



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

RESTRICTED

20215

DP/ID/SER.A/1647
17 May 1993
ORIGINAL: ENGLISH

TECHNOLOGIES FOR THE FOOD AND AGRO-BASED INDUSTRIES

DP/SRL/86/016

SRI LANKA

Technical report: First Mission of the Flavour and
Fragrance Specialist - Findings, Work Performed
and Recommendations*

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

Based on the work of Sudhir Jain, flavour and
fragrance specialist

Backstopping Officer: A. Sabater de Sabatés
Agro-based Industries Branch

United Nations Industrial Development Organization
Vienna

* This document has not been edited.

V.93 85600

CONTENTS

	<u>PAGE No.</u>
1. Introduction	3
2. Background Information	3
3. Purpose of the Project	4
4. Summary	6
5. Findings, Observations and Work Performed	9
6. Conclusions and Recommendations	20
7. Job Description - Annexure 1	27
8. Work Programme - Annexure 2	31
9. Equipment Required for the Manufacture of Aroma Chemicals - Annexure 3	32
10. List of the Varieties of Raw Materials that can be Produced in Sri Lanka - Annexure 3A	33
11. Project Profile - Production of Aromatic Chemicals - Annexure 3B	34
12. Method for Creation of an Olfactory Assessment and Sensory Evaluation Laboratory for Natural Synthetic Perfumery Materials - Annexure 4	49
13. List of Raw Materials and their Sources Required for the Fragrances and Flavours Creation Laboratory - Annexure 5	57
14. List of Soaps, Cosmetics, Toiletries and Joss Sticks Sold in the Sri Lanka Market - Annexure 6	66
15. Project Report - Production of Fragrances and Flavours - Annexure 7	76
16. Factory Layout - Annexure 7A	104
17. List of Fragrance Formulations finalised During the Mission - Annexure 8	105
18. Industrial Application of By-Product Fractions of Sri Lankan Essential Oils - annexure 8A	109

19. Conduct of Training course for Technicians of CISIR - Annexure 9	111
20. Glossary of Terms Relating to Natural and Synthetic Perfumery Materials - Annexure 10	114
21. National Workshop in Odour Evaluation and Creation of Fragrances - Annexure 11	120
22. Action Plan for the Integrated Development of the Essential Oils, Aroma Chemicals and Fragrance/Flavour Industries - Annexure 12	123
23. Backstopping Officer's Comments - Annexure 13	125

One of the agro-industrial branches selected for development work is the processing of spice and leaf oils to value-added materials. By long tradition, Sri Lanka produces essential oils from cinnamon bark, cinnamon leaves, pepper, nutmeg and cardomon as well as citronella and lemongrass. The aim is to locally produce improved products of added value from these raw materials in order to strengthen Sri Lanka's position in the export markets as well as save foreign exchange by substituting imported flavours and fragrances.

PURPOSE OF THE PROJECT

To enable the Ceylon Institute of Scientific and Industrial Research (CISIR) to develop on a pilot plant scale, compounding of flavours and fragrances based on indigenous and imported raw materials. The fragrance specialist was expected to advise the project team and the interested private sector in setting up a fragrance and flavour production facility in Sri Lanka.

Post Title : Flavour and Fragrance Specialist

Duties : The expert was expected to work under the direct supervision of the National Project Director and the Team Leader and was to be responsible for fulfilling the following functions:-

1. Specify pilot scale equipment required for the synthesis of aroma chemicals from citronella, lemongrass, cinnamon leaf and turpentine oils, and the compounding of flavours and fragrances as identified for local manufacture.
2. Specify and determine quantities and values of chemicals and other products to be imported for the development work to be performed under the project.
3. Identify the flavours and fragrances used by the local industry.

INTRODUCTION

The project DP/SRL/86/016, "Technologies for Food and Agrobased Industries", funded as part of an agreement between the Government of Sri Lanka and UNDP/UNIDO has enabled the Ceylon Institute of Scientific and Industrial Research (CISIR), Colombo to greatly expand its activities and take up the manufacture of Aroma chemicals and Fragrance and Flavour Materials in addition to its present activities.

BACKGROUND INFORMATION

The Government of Sri Lanka through the Ceylon Institute of Scientific and Industrial Research (CISIR) wishes to carry out extensive product and process development work in the agro-industrial production sector in order to improve and modernise industrial processing techniques and in this context make optimum use of raw materials produced in the country.

CISIR is to become instrumental in this special work by carrying out pilot plant and small scale industrial processing studies, evaluation of existing industrial scale production processes, development of improved processes and new technologies for the production of non-traditional products as well as by conducting extension services to the industry and the establishment of a relevant training centre.

In order to facilitate, the work done by CISIR, the Government of Sri Lanka requested UNDP/UNIDO assistance to CISIR to bring about access to new technologies, information about new processes and help in specific industrial development work by rendering special expert services, supplying necessary laboratory and pilot scale equipment and by instructing and training local personnel in this use within the scope of relevant product and process development operations.

4. Produce on a laboratory/pilot plant scale marketable flavour and fragrance blends using both imported chemicals and compounds and fractions obtained from locally grown raw materials eg traditional spices, citronella, lemongrass, cinnamon leaf and turpentine.
5. Identify industrial applications for the by-product fractions obtained in fractionating citronella, lemongrass, cinnamon leaf and turpentine oils and utilize these by-product fractions to produce on a laboratory/pilot plant scale products which are locally marketable.
6. Train the counterpart staff in methods of synthesis and compounding of flavours and fragrances selected for local manufacture.
7. Assist CISIR in preparing pilot plant scale batches of 4 flavours and/or fragrances in consultation with the local industry and according to their requirements.
8. Assist CISIR in the techno-economic evaluation of the developed compounds for their commercial viability.
9. Compile data on raw materials and processing methods demonstrated.
10. Submit a technical report outlining his activities, findings and recommendations.

The mission of the expert covered the aforementioned activities and a few other aspects of the project.

SUMMARY

The mission took place between 6th December 1992 and 1st January 1993, during which time the expert was attached to the Ceylon Institute of Scientific and Industrial Research (CISIR), Colombo.

As per the terms of reference of the assignment, the expert functioned under the direct supervision of the NPD, Dr. P M Jayatissa and the Team Leader Dr. U M Senanayake.

The expert worked with the Project Team of the CISIR and exhaustively covered all aspects of his mission as set out in the Job description. In addition, a number of aspects directly relating to the subject of the project but not covered in job description were also covered at the request of the Team Leader and the National Project Director.

