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DP/ID/SER.A/1563
27 February 1992
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STRENGTHENING OF ESSENTIAL OILS

DP/DRK/88/001

DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

Technical report: First mission of the analytical chemist*

Prepared for the Government of Democratic People's Republic of Korea
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of R. Thomann, Analytical Chemist

Backstopping Officer: T. De Silva, Chemical Industries Branch

United Nations Industrial Development Organization
Vienna

* This document has not been edited.

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ABSTRACT

Title of the project: Strengthening the Essential Oil Industry in Korea
Number of the project: DP/DRK/88/001/A/01/37
Number of the mission: DP/DRK/88/001/11-52
Description of job mission: Analytical chemist

The UNIDO consultant fulfilled his task at the Pyongyang Essential Oil Research Centre (PEORC), during his mission, in June 1991.

The special tasks were,

- to install the laboratory equipment, delivered from Germany, in accordance with the contract of acd-agro consult, Dresden;
- to put the laboratory equipment into operation and to train the PEORC laboratory staff in operating it;
- to discuss the organization of the laboratory work and the analytical methods (ordering solvents, glass ware, gases, and services);
- to discuss the research program for essential oils obtained by n-hexane extraction.

I. INTRODUCTION

This report is given by Dr. Thomann, head of the food technology department at the Institute for Cereal Processing, in 1505 Bergholz-Rehbrücke, Germany. Special objects of his department are essential oils, their production, quality control, and marketing.

The report gives a survey on the activities which were done at P.E.O.R.C.

- to install the laboratory equipment,
- to train the laboratory staff,
- to prepare the field purchase order (solvents, glass ware),
- to inspect the extraction unit in the fields,
- to organize some further activities for marketing.

The mission in Pyongyang started on June 8, 1991, and was finished on July 2, 1991, followed by debriefing stop in Vienna.

All the objectives planned in the analytical field were attained and connected with technological, commercial, and scientific questions which have to be solved by the P.E.O.R.C. staff, in future.

The mission was combined with the mission of Mr. Langner, CTA, for the installation of bench scale equipment, at P.E.O.R.C.

II. TECHNICAL REPORT

A. Laboratory situation

As described in the report of Mr. Hylands (1987), the level of laboratory equipment does not meet with the requirements, at present. The few existing glass ware is available only in single items. The use for different samples is connected with long waiting periods due to cleaning. Instruments and devices for quantitative and qualitative analyses did not exist, with the exception of an antiquated gas chromatograph (CSFR - packed columns).

The available solvents and chemicals do not suffice to clean the glass ware and instruments used or to produce the required solutions and standard mixtures for the adjustment of the instruments and to evaluate the essential oils produced.

The supply of media (cooling water, electricity, highly cleaned gases) is irregular and difficult.

The installation of media (especially of electricity) is hazardous to the health of the operators and the function of the equipment.

The laboratory is staffed with five members. The conversation in english was possible with three of them. They have good knowledge in chemical and analytical problems and are very interested in extending their knowledge. (Participation in a TLC training course, in China, in 1989.)

All the instruments have been adjusted or tested. Operating instructions (check-lists) for all new instruments have been established together with the laboratory staff.

Due to the missing appropriate standard substances/mixtures and glass ware for their preparation, simplified tests had to be performed.

After the realization of the field purchase orders for solvents (Annex IV), glass ware/standard substances, and miscellaneous, the laboratory staff immediately will be able to practice all these methods.

For TLC, the drying oven and desiccators have not been available in the required size (20 x 20 cm plates) so that it was necessary to improvise by a hand-made drying oven and development chambers filled with drying agents. The gas chromatograph was operated at 110 V/60 Hz. The standard electricity voltage in the laboratory is 200 to 230 V. A transformer with limited performance had to be used (warning!).

The gases to be used (nitrogen, hydrogen) should be pure (99.995 %) but a quality certificate was not available. The capacity of VARIAN-GC installed gas filters is limited, a more frequent replacement has to be taken into account.

It would be useful to connect the gas chromatograph with one of the personal computers at P.E.O.R.C. The details should be discussed with the regional service office of VARIAN, in Hong Kong.

b. New laboratory equipment

According to the contract with agro-consult, Dresden, the laboratory equipment was installed, at the P.E.O.R.C. laboratory. Any transport damage or defect of single items was recorded in a protocol. The supplier was informed correspondingly. He will send substitutes, as soon as possible. Thanks to the relatively unimportant function of the damaged parts, the laboratory activities/performance as a whole was not affected severely.

The new installation consists of,

- top load balance (Annex VI, fig. 1)
- precision balance (Annex VI, fig. 1)
- thin layer chromatography equipment (Annex VI, fig. 2)
  - . automatic and manual coater
  - . development chambers (different sizes)
  - . glass plates
  - . UV chamber
  - . different tools and reagent feeder
- automatic polarimeter with micro tubes (Annex VI, fig. 3)
- Abbe refractometer (Annex VI, fig. 4)
- rotational vacuum evaporator (Annex VI, fig. 5)
- gas chromatograph (VARIAN 3400)
  - . with split/splitless injector
  - . different packed and capillary columns
  - . FID and TCD as detectors

c. Essential oils and their processing

The management of P.E.O.R.C. organized a trip to the extraction unit for rosa rugosa, at Chong Pyong. Wild roga rugosa plants and flowers could be inspected. The area near Chong Pyong which is designated for harvest has an acreage of about 100 ha.

A further area of about 2000 ha is said to exist near the Chinese/ Korean border. In the area near Chong Pyong, 400 workers can be employed for harvesting. Every one of them will collect daily 5 to 10 kgs of flowers. 1500 tons of rosa rugosa flowers will be collected and extracted annually.

The flowers (Annex VII, fig. 1 and 2) are picked in the morning. The extraction with n-hexane was performed in one of the five extractors (240 l, each)(Annex VII, fig. 3, 4, 5, and 6). The flower/ solvent relation is 1 : 3. The extraction time for the first step is 1 hour. Most of the essential oil (especially Eugenol) is extracted. In a second extraction step, the flowers are "washed" with fresh n-hexane.

