	Not more than 1%	
5. pH of 5% Aquous Solution by Electric pH Meter , using BDH Neutral tablets as standard	Between 5 to 7	
6. Glycyrrhizin by USSRP X Method for "Ext. Glycyrrhiza Siccum, taking 6 g sample	Not more than 3%	
7. ASSAY (Flavones) See (I) overleaf	Not less than 1%	

8. Opinion of Analyst : The sample conforms / does not conform to the standard compared.

1. **ASSAY (For Flavones)**

ESTIMATION :

Take 10 g sample; shake it with 60 ml. Methanol for an hour; leave overnight. Filter; wash the residue with 20 ml. portion of Methanol twice. Combine the filtrate and washing and concentrate to 10 ml.; add this dropwise with continuous shaking to 100 ml. ether. After addition, shake the contents vigorously for 10 minutes, leave another 10 minutes contents vigorously for 10 minutes' leave another 10 minutes for settling; filter evaporate dry to constant weight.

2. DETECTION OF FLAVONES

(i) PREPARATION OF TLC PLATES :

Take 5 g of Silica Gel - G in a beaker & add 15 cc. of distilled water & shake it till complete mixing; then spread it glass plate either with the help of an applicator or by knife to desired thickness. Dry the plates at room temperature & then activate at 105 degree C for 30 - 45 minutes. (Plates can also be made by use of 80% V/V alcohol instead of water, to facilitate rapid drying).

(ii) DETECTION :

Dissolve the Flavones isolated under assay in 2 ml. Methanol. Spot it on TLC Plate prepared from Silica Gel-G. Develop the plate in solvent Chloroform : Methanol (9 : 1). After drying spray the plate with 1% Alcoholic Ferric Chloride, shows three spots, two of which are distinct.

(1) TLC Plate should be activated at 105 degree for atleast 30 minutes before use.

(2) The container in which plate is to be developed should be standard with solvent vapour.

(3) IDENTITY TEST FOR ALKALOIDS :

(i) Dissolve 1 gram sample in 50 ml. of 50% V/V alcohol by slight warming on w.b, filter.

(ii) Remove alcohol from the filtrate by warming on waterbath.

(iii) Acidify it with Dilute Sulphuric Acid and make it into 2 parts.

Part I : Add Mayer's Reagent-: Turbidity or ppt or both may be formed, arter standing for 5 minutes.

Part II : Spot it on filter paper, spray the spot with Dragendorff's Reagent. Light Orange Spot is obtained after 5 minutes.

ANNEXURE VIII-A

Laboratory equipment

1. Analytical balance
   (a) accuracy 0.1 mg
   (b) accuracy 0.1 g
2. Electrically heated water bath
3. PH-meter (electric)
4. Electric oven (temp. up to 250°)
5. UV spectroprotometer 200 mm to 1000 mm
6. Polarimeter
7. TLC. kit
8. A small fume cupboard
9. Melting point apparatus electric
10. Fire extinguisher
11. Karl Fisher apparatus for determination of moisture
12. Glass apparatus like standard burettes, standard pipettes, standard volumetric flasks, conical flasks, beakers, tubes, funnels, stands, tubes, etc. and dessicator
13. Muffle furnace electric for ash determination with porcelain and silica crucibles
14. Vacuum drying oven with VAC pump
15. Refractometer

ANNEXURE VIII-B

List of books

I. PHARMACOPOEIAS

1. Pharmacopoeia of India, latest edition
2. British Pharmacopoeia including Codex, latest
3. United States Pharmacopoeia including Formulary, latest
4. European Pharmacopoeia, 3 volumes
5. Extr. Pharmacopoeia Martindale, latest
6. International Pharmacopoeia, 3 volumes
7. Union of Socialist Soviet Republic Pharmacopoeia, edition IX and edition X

II. OTHER BOOKS

1. Quantitative Analysis of Drugs, Carratt, latest edition
2. Methodology for the Analysis of Vegetable Drugs, I. Cuilei: from UNIDO, Vienna International Centre, Vienna
3. Laboratory Manual of Natural Products, L. Kon (Hebrew University, Jerusalem, or Academic Press, London)
4. Comparative Phytochemistry, T. Swain, latest edition
5. Chromatography, E. Stahl
6. Pharmacognosy
   (a) Textbook of Pharmacognosy, Shah and Qundry, India
   (b) Textbook of Pharmacognosy, Trease, UK
   (c) Practical Pharmacognosy, Lala, India
7. Glossary of Indian Medicinal Plants and its Supplement, Council of Scientific and Industrial Research, Delhi (India)
8. Medicinal & Aromatic Plant Abstracts, Csir, Delhi, India

On Herbal Pharmacology: Only book known is Herbal Pharmacology in the People's Republic of China, National Academy of Sciences, USA, Washington

ANNEXURE IX

List of processing chemicals

1.	Acetic Acid, Glacial	17 kilo litres
2.	Acetone Pure	1500 litres
3.	Activated Charcoal	500 kg
4.	Ammonia Liquor (25 % to 30 %)	3800 litres (in 15 litres jars)
5.	Alcohol 95 % V/V	10 kilo litres
6.	Caustic Soda Flakes	200 kg
7.	Chloroform, Pure	4000 litres
8.	Lactose	700 to 1000 kg
9.	Methanol, Pure	30 tons
10.	Sodium Carbonate Anhydrous	3.5 tons to 4 tons
11.	Sulphuric Acid, Pure (1.94 Sp Gr) (but for Glycyrrhetinic Acid)	2 tons (160 tons)
12.	Anhydrous Sodium Sulphate	
13.	Petroleum Ether, 60 - 80 and 40 - 60	
14.	Benzene	

ANNEXURE X

List of plant and machinery sent for rate enquiry

1. Boiler

Steam Pressure:
Not more than 100 lbs per square inch

Steam Generation capacity:
(a) 300 kg
(b) 600 kg
(c) 750/800 kg
(d) 1000 kg/hour

Fuel:
Both Coal or Furnace Oil/Diesel

complete with all assessories.