The expert carried out the following functions:-

1. (a) Specified pilot scale equipment required for the synthesis of aroma chemicals from citronella, lemongrass, cinnamon leaf and turpentine oils.

(b) Specified pilot scale equipment required for the compounding of flavours and fragrances as were identified for local manufacture for use by the local industry.
2. Specified and determined the quantities and values of aroma chemicals, essential oils, resinoids and other raw materials to be imported for the development work to be performed under the project.
3. Identified the flavours and fragrances used by the local industry.

4. Demonstrated on a laboratory scale production of fragrance blends using both imported chemicals and the fractions obtained as a result of the fractionation of locally distilled essentials. eg citronella, lemongrass, cinnamon leaf and turpentine oils.
5. (a) Identified industrial applications for the by-product fractions obtained in fractionating citronella, lemongrass, cinnamon leaf and turpentine oils.
(b) Utilized these by-product fractions to produce on a laboratory scale/products which are locally marketable.
6. Trained the counterpart staff in the general methods and principles of synthesis, compounding and manufacture of flavours and fragrances.

In addition, looking to the requirements of the project and in the interest of providing comprehensive and practical guidance, the following jobs were also accomplished:-

1. A one week training course was conducted for the Project Team on the subject of 'Olfactory Assessment of Perfumery Materials and creation and production of fragrances'.
2. Since a proper fragrance and flavour laboratory required to do the creation and development work did not exist in the project, the 'Method for creation of an Olfactory Assessment and Sensory Evaluation Laboratory for Natural and Synthetic Perfumery Materials' was explained so that such a laboratory could be established for the commercially viable development work required to be done in the project.
3. To enable the project team to deal with the flavour and fragrance industries on a commercial basis and to fully understand the working of the industry so as to be able to interact within successfully, the technical terms used in the industry were explained to them and a glossary thereof was provided to them.

4. A comprehensive project report for the production of fragrances and flavours was prepared and provided to the CISIR to enable them to interact with the industry and attract private entrepreneurs to this area.
5. A layout plan for a typical flavour and fragrance factory was prepared and provided to the CISIR to enable them to explain and discuss the same with the local industry.
6. Since utilization of locally distilled essential oils and their fractionation, is an essential part of the project, a project profile for the production of Aroma chemicals was prepared and provided to the CISIR to enable in proceed further from the stage of simple fractionation of essential oils and take up secondary processing of the fractions obtained and produce standardized aroma chemicals capable of being utilized in the production of fragrances and flavours.
7. An outline of a 'National workshop in odour evaluation and creation of fragrances' was prepared of provided to the CISIR to enable them to conduct the same with the help of suitable experts for the benefit of the local industry.
8. An Action Plan for the Integrated Development of the Essential Oils, Aroma chemicals and fragrance/flavour industries in Sri Lanka was prepared to enable the CISIR to orient itself in a suitable manner so as to interact meaningfully with the local entrepreneurs and develop the fragrance and flavour industries in Sri Lanka.
9. The Project Team was trained in the Olfaactory evaluation of the fractions obtained by fractionation of various essential oils.
10. The Project Team was trained in the proper fractionation and distillation methods.

FINDINGS, OBSERVATIONS AND WORK PERFORMED

1. Production of Aroma Chemicals

The project as it is being presently executed has as one of its main objectives, the fractionation of locally produced essential oils namely citronella oil, lemongrass oil, cinnamon leaf oil and turpentine oil.

It was found that during an earlier mission undertaken by another expert, 20 litre and 10 litre glass fractionation columns had been installed and commissioned, for the purpose of carrying out this type of fractionation. After the commissioning of these glass fractionation columns, these oils had in fact been distilled and fractionated and the fractions duly analysed with the help of GLC analysis.

However, no clearly definable and sustained effort has been undertaken to further process the fractions obtained into single well defined Aroma chemicals. It must be noted that if the derivatives of Sri Lankan essential oils are to be used for the production of fragrances and flavours, then the secondary processing the fractions obtained from the local essential oils must be undertaken to produce single well defined Aroma chemicals of a consistent quality. This is necessary because the primary fractions obtained during distillation are never of a consistent composition and as such a consistent quality of the end product cannot be maintained. Although some work has been done on a laboratory scale and a few of the possible derivatives have been produced, there is no component in the project which will ensure that commercial and industrially viable processes for the manufacture of isolates and derivatives of essential oils are developed. Also no evaluation of the laboratory scale processes has been carried out in terms of yields and commercial cost.

The importance of undertaking this exercise was explained to the Project Team and it was emphasised that the only feasible method of utilizing local essential oils in the production of fragrances and flavours was by means of converting them into isolates and derivatives of a consistent and olfactorily acceptable quality.

Full scale development work is required to be done in this area and for this purpose, the items that can be produced and the equipment required for pilot scale production of such Aroma chemicals has been defined. A project profile for the same has also been prepared.

The requisite industrial and commercial know-how can be transferred to the project authorities if required.

For details see Annexure 3, 3A AND 3B

2. Production of Fragrances and Flavours

The production of fragrances and flavours from imported as well as local raw materials for the sake of import substitution is an important component of the project.

However it was found that on the ground, no proper facilities existed for either development or production. It was found that although laboratory space had been designated, yet there was no equipment or raw materials available for setting up a fragrances and flavours creation laboratory.

It was emphasised and explained to the project team that the creation of fragrances and flavours is a time consuming, painstaking and precise job for which proper facilities must be made available.

The requisite details regarding the design, equipment required and the raw materials necessary for the creation of such a laboratory were given to the project team, to enable them to set up a proper laboratory. It was found that the development of marketable fragrances and flavours and interaction with the industry was not feasible at the present juncture because of the lack of any facilities. It was emphasised and explained to the project team that when the output required is to be of commercial value which the industry will accept, then development facilities of an international level were required to be created in order to not only achieve the given target of producing marketable fragrances and flavours but also to convince the local entrepreneurs that the establishment of the fragrance and flavours industry in Sri Lanka was a real possibility.

Full details regarding the work required to be done in this direction have been given to the project team and further development work of a commercial nature can be undertaken when the same are in place.