The hexane has not the required quality (perfume grade). In an analysis of two samples, performed in Germany in July 1991, contents of n-hexane of 25 % and 40 %, respectively, were detected in the redistilled sample (Annex V). 2000 kg flowers (70 % moisture) are yielding 1 kg of "concrete oil".

The five extraction vessels may be used daily up to three times, thus facilitating the processing of 3 tons of rosa flowers.

The extraction residue is steam treated to obtain the remaining n-hexane. The extract is concentrated on a normal-pressure fall-film evaporator which is situated outside the extraction building. Water steam is used as heating medium. The residence time of the extract in the fall-pipe is 7 sec. at a capacity of about 10 kg/h (Annex VII, fig. 7, 8, 9, and 10).

Sometimes, a steam-heated distillation unit is used for solvent refractionation (Annex VII, fig. 11).

After experimental testing the bench scale fall-fill vacuum evaporator, in Pyong Yang (time of delivery November, 1991), the equipment in Chong Pyong will be reconstructed according to the possibilities of Korean engineering and the demands of their commercial partners.

The enriched extracts were subjected to vacuum rectification in a bench vacuum evaporator or a laboratory scale evaporator (Annex VII, fig. 12), in Pyongyang.

The situation of extract processing will be changed drastically with the new equipment which will be deliverd, in autumn 1991.

A verbal report on the water steam distillation was given by Mr. Dr. Choi. The technical requirements to this technology are realizable and can be met without any problems. It is estimated that the size of the equipment, which exists in the D.P.R.K., will cover the demands of the industrial production of different Korean plants.

The following plants for water steam distillation are planned,

- Acorus calamus L. var. angastatus Berrer
- Angelica gigas Nakai*
- Acorus gramineus solunder
- Agastache rugosa (Fischer et Meyer)
- Thymus vulgaris L.
- Angara schnifolia Eugler
- Thuja orientalis L.**
- Ledum palustre L.
- Convallaria Keiskei Mig.
- Syringia dilatata Nakai

* 1000 kg essential oil of the 1990 harvest available

** 5000 kg essential oil of the 1990 harvest available

If the planned objectives, such as

- bench scale equipment installation,
- glass ware,
- solvents for laboratory and 1000 l for extraction tests,
- miscellaneous,
- VARIAN service,

are realized by the management of P.E.O.R.C. and the started activities for commercialization of essential oils (1st step - water steam distillates, 2nd step - hexane extracts) are continued, there will be good chances for fulfilling the planned outputs.

III. RECOMMENDAT ONS

A. Technical section

1. For the continuous work of the gas chromatograph the acquisition of four new gas steel-flasks (2 nitrogen, 2 hydrogen) with precision manometers is recommended to the institute.
2. Sufficient electrical connections should be available to the laboratory equipment in order to meet with the safety requirements for the operators and instruments (sockets with earthing).
3. Water supply should be installed in separate water traps with threads and belonging connections to rubber/plastic tubes.
4. For strengthening the international connections, computer software programs should be used which will increase the efficiency of writing letters, offers, requests.
5. It is recommended to raise the budget 1991 by the following positions,

- 1000 l hexane (perfume grade)	1000.- US-$
- stock of solvents (Annex IV)	1000.- US-$
- VARIAN service consultation in November 1991	1000.- US-$

B. Staff section

Any participation in the international communication is advisable. This could be done by

- continuation of English language training to the laboratory staff,
- subscription to scientific publications (journals, reprints, or copies),
- participation in international workshops,
- organizing national workshops with universities, pharma-enterprises at P.E.O.R.C.,
- participation in the 1st World-Congress on Medicinal and Aromatic Plants for Human Welfare (The Netherlands, 1992) by presenting a poster on P.E.O.R.C. activities (Annex VIII),

- intensification of the correspondence with essential oil processing enterprises, universities, and research centres (contact letters have been drafted),
- issuing publications on results of their own as "short informations" to international journals and publication bulletins,
- working out a P.E.O.R.C. offer.

C. Commercial section

- Promising prospects on the market are expected, first of all, for the essential oils from

  Angelica gigas and
  Thuja orientalis.

  Contacts to different trading organizations should be advisable for price and quality comparison purposes.

- Before offering the Rosa rugosa extracts, investigations on hexane extracts (perfume grade) for quality determining criteria should be performed (import of 1000 l pure n-hexane - at a price of 1000.- US-$).

- Depending on the demands on the international market, further essential oils should be offered, if the plants are available, in D.P.R.K.

- High prices should be argued as follows,
  natural, wild growing plants are used;
  no use of plant protection substances (analytical data);
  utilization of pure solvents (?!) or water steam;
  qualified quality control (when established).

Annex I

KDuerbeck/rleón

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

JOB DESCRIPTION

DP/DRK/88/001/11-52

Post title Analytical Chemist

Duration 1 month

Date required May or June 1991

Duty station Pyongyang

Purpose of project Utilization of indigenous essential oils to develop suitable fragrance materials for local industry and export.

Duties The expert will work under the supervision of the National Project Coordinator and will have particular responsibility for assisting in the design and fabrication of improved distillation and extraction equipment for local construction and supervise their initial fabrication.

The expert will participate at the preparatory stages for evaluation of the project and assist in formulating proposals for a time-framed workplan of future activities for the project.

The expert will prepare a full report on his findings and recommendations

..../..

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

Project Personnel Recruitment Section, Industrial Operations Division

Qualifications: A chemical design engineer with a thorough grasp of the up-to-date technology of distillation and extraction of essential oils who will assist local personnel in the design and fabrication of improved stills for local construction. The expert should have recent experience of field distillation, preferably in a developing country.

Language: English

Background information: As part of a new initiative, the Government of DPR Korea has recently established the Pyongyang Essential Oil Research Centre (P.E.O.R.C) to act as a central body to supervise the production of essential oils and related products, principally from rose, lilac and lily of the valley, to serve a growing domestic market for scented toiletries as well as export. The Government is receiving assistance from UNDP through a UNIDO project designed to facilitate the development of P.E.O.R.C. The project will enhance rural development and provide raw materials for local industry (including that with high added value such as comestics) in a hitherto somewhat neglected sector of the economy.
Ultimately, by producing material for export, will contribute to foreign exchange earnings.