Water feed pump

Steam Injector Type in addition to one electric run blower: Electric but capable of being switched on to steam if power cut off.

2. Weighing scales

(i) 1000 kg
(ii) 300 kg and
(iii) 30 kg for accurate weight of finished products.

3. Storage vessels

(i) Stainless steel 300 litres; 500 litres and 1000 litres
(ii) High density polythelene tanks complete with stands: 500 litres; 1000 litres; 5000 litres and 10,000 litres

4. Sieves, stainless steel

600 mm diameter

5. Centrifugal pumps (contact parts stainless steel)

(i) 250 litres/hour
(ii) 400 litres/hour

Should be able to work on liquids up to 90° C

6. Disintegrator

Capable of crushing Liquorice pieces to coarse powder 10 mesh - complete.

(i) 250 kg/hour
(ii) 500 kg/hour
(iii) 100 kg/hour

7. Stainless steel extractor

Steam-jacketted with chutes of stainless steel to drain water extract 1000 litres

8. Filter press

Contact parts stainless steel; frame of wood, with pump

(i) 250 litres/hour
(ii) 400 litres/hour

9. Forces circulation evaporator

Contact parts stainless steel, with vacuum system, double effect, feed 10 % total solids.
Product: 60 % total solids evaporation capacity:

(i) 100 litres water per hour
(ii) 250 litres water per hour

10. Steam-jacketted pan with Anchor stirrer

Contact parts stainless steel

(i) 300 litres
(ii) 500 litres
(iii) 1000 litres

11. Vacuum shelf drier 48 trays

Complete with vacuum pump, condenser and receiver. Trays of stainless steel/Aluminium; high density polythelene. Distance between a tray and shelf: minimum 6 inches. Worked with

(i) Steam
(ii) Power

12. Pulveriser

Contact parts stainless steel; up to 100 Mesh powder. Size: 25 kg/hour and 50 kg/hour

13. Powder mixer

Stainless steel. 200 litres size, 300 litres size

14. Solvent recovery cum volatile distillation plant

Stainless steel; 500 litres distillation rate
50 litres/hour

15. Reaction cum reflux assembly

    Stainless steel; 200 litres with arrangement for liquid extraction with heavy solvent.

16. Nutsche filter

    Stainless steel, 500 litres with vacuum pump.

17. Steam-jacketted pan

    Stainless steel, 150 litres and 200 litres

18. Basket centrifuge

    Contact parts stainless steel (also liquid holder of stainless steel), min. charge 25 kg at a time.

19. Crystalliser with spare SS vessels

    Electric, 150 litres/200 litres size

20. Attachment for liquid extraction

    (Heavy solvent). To be attached to No. 14 or 15, 300 litres size

21. Attachment for solid liquid extraction

    Stainless steel, for being fitted to No. 14 or 15, 50 kg herb capacity

22. Solvent extraction plant

    Stainless steel, 100 kg herb capacity; improved design (i. e. Soxhlet Plant with arrangement for ciruclation of solvent with herb, cold or hot as may be needed, by centrifugal pump and with arrangements for solvent recovery for reuse of solvent).

    Alternate: Vortex extractor (i. e. solvent stirred with herb at slow speed and then extract taken out to Nutsche and receiver; solvent in herb sparged with steam and solvent remaining in the herb recovered by condenser attached to extractor).

23. Glass lined reactor

    300 litres size, stainless, with condenser and receiver.

24. Fluid bed drier

    10 kg/hour

25. Mixer grinder

(for fine chemicals only), 10 litres vessel

Kabul 5/8 January 1984 R. D. Chaudhri

NB: Minor equipment like Cast Iron Blocks for Block Liquorice (5 kg), stainless ladles for filling, trollies, drum carriers, arrangement for Polyethylene bag sealing etc. are not included.

Details of Workshop for repair/maintenance are also not given.

R. D. Chaudhri

ANNEXURE XI

Level of wages in Government enterprises

1. Extra benefits per employee

Food 5 days a week	300 Afs.
Transport	250 Afs.
Co-operative	500 Afs.
Total:	1,050 Afs.

2. Pension

The enterprise pays 6 % of the basic salary to the Government Pension Department.

3. Bonus

On 2 % of the profits before tax: Not less than one month; not more than 3 months.

Wage scales

1. General President	8,000 Afs.
2. Chemists and Engineers (with degree)	5,550 Afs.
3. Office Staff lower category	
(a)	3.650 Afs.
(b)	2,450 Afs.
4. Workers	
skilled (with diploma)	4,200 Afs.
semi-skilled (with certificate)	2,400 Afs.
unskilled	1,550 Afs.

Leave benefits

1. Earned leave	20 days/year
2. Sickness leave	20 days/year
3. Casual leave	10 days/year

Working days in a year

Off days: All Fridays		52 in a year
Festival holidays		10 in a year
So net working days:		365 days
	- (52 plus 10)	62 days
		303 days
	say 300 working days per year	


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