For details see Annexure 4

3. Raw Materials Required for Development Work

The project presently envisages the manufacture of isolates and derivatives from citronella oil, lemongrass oil, cinnamon leaf oil and turpentine oil for the express purpose of utilizing these in the manufacture of fragrances and flavours for the local industry. It was explained and emphasised to the project team, that this would at best yield 15-20 aroma chemicals, whereas in a modern laboratory at least 500-600 raw are required to create fragrances and flavours of an international quality. It was further explained that since Sri Lanka was an open market, with no restrictions on the import of fragrances and flavours, such a laboratory would indeed have to compete with the international industry.

The raw materials required, their quantities and their suppliers and sources were listed and the complete details were given to the project authorities to enable them to procure the same and thus equip the laboratory properly.

For details see Annexure 5

4. Flavours and Fragrances used by the Local Industry

A complete survey of the consumer goods market was made and the major consumer products sold in the market were identified.

The market was surveyed from the point of view of quality as well as cost and a list of the major fragrances and flavours sold in the market has been prepared. A list of the areas and the products where the greatest potential exists for break through by a local entrepreneur or the CISIR has been prepared and handed over to the project team.

It was emphasised and explained to the project authorities that in the first instance, the development work would have to be concentrated in these directions, so as to achieve a quick break through.

It was observed that till this mission, no such survey had been undertaken to identify the fragrances and flavours required in the Sri Lankan market and as such the listing now made by the expert will serve as the basic guideline for determining the directions of the development work to be undertaken at the CISIR.

For details see Annexure 6

5. Laboratory scale demonstration of production methods employed for Fragrances & Flavours

It was found that although no proper laboratory facilities were available in the project, a small number of raw materials (about 100) were available, being the standard samples received by CISIR from various foreign suppliers.

In addition, the fractions obtained from the distillation of Citronella, Lemongrass, Cinnamon leaf oil, Turpentine and some of the isolates and derivatives prepared there from were also available. The fractions available were classified according their chemical constituents and the olfactory characteristics. Thereafter formulations were prepared by the expert to demonstrate the use of the various fractions, isolates and derivatives of the Sri Lankan essential oils emphasising in the process the odour characteristics of each individual item.

These formulations also demonstrated the versatile manner in which the various raw materials could be used ie: the same materials in different combinations give size to different odour styles and it was emphasised and explained to the project team that this was the basic technique that had to be learnt to be a perfumer or flavourist ie: the ability to use the same materials in different combinations so as to produce different odour styles for different end products.

After the finalization of the formulations, the principles and techniques used in actual manufacturing under industrial and commercial conditions were explained. To explain the entire concept, a full layout of a typical fragrance and flavours factory was prepared and explained to the project team along with a detailed project report covering all aspects of fragrance and flavour manufacturing including an economic analysis to illustrate the potential profitability of the industry.

6. Identification of Industrial Applications of By-product fractions of Sri Lankan Essential Oils

The by-product fractions obtained during the distillation and fractionation of Citronella, Lemongrass, Cinnamon leaf and Turpentine oils were studied for their Olfactory characteristics and their chemical nature was defined on the basis of GLC analysis. Based on economical cost price for these fractions, their use was finalized by conducting trials with various formulations in which these fractions constituted the major portion.

After a number of trials, it was found that these fractions were best used in laundry soap, detergent and joss stick formulations. The detailed formulations were compiled and given to the project team for use in the local industry accordingly.

For details see annexure 7, 7A and 8

7. Utilization of By-product Fractions to produce Marketable Products

It was observed that Sri Lanka has a large production of laundry soaps, detergents and joss sticks. A large part of this production is based in the medium, small and cottage sectors and for these industries the primary choice in choosing a fragrance is cost.

By trials in the laboratory, it was found that the by-product fractions obtained during the fractionation of citronella, lemongrass, cinnamon leaf and turpentine oils were best utilized for the production of fragrances for these products as they were stable, cheap and olfactorily adequate to produce the requisite functional fragrances.

Accordingly in the laboratory a series of formulations were made specifically for this sector keeping in mind all the commercial requirements of the industry. Samples were given for trials to industries and the results were found to be satisfactory and acceptable to the local industry. The formulations were thus finalized and given to CISIR for further commercial exploitation.

For details, see annexure 8A

8. Training of Counter-part Staff in the Manufacture of
Fragrances and Flavours

It was found that the members of the Project Team had only elementary training in and exposure to the fragrance and flavour industries. They had been sent to Europe for exposure training and had visited a few companies. However, the degree of training was very elementary and not sufficient to enable them to undertake manufacturing activities. Accordingly, the principles and practices involved in the manufacture of fragrance and flavours were explained and demonstrated to the counter-part staff using the available equipment and facilities.

It was found infact that proper equipment was not available and as such a comprehensive list of the equipment required for setting up a fragrance/flavour unit was prepared and handed over to the Project Authorities to enable them to procure the same.

For details see Annexure 9

9. Compilation of Data on the Raw Materials Required

It was found that only a minimal number of raw materials were available with the project team and as such no sustained development work could be undertaken. Also the formulations that were finalized could not be taken up for manufacture because of lack of materials.

As such a quantitative and qualitative list of the raw materials required for the laboratory and the pilot scale manufacturing division was drawn up along with full details of the sources from which the some were to be procured. The list was given to the project authorities to enable them to procure the same.

For details, see annexure 5

10. Conduct of Training Course

It was found that the Project Team had only very minimal training in the techniques used for the creation of fragrances and flavours.

As such to rectify this deficiency, a one week training course was conducted for the Project Team which covered the following topics.

- (a) Definition of fragrances and flavours
- (b) Uses of fragrances and flavours
- (c) Classification of fragrances and flavours
- (d) Raw materials used in the fragrance and flavour industries - both Natural and synthetic
- (e) Proper methods of odour evaluation
- (f) Terminology used in the fragrance and flavour industries
- (g) A Combinations and Accords used in fragrance and flavour industries
- (h) Production of fragrances and flavours
- (i) Use of odour evaluation ability to do compounding and blending as well as quality control.

11. Establishment of Laboratory for Olfactory Assessment and Sensory Evaluation

It was found that the basic pre-requisite for doing creative and development work in the field of fragrances and flavours by way of proper laboratory did not exist in the project. As such , without this facility it was not possible to do systematic and sustained development work so as to serve the Sri Lankan Industry. The importance of having such a facility was explained in great detail as also the method of creating the same along with full details of the procedures to be followed and equipment to be procured.

For details, see annexure 4

12. Glossary of Terms used in the Industry

It was found that the project team had little experience in dealing with the fragrance and flavour industry on an international basis and consequently they were generally unaware of the language of perfumery or the technical and /or commercial terms used within the industry.