Annex II: List of partners

Mr. Dr. Choi Dung Guang	director of P.E.O.R.C.
Mr. Dr. Li Myong Ho	assistant director
Miss Hong Dong Suk	laboratory staff
Miss Kang Gum Suk	laboratory staff
Mr. Dr. Kim Dyong Chol	technologist
Mr. Mun Si Song	interpreter
Mr. Dr. Karcher	U.N.D.P. representative
Mrs. Williams	U.N.D.P. assistant representative
Mr. Li	U.N.D.P. senior officer
Miss Rieger	U.N.D.P. junior officer

Addresses:

Pyongyang Essential Oils
Research Centre,
Bucksu, Daedonggang,
Pyongyang
D.P.R. of Korea

U.N.D.P.
P.O. Box 27
Pyongyang
D.P.R. of Korea

Annex III: List of recommended equipment for 1992 ff.

- water thermostates
- precision manometers
- drying ovens (for TLC)
- semiautomated burettes
- apparatus for essential oil determination (Clevenger)
- store flasks (glass and aluminium)
- collectors for used solvents, sealed for solvent recycling and water protection
- rubber and plastic tubes
- apparatus for distilled or deionized water
- electrical extension flex
- watertraps with thread
- desk exhausters (toxic gases)
- eye glasses (window glass)
- refrigerator for samples and standards
- fastening for steel flasks
- transformer 110 V
- compressor for low oil air (gas chromatography)
- gas filters/absorbers (gas chromatography)
- VARIAN service (check/consultation/PC adaption)

Annex IV: List of solvents

solvents, analytical grade	Variant I l or kg	Variant II l or kg
n-hexane	15	25
n-heptane	1	2
n-octane	1	2
methanol	5	10
ethanol	10	20
n-butanol	1	5
i-butanol	1	5
n-propanol	1	2
benzene	10	15
toluene	1	5
acetone	5	15
cyclohexane	1	2
diethyl ether	5	10
acetic acid (glac.)	1	2
ethyl butyl ether	1	5
ethyl acetate	5	10
petroleum ether	5	10
chloroform		5
tetrachloromethane		2
methylene chloride		2
1,4 dioxan		2
tetrahydrofuran		2
trichloroethylene		5

Annex V: Analytical data of solvent used (n-hexane)

[illegible] 22 JUL. 1991 10:11 FID, METHANE

[illegible] METHOD: C7

[illegible] 22.7 INJECTED ON: 22 JUL. 1991 9:35

MIN AR	MULTI	DELAY	EXT	FACTOR	TO LVL	REF-PEAK	TYPE
100	.500	0.00	0.00	1.0000E+ 0	50	.50	I

END RESULTS

RT	ITH	AREA	%	NAME	
5.63	5.63#	190 BB	.005	#ISOBUTAN	
5.70	5.70#	171 BB	.004	#BUTAN	
6.44	6.44#	43038 BV	1.059	#2-M B	
6.64		204 BB	.005		
6.85	6.85#	140603 BV	3.540	#PENTAN	
6.94		465 VB	.011	Olefine	
7.12		1834 BB	.043		
7.63	7.50	88705 BB	2.139	2.2 DM B	
7.92		333 BV	.009	Olefine	
8.05		1311 VB	.031		
8.26		557 BV	.013		
8.39		1274 VV	.030		
8.48	8.48#	65404 VV	1.548	#CP	
8.65	8.65#	194600 VV	4.677	#2,3-DMB	
8.89	8.89#	1072032 VV	25.767	#2-MP	
9.23		3431 VV	.081	Olefin	
9.51	9.51#	844836 VV	20.294	#3 M P	
9.85		3645 VB	.086	Olefine	
10.16		7266 BV	.171		
10.48	10.48#	1190200 VB	26.494	#HEXAN	
11.03		6065 BB	.143	Olefine	
11.20		179 BB	.004		
11.86	11.86#	185560 BV	4.459	#2,4 DM P	
11.91		35020 VV	.845		
12.25	12.25#	61423 VV	1.446	#MCP	
12.38	12.38#	9370 VV	.204	#BENZEN	
12.72	12.47	3426 BB	.082	2,2,3-TM Butan	
13.05		195 BV	.005		
13.11		3561 VV	.084	Olefine	
13.21		197 VB	.005		
13.68		802 BV	.019		
14.20		522 BV	.012		
14.39	14.39#	15360 VV	.369	#3,3-DM P	
14.49	14.49#	14739 VV	.346	#CH (Cyclohexan)	
14.63		152 VV	.004	Olefine	
14.71		329 VB	.008		
15.30		312 BV	.007		
15.49	15.49#	95770 VV	2.296	#2-M H	
15.65		3950 VV	.093		
15.77	15.77#	35334 VB	.847	#2,3-DM P	
16.38	16.38#	72917 BV	1.748	#3-M H	
16.53		486 VV	.011	Olefin	
16.63	16.63#	3982 VB	.093	#1,C-3-DM-CP	
16.91		127 BV	.003	Olefin	
17.03	17.03#	3125 VB	.073	#1,T-3-DM-CP	
17.20	17.20#	7702 BB	.181	#1,T-2-DM-CP	
17.63	17.42	287 BB	.007	2,2,4-TM-P	
17.95		278 VV	.007	Olefin	
18.01	18.01#	5459 BB	.131	#HEP	
20.60	20.60#	129 BB	.003	#2,2-DMH	
21.17	21.17#	742 BB	.017	#MCH Methylcyclohexan	
22.07	22.07#	171 BB	.004	#ECP Ethylcyclopentan	
23.48	23.48#	744 BB	.016	#TOLUEN	
26.36	26.36#	439 BB	.010	#2-M-HP	
26.61	26.61#	130 BB	.003	#4-M-HP	
27.20	27.20#	493 BB	.012	#3-M-HP+1C2T3TMCP (Weiß Komponenten)	
30.32	30.32#	102 BB	.004	#PM	
30.53	30.53#	570 BB	.013	#M-X	
34.37	34.37#	362 BB	.009	#NONEN	
35.13	35.09	237 BB	.005	3-E-HP+2,2,6-TM H (Weiß Komponenten)	
36.39		409 BB	.010		
38.60	38.61	249 BV	.006	2,3,5-TM-HP	
38.66	38.71	171 VB	.004	2,4,5-TM-HP	
41.99	41.99#	388 BB	.009	#CUMEN	
46.35	46.35#	533 VB	.012	#P-ET	
47.16	47.45	147 BV	.004	#3-M N	
48.00	48.00#	272 VB	.006	#O-ET	
48.54	48.20	245 BB	.006	SEC.BB	
48.96	48.96#	180 BB	.004	#MESITYLEN+4MN	
~~50.47~~	~~50.47~~	~~403 BB~~	~~.009~~	~~#nC9MON~~	
52.25		221 VB	.005		
53.07	54.43	225 VB	.005	1-M-3-PR-Benzen	
59.53	59.06	3016 BB	.069	#12DM4EB+13DM2EB	"

TOTAL AREA = 4167188

Abkürzungen: DM-B Dimethyl-Butan

Legend: 1,C-3-DM-CP cis-1-Dimethyl-Cyclopentan
O-ET ortho-Ethyl-Toluen
4-Xylen B-Benzen n-Hexan HP-Heptan

REPORT # 391 23 JUL, 1991 13:33 ENG-ENVIRONMENTAL

CHANNEL: 7 METHOD: C7

SAMPLE: BCC FF2 23.7 INJECTED ON: 23 JUL, 1991 10:24

MIN AR	WIDTH	DELAY	EVT	FACTOR	ID LVL	REF WIN	AREA
100	.500	0.00	0.00	1.0000E+0	50	10	3

PEAKS REPORTED

RT	ITH	AREA	%	NAME
5.73	5.73#	105	BB .005	#1,3-BUTADIENE
6.58	6.58#	2159	BB .050	#2-M-2-
7.00	7.00#	6041	BB .139	#PENTANE
7.65	7.65	13713	BB .371	#1,2-DM-C
8.66	8.66#	16732	BV .442	#CP
9.04	9.04#	90290	VV 2.650	#2,3-DMB
9.37	9.37#	720709	VB 19.490	#2-MP
9.79	9.79#	677036	BB 18.332	#3-M-P
10.73	10.73#	1482674	BB 40.092	#HEXANE
12.12	12.12#	338154	BV 9.119	#2,4-DM-P
12.40	12.40#	63212	VV 1.674	#MCP
12.61	12.61#	3167	VV .079	#BENZEN
12.95	12.72	2300	VB .064	#2,2,3-TM-B
14.63	14.64	8704	BV .235	#3,3-DM-P
14.76	14.76#	36307	VB .959	#CH
15.73	15.73#	74772	BV 2.016	#2-M-H
15.90	15.90	3824	VV .101	#1DMCP
16.01	16.01#	25146	VB .678	#2,3-DM-P
16.62	16.62#	60013	BV 1.618	#3-M-H
16.88	16.88#	3600	VB .095	#1,C-3-DM-CP
17.29	17.29#	3220	BB .085	#1,T-3-DM-CP
17.58	17.58#	8130	BB .219	#3EP
19.16	19.16#	20814	BB .561	#HEP
20.00	20.00#	428	BB .011	#1C-2-DM-CP
21.19	21.19#	193	BV .005	#1,1,3-TMCP
21.38	21.38#	5366	VB .142	#MCH
22.25	22.25#	1286	BV .035	#2,5-DM-H
22.44	22.44#	1038	VV .028	#ECP
22.60	22.60#	1577	VB .042	#2,4-DM-H
23.36	23.36#	506	BB .013	#1,T-2-C4-TMCP
23.65	23.65#	2309	BV .057	#TOLUOL
23.79	23.78	107	VB .005	3,3-DM-H
24.16	24.16#	455	BB .012	#1T2-C3-TMCP
25.83	25.83#	1229	BB .033	#2,3-DM-H
26.51	26.51#	3241	BB .087	#2-M HP
26.76	26.76#	1335	BB .036	#4-M-HP
27.03	27.03#	365	BB .010	#3,4-DM-H
27.36	27.36#	3579	BB .096	#3-M HP+1C2T3TMCP
27.82	27.82#	597	BB .016	#1C2C4-TMCP+2,2,5TMH
28.51	28.51#	810	BB .021	#1T4DMCH+1C3DMCH
28.93	28.93#	212	BB .006	#1-M-C-3-ECP
29.22	29.22#	141	BV .004	#1-M-T-3-ECP
29.31	29.31#	337	VB .009	#1-M-T-2-ECP
30.50	30.50#	150	BB .004	#1-M-1-ECP
30.68	30.68#	2170	BB .059	#OCTANE+1C2C3TMCP
30.99	30.99#	123	BB .003	#1-EP-CP
33.07	33.07#	131	BB .003	#N-PR-CP
33.81	33.81#	286	BB .008	#1C2-DMCH
34.50	34.50#	711	BB .019	#ECH+3,5-DM-HP
35.25	35.25#	192	BB .005	#1,1,3TMCH+2,3,5TMH
36.28	36.28#	313	BB .008	#P-X
36.55	36.55#	463	BB .012	#MX
38.17	38.17#	169	BB .005	#4-M-O
38.81	38.79	271	BB .007	STYREN
39.15	39.15#	202	BB .007	#O+3-MO
39.71	39.71#	200	BB .006	#3MO
41.22	41.22#	247	BB .006	#CUMEN
42.14	42.14#	269	BB .007	#NONAN
46.16	46.16#	206	BB .005	#P-ET
47.29		209	BB .008	#M-ET
47.60		219	BB .006	
47.97	47.97#	220	BB .006	#O-ET
48.65	48.26	242	VB .006	SEC.BU
49.26	49.26#	130	BB .003	#MESITYLEN+4MN
50.62	50.62#	131	BB .003	#1,2,4-TM-B