It was found that because of this reason, the project team was not in a position to fully comprehend the technical literature relating to the industry and to communicate with trade meaningfully. To rectify this a full glossary of the terms used in the fragrance and flavour industry was prepared and provided to the Project Team at CISIR.

13. Project Report for the Production of
Fragrances and Flavours

The project envisages the interaction of the private industry with the CISIR with regard to the development of the Fragrance and Flavour Industry in Sri Lanka.

It was observed, however, that the project team whose task it was to interact with the industry and fulfill its requirements with regard to development of technology and setting up of new industries, had practically no experience in the practical aspects of setting up a fragrance and flavour industry.

To rectify this situations, a detailed project report covering all aspects of the establishment of a fragrance and flavour industry was prepared and handed over to the CISIR to enable it to render practical guidance to the industry.

For details, see annexure 7

14. Layout Plan of a Fragrance and Flavour Factory

In further pursuance of the objective mentioned in the foregoing paragraph, and as a part of the project report cited above, a detailed lay out of a typical fragrance and flavour manufacturing unit was prepared and handed over to the CISIR to enable it to render practical advice to the industry.

For details see Annexure 7A

15. Project Profile for the Production of Aroma Chemicals

It was observed that till the time of the present mission, the project team had primarily concerned itself with only the fractionation of the Sri Lankan Essential Oils.

It was observed that in successive fractionations of the same essential oil, identical fractions were not obtained and hence it was not feasible to have the production of fragrances and flavours on the use of the said fractions alone. It was therefore, absolutely essential that the fractions obtained should be processed further to produce well defined and standardized isolates and derivatives. It was observed that of all the possible isolates and derivatives that could be produced from citronella, lemongrass, cinnamon leaf and turpentine oils, only a very small number of isolates and derivatives had been prepared and that too not always using a commercially viable or technically correct process.

To rectify this a detailed project profile for the production of Aroma chemicals was prepared and handed over to CISIR to enable into consider this aspect in detail and suitably alter or modify the outputs of the project accordingly.

For details, see annexure 3B

16. National Workshop in Odour Evaluation and Creation of Fragrances

It was observed that the along with the project team, the Sri Lankan industry at large, including the entrepreneurs engaged in the manufacture of essential oils, were generally unaware of the principles of odour evaluation and its benefits in terms of quality control and creation of fragrances. As a result of this, it was observed, that they were generally unable to accept the concept and feasibility of starting domestic industries manufacturing aroma chemicals, fragrances and flavours. It was found that this prejudice could be removed by the greater disessimation of information and knowledge about the industry.

To take care of this an outline of a 'National Workshop in Odour Evaluation and Creation of Fragrances' was prepared and provided to the CISIR to enable into conduct the same with the keep of suitable experts.

For details, see Annexure 11

17. Action Plan for the Integrated Development of the Essential Oils, Aroma chemicals and Fragrance/Flavour Industries

It was observed that no comprehensive plan had been formulated for the development of these industries on a long term basis and as such the development work being done by the project was concerned with individual oils and their processing and not with the industry as a whole and did not take into consideration the fact that the essential oils, aroma chemicals and fragrances/flavour industries were interconnected and that the only viable method to establish these industries was to establish an integrated facility. The importance of this approach was explained to the project team and in support thereof an Action Plan was prepared to set out the basis for the integrated development of the said industries.

For details see Annexure 12

CONCLUSIONS AND RECOMMENDATIONS

1. Production of Aroma Chemicals

Conclusion : It was concluded that:-

- (i) No clearly definable or sustained effort has been undertaken to further process the fractions obtained from Citronella, Lemongrass, Cinnamon leaf and Turpentine oils into single well defined Aroma chemicals.

(ii) The use of the derivatives of Sri Lankan essential oils in the production of fragrances and flavours can be feasible only if the secondary processing of the fractions obtained is undertaken to produce single well defined Aroma chemicals of a consistent quality.

(iii) The development of commercial and industrially viable processes for the manufacture of isolates and derivatives from Sri Lankan essential oils.

2. Production of Fragrances and Flavours

Conclusion : It was concluded that:-

(i) Proper facilities including a laboratory did not exist in the project for development or production of fragrances and flavours, in terms of both equipment and raw materials.

(ii) A proper fragrance and flavour creation laboratory of proper design equipped with the requisite facilities and raw materials was necessary to produce the desired outputs of the project.

ie: Marketable fragrance and flavours in consultation with the local industry.

3. Raw Materials Required for Development Work

Conclusion: It was concluded that:-

(i) The raw materials that would become available as a result of the processing of Sri Lankan essential oils namely Citronella, Lemongrass, Cinnamon leaf and Turpentine would not be sufficient for the development of marketable fragrances and flavours.

(ii) At least 500-600 raw materials of both synthetic and material origin would have to be procured from international suppliers to equip the creation laboratory.

4. Flavours & Fragrances used by the Local Industry

Conclusion : It was concluded that:-

- (i) Fragrances and flavours for the local industry could be developed at the CISIR by concentrating its efforts in certain selected areas with the greatest potential.

5. Identification of Industrial Applications of By-product Fractions of Sri Lankan Essential Oils

Conclusion : It was concluded that;-

- (i) The by-product fractions obtained as a result of the distillation and fractionation of Citronella, Lemongrass, Cinnamon leaf and Turpentine oils could be commercially used in laundry soap, detergents, and Joss stick formulations.

6. Training of Counter-part Staff in the Manufacture of Fragrances and Flavours

Conclusion : It was concluded that:-

- (i) Although the principles and practices involved in the manufacture of fragrances and flavours were demonstrated to the counter-part staff on a laboratory scale, it was necessary to procure proper equipment for pilot scale manufacturing work, to not only train the staff on a practical basis, but also to prepare the pilot scale batches of formulations developed in the creation laboratory.

7. Compilation of Data on the Raw Materials Required

Conclusion: It was concluded that:-

- (i) To undertake development of manufacture of marketable fragrances, a large number of raw materials would have to be procured from international suppliers, by the project authorities on the basis of the detailed list provided by the expert.

6. Establishment of Laboratory for Olfactory Assessment and Sensory Evaluation

Conclusion : It was concluded that:

- (i) A proper laboratory for the purpose would have to be created to do creative and development work in the field of Fragrances and Flavours, in a systematic and sustained manner.

9. Project Profile for the Production of Aroma Chemicals

Conclusion : It was concluded that:

- (i) To establish a viable fragrance and flavour industry in Sri Lanka, the production of Aroma chemicals would have to be established to introduce an element of vertical integration in the industry and provide raw materials and by-products derived from local sources and also in due course from essential oils and basic raw materials available in the international market.

10. National Workshop in Odour Evaluation and Creation of Fragrances

Conclusion: It was concluded that:

- (i) The Sri Lankan Industry concerned with the manufacture of Essential oils, Soaps, Detergents, Cosmetics, Toiletries, Joss sticks, bakery and confectionary products, beverages and the like, was required to be made aware of the technical side of the industry to enable into appreciate the benefits of odour evaluation in terms of both quality control and creation of fragrances and flavours, and thus to eventually invest in this area.

11. Action Plan for the Integrated Development of the Essential Oils, Aroma Chemicals and Fragrance/Flavour Industries

Conclusion : It was concluded that:

- (i) An integrated plan for the development of these industries was required to be put into operation so as to ensure the development all the three sectors of the industry. ie: Essential oils, Aroma chemicals and fragrances/flavours each of which is interdependent on the other for survival.

1. Production of Aroma Chemicals

Recommendation : It is recommended that:

- (i) A sustained effort should be undertaken to further process the fractions obtained from Citronella, Lemongrass, Cinnamon leaf and Turpentine oils into single well defined Aroma chemicals.

- (ii) A component to ensure the development of commercial and industrially viable processes for the manufacture of isolates and derivatives of Sri Lankan essential oils should be introduced in the project.

2. Production of Fragrances and Flavours

Recommendation : It is recommended that:

- (i) Proper laboratory and pilot scale manufacturing facilities for the development and production of fragrance and flavours should be created immediately in the project, to obtain the desired outputs of the project, ie: marketable fragrances and flavours in consultation with the local industry.

3. Raw Materials Required for Development Work

Recommendation : It is recommended that:

- (i) In addition to the raw materials becoming available as a result of the processing of Sri Lankan essential oils, a further 500-600 raw materials, of both synthetic of natural origin should be procured immediately from international suppliers to equip the creation laboratory.

4. Flavours and Fragrances used by the Local Industry

Recommendation : It is recommended that:

- (i) After the establishment of a properly equipped creation laboratory at the earliest possible date, fragrances and flavours for the local industry should be developed at the CISIR with the help of the expert during the 2nd part of the mission.

5. Training of Counter-part Staff in the Manufacture of Fragrances and Flavours

Recommendation : It is recommended that:

- (i) Proper equipment for a pilot plant scale manufacturing unit be procured immediately, to not only train the staff on a practical basis but also to prepare the pilot scale batches of formulations developed in the creation laboratory.

6. Procurement of the Raw Materials Required

Recommendation : It is recommended that:

- (i) The raw materials required to undertake development and manufacture of marketable fragrances be procured at the earliest from the concerned international suppliers.

7. Establishment of Laboratory for Olfactory

Assessment and Sensory Evaluation

Recommendation : It is recommended that:

- (i) A proper laboratory for Olfactory Assessment and Sensory Evaluation be established at the earliest to do the requisite creative and development work in the field of fragrances and flavours.

8. Production of Aroma Chemicals

Recommendation : It is recommended that:

- (i) The production of aroma chemicals be established at the earliest to introduce vertical integration in the industry based not only from Sri Lankan Essential oils but also from essential oils and basic raw materials available in the international market.

9. National Workshop in Odour Evaluation and Creation of Fragrances

Recommendation : It is recommended that:

- (i) A National workshop in odour evaluation and creation of fragrances be organized at the earliest to make the Sri Lankan Industry concerned with the manufacture of products in which fragrances and flavours are used, aware of the technology and techniques used in the industry and to disseminate information about the techno-economic aspects to enable the Sri Lankan entrepreneurs to keep pace with the changing world market and to eventually invest in this area.

10. Action Plan for the Integrated Development of the Essential oils, Aroma chemicals and Fragrance/Flavour Industries

Recommendation : It is recommended that:

- (i) An integrated plan for the development of these industries be implemented so as to ensure the development of all the three sectors of the industry ie: essential oils, aroma chemicals and fragrances/flavours, each of which is inter-dependent on the others.

ANNEXURE 1



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

JOB DESCRIPTION

DP/SRL/86/016/11-05

Post title

Flavour and Fragrance Specialist

Duration

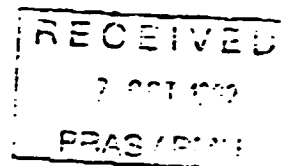
2 months

Date required

November 1992. March 1993

Duty station

Colombo, Sri Lanka



Purpose of project

To enable the Ceylon Institute of Scientific and Industrial Research (CISIR) to develop on a pilot plant scale compounding of flavours and fragrances based on indigenous and imported raw materials. The fragrance specialist is expected to advise the project team and the interested private sector in setting up a fragrance and flavour production facility in Sri Lanka.

Duties:

He is expected to carry out the following duties:

1. Identify the flavours and fragrances used by the local industry and produce on a laboratory/pilot plant scale marketable flavour and fragrance blends using both imported chemicals and compounds and fractions obtained from locally grown raw materials, e.g. traditional spices, citronella, lemon grass, cinnamon leaf and pinus turpentine.

The fragrances and flavours to be developed should be marketable in the local industry manufacturing: laundry and toilet soap, washing powders and liquids, household and other cleansing agents, toiletries such as shampoos, cosmetics, perfumes toilet waters, processed food and beverages.

2. Identify industrial applications for the by-product fractions obtained in fractionating citronella, lemon grass, cinnamon leaf and turpentine oils. Utilizing these by-product fractions produce on a laboratory/pilot plant scale products which are locally marketable.

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

Project Personnel Recruitment Section, Industrial Operations Division

3. Specify pilot scale equipment required for the synthesis of such aroma chemicals and the compounding of flavours and fragrances as identified for local manufacture.
4. Specify and determine quantities and values of chemicals and other semiproducts to be imported for the development work to be performed under the project.
5. Train the counterpart staff in methods of synthesis and compounding of flavours and fragrances selected for local manufacture.
6. Assist CISIR in preparing pilot scale batches of 4 flavours and/or fragrances in consultation with the local industry and according to their requirements.
7. Assist CISIR in the techno-economic evaluation of the developed compounds for their commercial viability.
8. Compile data on raw materials and processing methods demonstrated in form of annexes to his report.
9. Submit a technical report outlining his activities, findings and recommendations at the conclusion of his mission.