TOTAL AREA = 3703431

Annex VI: The new equipment

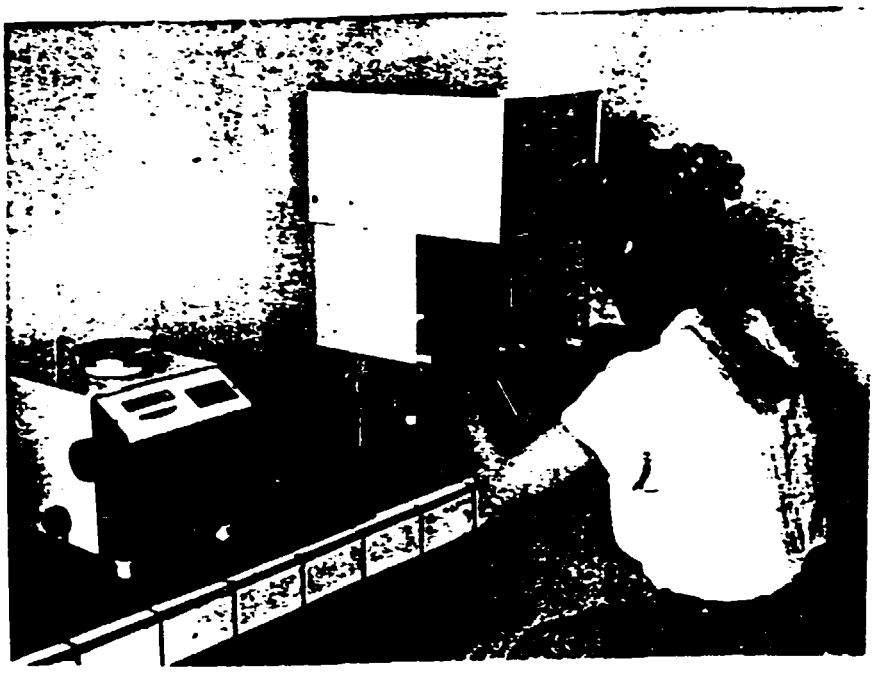


Figure 1: The top load balance (left) and the precision balance (right)

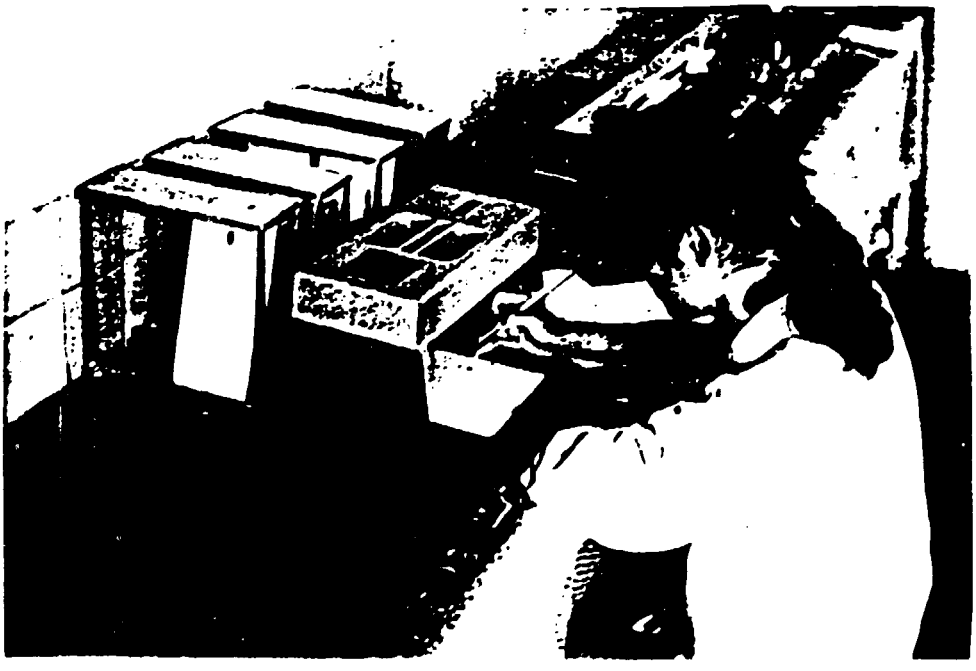


Figure 2: The TLC equipment. The UV chamber (in operation) and four developing chambers.

Annex VI

Figure 3: The automatic polarimeter "POLAMAT A"

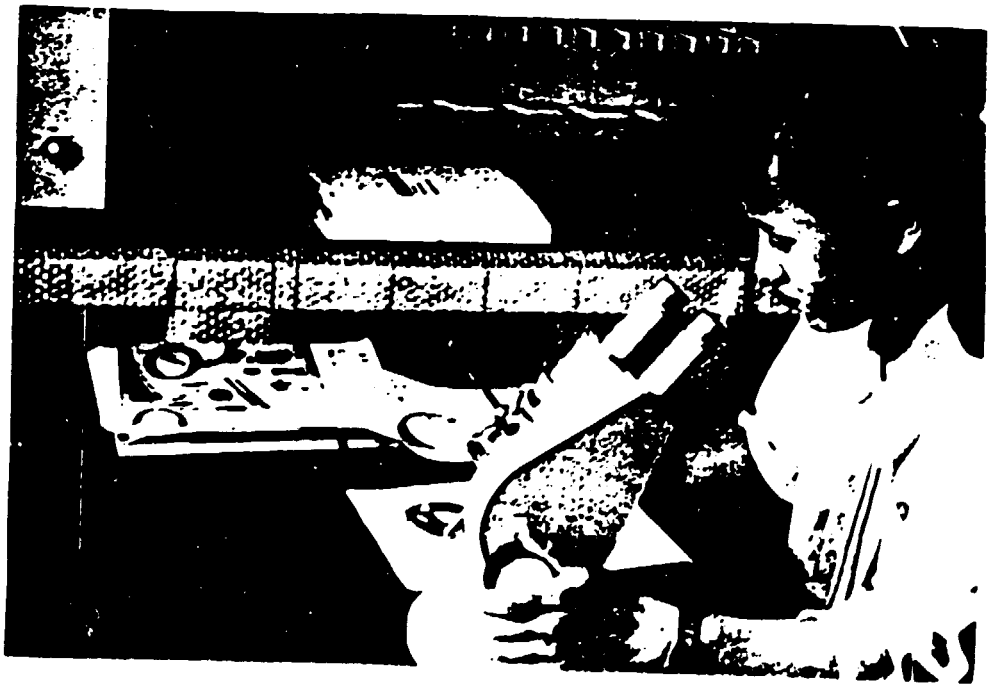


Figure 4: The Abbe-refractometer

Annex VI

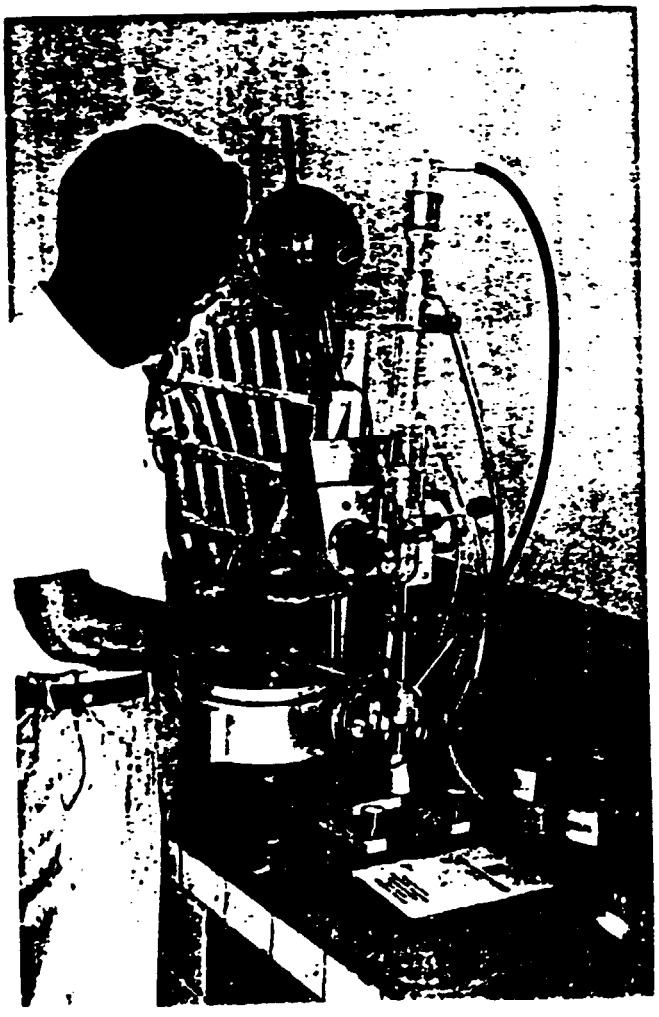


Fig. 5: The rotational vacuum evaporator.

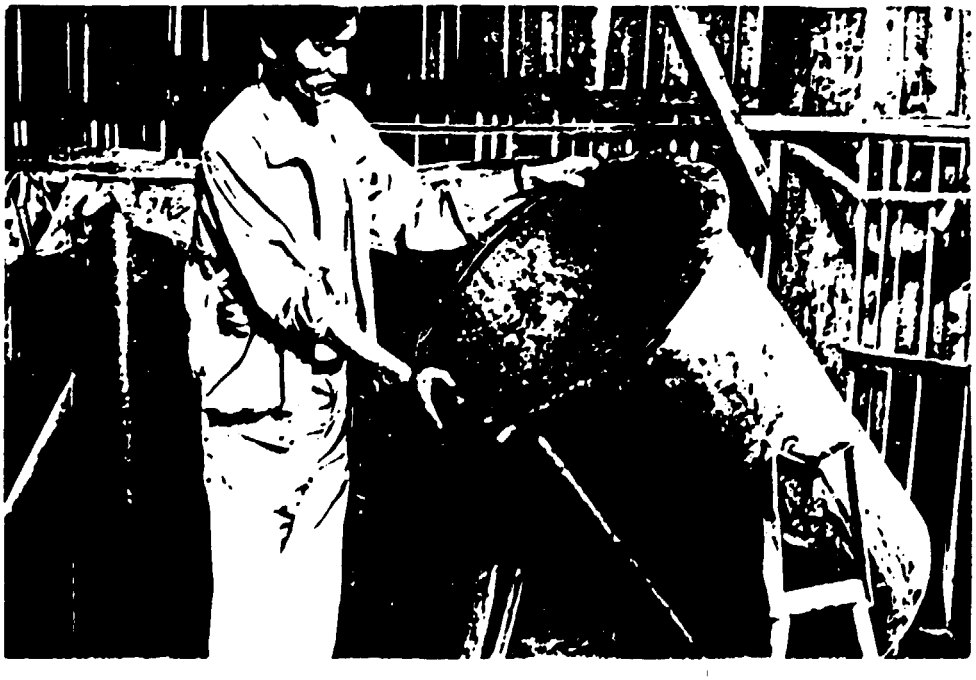
Annex VII: The oil processing equipment

Figures 1 and 2: The rosa rugosa flowers.

Annex VII

Figure 3: One of the extraction Vessels

Figure 4: Director Choi presents the mobility of the vessel



Annex VII

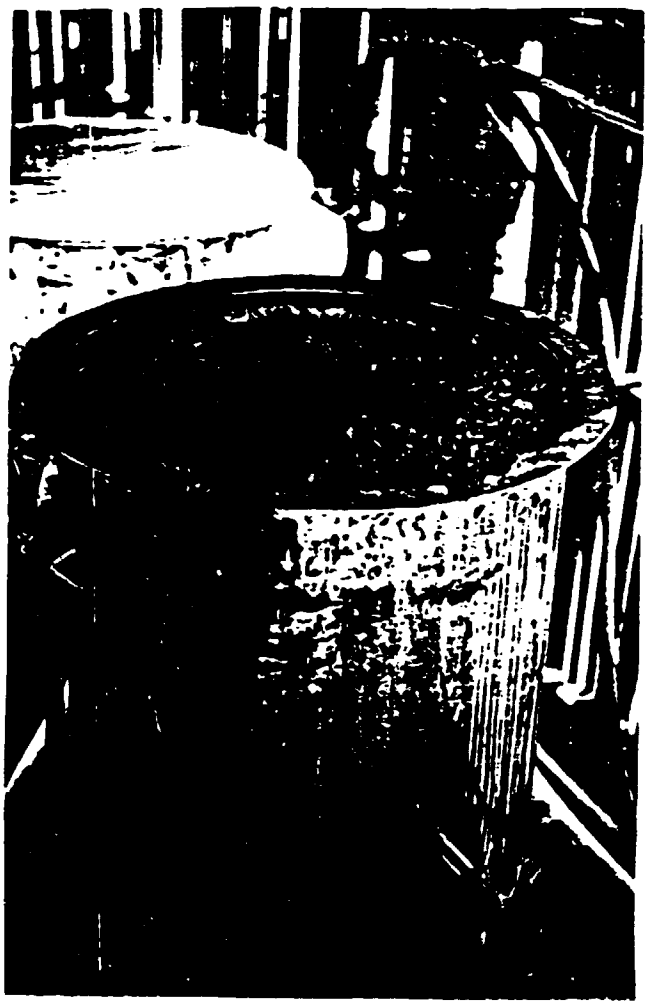


Figure 5: The extraction Vessel, filled with rose flowers and n-hexane (1:3)