Qualifications

University degree in organic chemistry.

Extensive practical experience in research and development of aroma chemicals, flavours and fragrances from raw materials specific for the region.

Language

English

Background information

The Government of Sri Lanka through the Ceylon Institute of Scientific and Industrial Research (CISIR) wishes to carry out extensive product and process development work in the agro-industrial production sector in order to improve and modernize industrial processing techniques and in this context make optimum use of raw materials produced in the country.

CISIR is to become instrumental in this special work by carrying out pilot plant and small scale industrial processing studies, evaluation of existing industrial scale production processes, development of improved processes and new technologies for the production of non-traditional products as well as by conducting extension services to the industry and the establishment of a relevant training centre.

In order to facilitate the work to be done by CISIR, the Government of Sri Lanka requested UNDP/UNIDO assistance to CISIR to bring about access to new technologies, information about new processes and help in specific industrial development work by rendering special expert services, supplying necessary laboratory and pilot scale equipment and by instructing and training local personnel in their use within the scope of relevant product and process development operations.

One of the agro-industrial branches selected for development work is the processing of spices and leaf oils to value-added materials. By a long tradition Sri Lanka produces essential oils from cinnamon bark, cinnamon leaves, pepper, nutmeg and cardamom as well as citronella and lemon grass. The aim is to locally produce improved products of added value from these raw materials in order to strengthen Sri Lanka's position in the export markets as well as save foreign exchange by substituting imported flavours and fragrances.

Annex

Following fractions are already available for further processing either to pure chemicals or fragrance blends for commercial use.

Citronella oil base

- Geraniol fraction (76%) - with geranyl acetate and citronellyl acetate as minor constituents.
- Citronellal fraction (70%) - with linalool and geranyl formate as minor constituents.
- Camphene fraction (76%) - with pinene as minor constituent.
- Borneol (79%)
- Methyl iso eugenol fraction (75%) - with geranyl butyrate and elemol

Cinnamon leaf oil base

- Eugenol (76%)
- Carvophellene (70%) - with linalool and other monoterpenes
- Benzyl benzoate (74%) - with eugenyl acetate and eugenol
- para-Cymene fraction (73%) - with thienandrin and pinene 16%

Limonene oil base

- Citral A and citral B - 93%
- Linalool fraction (71%) with citronellal and limonene

Turpentine bases

- pinene - 99.8%
- para-cymene fraction (60%) - with thienandrin and pinene

ANNEXURE 2

TECHNOLOGIES FOR FOOD AND AGROBASED INDUSTRIES
DP/SRL/86/016
ESSENTIAL OIL PROJECT
GNR/89/7B

CONSULTANT : MR. SUDHIR JAIN

Project Team

- | | | |
|----------------------|---|---|
| Dr. U M Senanayake | - | Team Leader, (Head/NPS) |
| Dr. T Habarakada | - | Project Co-ordinator (OIC/PP & D Section) |
| Dr. A M Mubarak | | |
| Miss. S de Costa | | |
| Miss. N Amarasinghe | | |
| Mr. K R Dayananda | | |
| Mrs. Chandrani Dias | | |
| Mrs. Kamani de Silva | | |
| Miss. S Jayakody | | |
| Mr. Saman Weeraratne | | |
| Mrs. R de Costa | | |

List of things to be discussed with Mr. Sudhir Jain

1. The use of various fraction of citronella oil
2. Perfume for Laundry soap
3. Lemon - Lime and Orange flavours for soft drinks
4. Perfume for Joss sticks
5. Mosquito repellents
6. Turpentine based disinfectants
7. Use of turpentine in polishes, waxes etc.
8. Air fresheners
9. Lemon - Lime based toilet disinfectants
10. Flavour encapsulation

ANNEXURE 3

**EQUIPMENT REQUIRED FOR THE MANUFACTURE
OF AROMA CHEMICALS**

1. Stainless Steel Reactors
2. Glass and Glass lined Reactors
3. Distillation and Fractionation Units
4. Vacuum Pumps
5. Water Circulation Pumps
6. Cooling Tower
7. Chilling Plant
8. Oil Heating System
9. GLC and other analytical equipment

ANNEXURE 3A

LIST OF THE VARIETY OF RAW MATERIALS THAT CAN BE
PRODUCED IN SRI LANKA

For Fragrances

1. Citronellal
2. Citronellol
3. Dimethyl Octanol
4. Citronellyl Acetate
5. Citronellyl Butynate
6. Citronellyl Formate
7. Citronellyl Valerate
8. Geraneol
9. Geranyl Acetate
10. Geranyl Butynate
11. Geranyl Formate
12. Geranyl Propionate
13. Geranyl Valerate
14. Citral
15. Alpha Ionone
16. Ionone Pure
17. Methyl Ionone
18. Eugenol
19. Iso Eugenol
20. Acetyl Iso Eugenol
21. Terpeneol
22. Terpenyl Acetate
23. Iso borneol Acetate
24. Iso borneol
25. Camphor
26. Borneol
27. Methyl Iso eugenol
28. Iso bornyl cyclohexanol
29. Hydroxy citronellal
30. Nerol

For Flavours

1. Ethyl Acetate
2. Ethyl Formate
3. Ethyl Propionate
4. Ethyl Butynate
5. Ethyl Valerate
6. Ethyl Caproate
7. Ethyl Heptoate
8. Ethyl Caprylate
9. Ethyl Pelargonate
10. Ethyl Salicylate
11. Ethyl Benzoate

ANNEXURE 3B

PROJECT PROFILE

PRODUCTION OF AROMATIC CHEMICALS

C O N T E N T S

1. Natural Essential Oils available for the Production of Aromatic Chemicals as Isolates and further derivatives
2. Odour Characteristics and Uses of Aromatic Chemicals thus Produced
3. General Methods of Production
4. Packing and Storage
5. Quality Standards
6. Estimated World Demand & Current Market Prices
7. Project Parameters for a Typical Installation

1. Natural Essential Oils Available for the Production of Aromatic Chemicals as Isolates.

Sri Lanka is a traditional producer of many spices and essential oil bearing plants. These serve as raw materials for the production of essential oils.

Definition of an Essential Oils:

An essential oils is a volatile material, derived by a physical process from odourous plant material of a single botanical form and species with which it agrees in name and odour.