Figure 6: Four of the five extraction vessels (two of them filled)

Annex VII

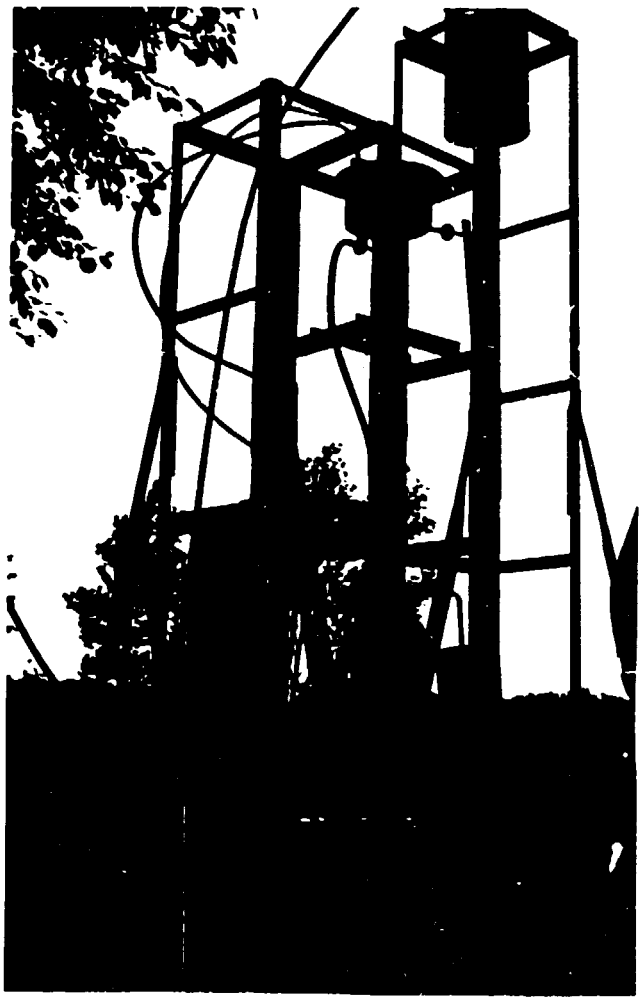


Figure 7: The fall-film evaporator. The extract is pressed into the storage container (A) by pressure.

Figure 8: The fall-film evaporator and the condenser for the solvent (left).

Annex VII

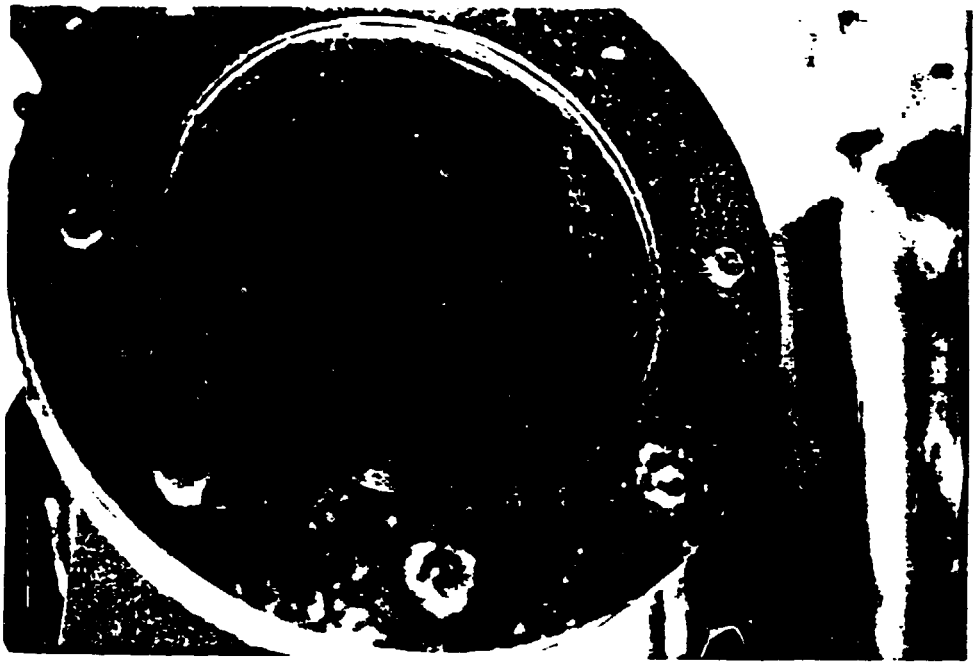


Figure 9: The evaporation speed is observed at the window between fall-pipe and the collector (down)

Figure 10: The enriched extract can be taken at the bottom of the collector.

Annex VII

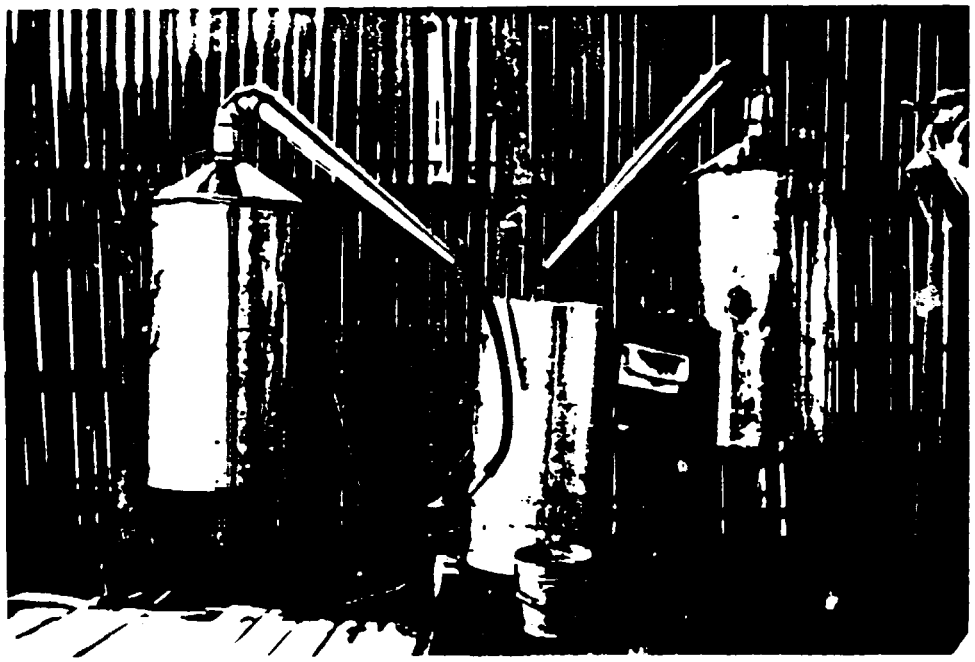


Figure 11: The fifth extractor, prepared for evaporating the residue of solvent from the extracted rosa flowers (left), the cooler (middle), and a distillation unit (right)

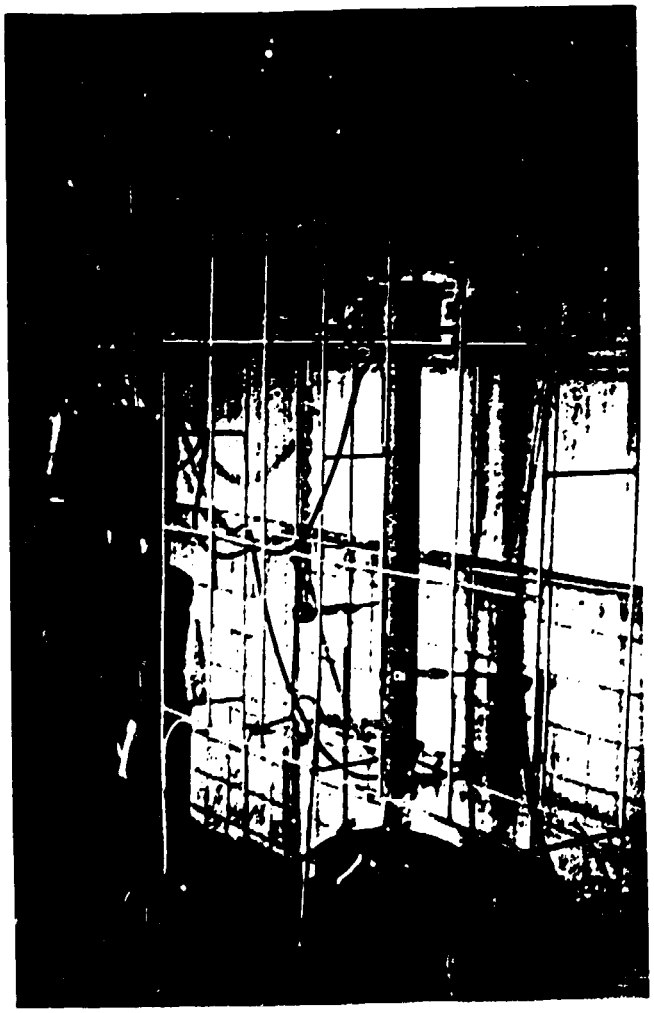


Figure 12: The laboratory scale fall-film evaporator.

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MAP

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invite you, scientists, technicians and managers engaged in research, teaching, public and private service, production, transformation and consumption to meet in the first

WORLD CONGRESS ON MEDICINAL AND AROMATIC PLANTS FOR HUMAN WELFARE
– WOCMAP –
20-24 July, 1992

Plant originated products are becoming ever more popular these days. A 'Green Wave' is driving people of many industrialized countries to 'return to nature'. In developing countries traditional medicine reflects their therapeutical qualities.
The Medicinal and Aromatic Plants Section of ISHS would like to accumulate data on the usefulness of these plants. The 500-year anniversary of Columbus' arrival in America is a timely occasion to evaluate the plant resources of the Western Hemisphere. Only 10% of all flowering species have been examined so far in this respect. Loss by extinction is threatening.

WOCMAP will outline aspects of:
- raw materials
- genetic improvement
- agro-systems
- environmental conditions
- processing
- quality control
- energy.

Other topics of interest are:
- product innovation
- pharmaceutical and pharmacological aspects of plants
- international projects and networks
- commercial aspects, marketing
- trade and product regulations
- preservation of natural resources
- quality of life, food, healthcare

The demand for pharmaceuticals, cosmetics and flavours derived from the plant resources is estimated at 30 billion US Dollars, materials used by healers are not included.
All colleagues dealing with the cultivation, breeding, processing, marketing and social impact of these plants are invited to the WOCMAP meeting in Maastricht, Netherlands, in July 20-24 1992, where exchanges and contacts among researchers, producers, users and consumers can be made.

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Trade and Technical Exhibition
The Congress Center of MECC (Maastricht Exposition and Congress Center) offers excellent possibilities for expositions next to the main conference hall and to the restaurant.

Hotel accommodation
Accommodation in different price levels is available in Maastricht, Aachen and Liège.

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Backstopping Officer's Technical Comments on
Technical Report by Dr. Ralph Thomann
DP/DRK/88/001/11-52

The report describes the present status of the activities at the Pyongyang Essential Oil Research Centre (PEORC) and the recommendations for development of processing and the achievement of objectives. The installation of equipment have been described together with photographs of the available equipment for processing. The training in the use of gas chromatograph for quality control and analysis has to be extended further in order to achieve the objectives as envisaged. The duties of evaluation and formulating proposals for future activities as given in the job description have been carried out.