The essential oils which are produced in Sri Lanka are the following:-

1. Cinnamon Bark Oil
2. Cinnamon Leaf Oil
3. Cardamom Oil.
4. Black Pepper Oil.
5. Clove Stem Oil.
6. Clove Bud Oil.
7. Ginger Oil.
8. Nutmeg Oil.
9. Mace Oil.
10. Citronella Oil Ceylon Type.
11. Lemongrass Oil.

Of these, Cinnamon Leaf Oil and Lemongrass Oil can serve as starting materials for the production of Aromatic Chemicals by means of chemical Isolation and subsequent processing.

The aromatic chemicals which can thus be produced from these two essential Oils are:-

a). From Cinnamon Leaf Oil

- i) Eugenol.
- ii) Isoeugenol.
- iii) Methyl Eugenol and Aceteugenol.
- iv) Methyl Isoeugenol, Acet Isoeugenol and Benzyl Isoeugenol.

Of these Eugenol and its derivatives are more economically produced from Clove Leaf Oil. However Isoeugenol and its derivatives can be successfully and economically produced from Cinnamon Leaf Oil.

b). From Lemon Grass Oil.

- i) Citral.
- ii) Ionones, Alpha, Beta and Pure.
- iii) Methyl Ionone.

2. Odour Characteristics and Uses of Aromatic Chemicals thus produced.

(a) From Cinnamon Leaf Oil:-

Cinnamon Leaf Oil, Ceylon Type contains high concentrations of Eugenol - 80 to 88%. It also contains many of the major constituents present in Cinnamon Bark Oil eg. Cinnamic Aldehyde, Cinnamyl Acetate, Eugenol Acetate, Benzaldehyde etc. These minor constituents which are present in-addition to Eugenol add to the sweetness of the odour of Isoeugenol and as such many perfumers prefer to have and use Isoeugenol ex. Cinnamon Leaf Oil.

Isoeugenol: The commercial product is a mixture of Cis and trans isomers. The trans-isoeugenol (M.P. 33°C and B.P. 266°C) is normally 82 - 88% of commercial isoeugenol and Cis-isoeugenol(BP 262°C) is

is normally 12 - 18% of Commercial Isoeugenol.

Isoeugenol is a pale yellowish or almost colourless, slightly viscous liquid, practically insoluble in water, soluble in alcohol, oils and Propylene Glycol.

It has a mild and sweet, deep-floral, very tenacious odour with great warmth and resemblance to carnation, sweet williams or wall flower. The taste is warm, sweet and slightly burning.

It is extensively used in perfume compositions, mainly as a base for carnation but also in general as a sweet floralizing agent of excellent tenacity. Isoeugenol is a classic ingredient in the "Origin" type fragrances and it gives the highly desirable warm background and powdery note in a Lilac base. It thus finds its way into numerous perfume bases and enjoys the position there is no substitute for Iso-eugenol in perfumes.

It is also sparingly used in many types of flavours e.g. Raspberry, peach, Nutmeg, Cinnamon, Apricot, Fruit Complexes, Nut, Mint and Spice bases, and Clove Flavours.

Iso-eugenol can be further processed to yield the following derivatives:-

1) Isoeugenol Acetate:-

White crystals, M.P. App. 80°C, Soluble in most organic solvents weak - rose-carnation somewhat spicy odour; initially burning, then sweet taste. Used in rose, carnation and sweet floral bases. Often used as a fixative. Also used in flavours.

ii) Benzyl Isoeugenol:

White to Ivory coloured crystalline Powder, M.P. 58-59°C Soluble in most organic solvents. Faint floral odour of rose - carnation. Used in

rose, carnation and sweet floral bases. Often used as a fixative.
Also used in Flavours.

iii) Methyl Isoeugenol

Colourless to pale yellow liquid. B.P. 262 - 264°C. Soluble in most organic solvents. Delicate clove carnation odour, Burning bitter taste. Used in Clove and carnation bases and as a fixative in spicy floral compositions. Also used in flavours.

b) From Lemongrass Oil:

Lemongrass Oil is a yellow or amber coloured, somewhat viscous liquid with a very strong, fresh - grassy lemon type herbaceous odour. Lemongrass oil contains about 70 - 75% citral which is used in both perfumes and flavours and also for the production of Ionones, or for the synthesis of Vitamin A. Lemongrass oil as such is not used extensively in perfumes.
Citral: Colourless to slightly yellowish liquid. B.P. 228°C. Insoluble in water, soluble in alcohol, miscible with most perfume and Flavour oils. Widely used as a powerful lemon-fragrance chemical. Very commonly used in flavour compositions. Used in Apple, Cherry, Ginger, Grape, Lemon, Lime Orange, Grape fruit, Spice, Strawberry and sometimes even in Vanilla.

Alpha Ionone:

Almost colourless or pale straw coloured to pale yellowish oily liquid. B.P. 237°C.

Very slightly soluble in water, soluble in alcohols and oils. Warm-woody, balsamic - floral odour of deep sweetness and moderate tenacity. Its remembrance to the odour of Violet flowers is legendary.

Relatively powerful, Sweet woody taste with a fruity note. Alpha Ionone is widely used in all types of perfume compositions. The use of Ionone in Rose bases is very common and smaller amounts of Ionone are used in

woody, herbaceous, floral, balsamic, piney or citrus-type fragrances. It is used for modifying, blending, floralizing and mellowing of various types of fragrances. Alpha Ionone is also used in flavours like, Blackberry, Loganberry, Raspberry, Cherry, etc., and in Spice blends, fruit complexes, citrus flavours, floral flavours and Vanilla imitation.

Beta Ionone: Almost colourless or very pale straw coloured oily liquid
B.P. 239°C.

Very slightly soluble in water, soluble in alcohols and oils. Warm-woody somewhat dry odour with a fruity under tone. Beta Ionone is used in perfumery although not to the same extent as Alpha-Ionone. It is used in fragrances rich in woody notes. Beta Ionone is also used for flavour compositions like Raspberry, Loganberry, Strawberry, Cherry, Grape, Muscatel Nut and fruit complexes, Pistachio, Pineapple, floral complexes and liqueur flavours.

Methyl Ionone:

Almost colourless or pale straw coloured oily liquid sp. gr. 0.93
B.P. 238°C.

Almost insoluble in water, soluble in alcohol and Oils. Floral and sweet oily odour of moderate tenacity.

Methyl Ionone is used quite extensively in perfume compositions as a blender/modifier and back-ground note in floral or floral - oriental compositions, Mimosa - Cassia bases, chypre and 'l' origan type of bases.

It is also used in flavour compositions as part of imitation raspberry and other berries, violet and various floral types and in some fruit complexes and 'Sen - Sen' type licorice flavourings.

3. General Methods of Production:

Since there is no single general method for the production of the Aromatic Chemicals under discussion, an outline of the process of manufacture of each chemical is given below:-

i) Isoeugenol:- Cinnamon Leaf Oil is heated with Pot. Hydroxide solution in stainless steel vessels till complete Isomerisation of the eugenol content of the Cinnamon Leaf Oil takes place, leaving the non-eugenolic portion unaltered. The reaction product is washed with a suitable solvent to remove the non-eugenolic portion and the isomerised material is recovered by acidification and washing followed by distillation under vacuum.

ii) Isoeugenol Acetate: Isoeugenol is esterified using Glacial Acetic Acid or Acetic Anhydride. The reaction product is washed, distilled and crystallised from a suitable solvent.

iii) Benzyl Isoeugenol: Isoeugenol is reacted with Benzyl Chloride in a suitable media so as to benzylate the isoeugenol. The reaction product is washed, distilled and crystallised from a suitable solvent.

iv) Methyl Isoeugenol: It is produced by the methylation of isoeugenol with Dimethyl Sulphate in alkaline solution. The reaction product is washed and distilled to the required purity.

v) Citral: It is isolated from Lemongrass oil using Sodium bi-sulphite which forms a solid adduct with the Citral contained in the Lemongrass oil. The solid adduct is washed free of the adhering unreacted oil and filtered through a pressure filter. After filtration, the adduct is decomposed by dilute acid and the pure Citral thus liberated is recovered by extracting the aqueous phase with a suitable solvent. The organic

phase is washed and distilled to obtain the pure citral.

vi) Alpha Ionone & Beta Ionone: Citral is condensed with Acetone in the presence of alkali. The condensation product thus obtained is cyclised in the presence of acid. By varying the conditions of isomerisation, different isomers can be obtained. The cyclised product is washed free of acid and carefully fractionated.

vii) Methyl Ionone: It is synthesised by the condensation of Citral with Methyl Ethyl Ketone and cyclising the product with acid reagents.

4. Packing & Storage:

Aromatic Chemicals are in general sensitive materials and even the slightest change because of any deterioration can spoil the commercial value of a given product because the same depends entirely upon its, Organoleptic characteristics. Therefore care and precautions have to be taken to store the chemicals. The storage conditions required for the Aromatic Chemicals being described in this profile are summarised below:-

i) Isoeugenol:- On prolonged storage, tends to increase in viscosity and deepen in colour, particularly if exposed to light and air. Store in a cool, dry place, in full, tightly sealed containers, protected from light. Do not use iron or steel containers, unless coated internally with a suitable impervious lacquer; otherwise excessive darkening will occur. Stable under above conditions; when stored for more than one year quality should be checked before use.

ii) Isoeugenol Acetate:- Store in glass, aluminium or containers internally lined with an impervious lacquer, in a cool, dry place protected from light. The containers should be full and tightly sealed.

iii) Benzyl Isoeugenol: It may be stored in glass, wood or fibre containers or suitably lined metal containers. Other than that no special storage precautions are necessary.

iv) Methyl Isoeugenol: Store in a cool place, protected from light in full, tightly sealed containers made of glass, aluminium or those which are internally lined.

v) Citral:- Store in glass, aluminium or containers internally lined with an impervious lacquer in a cool dry place protected from light. The containers should be full and tightly sealed.

vi) Alpha Ionone and Beta Ionone:

Store in glass, aluminium or containers internally lined with an impervious lacquer in a cool dry place protected from light. The container should be full and tightly sealed.

vii) Methyl Ionone: Store in glass, aluminium or containers lined internally with an impervious lacquer in a cool dry place protected from light. The containers should be full and tightly sealed.

5. Quality Standards:- All Aromatic Chemicals destined for perfumery and flavour use are judged for quality on the basis of their organoleptic properties. In spite of the development ^{of} highly sophisticated analytical instruments, the nose remains the final arbiter of quality as far as a perfumer is concerned. However apart from the olfactory assessment of a given product, certain other parameters of physical and chemical properties have been standardised and those parameters form the basis of quality control of Aromatic Chemicals. Thus the standards which are set out below represent the minimum requirements for a given product and any deviation from the defined parameters will render a product non-standard.

1) Isoeugenol:

Appearance	:	Almost colourless or pale yellow liquid.
Odour	:	Floral, Spicy, Powdery, Sweet.
Specific Gravity	:	d_4^{20} : 1.082 - 1.086.
Refractive Index	:	n_D^{20} : 1.573 - 1.578
Purity	:	Cis Isomer : max. 12% trans isomer : min. 88% Sum of isomers : min. 98%.
Solubility	:	Soluble in one part of alcohol 70% (w/v).

ii) Isoeugenol Acetate:-

Appearance	:	White Crystals
Odour	:	Weak Rose - Carnation
Congearing Point	:	Min. 78°C
Acid Value	:	Max. 1.0
Purity	:	Min. 98%.
Solubility	:	

iii) Benzyl Isoeugenol:-

Appearance	:	White to Ivory coloured Crystalline Powder.
Odour	:	Faint - Floral Rose - Carnation.
Congearing Point	:	Not less than 57°C
Purity	:	Min. 99%.
Solubility	:	One gram is soluble in 50 ml of 95% alcohol at 25°C.

iv) Methyl Isoeugenol:

Appearance	:	Colourless to Pale Yellow Liquid.
-------------------	---	-----------------------------------

Odour : Delicate Clove - Carnation
Sp. Gravity : d_4^{25} : 1.047 - 1.053
Refractive Index : n_D^{20} : 1.5660 - 1.5690
Purity : Min 99%.
Solubility : Clearly soluble in 2 volumes of 70% alcohol at 25°C.

v) Citral:

Appearance : Colourless to Pale Yellow Liquid.
Odour : Citrus - Lemon
Sp. Gravity at 27°C : 0.8850 to 0.8875
Refractive Index at 27°C : 1.4830 to 1.4860
Purity : Min 97%.

vi) Alpha Ionone:

Appearance : Colourless to Pale Yellow Liquid.
Odour : Noticeably - Woody - Violet
Sp. Gravity at 27°C : 0.926 to 0.932
Refractive Index at 27°C : 1.4943 to 1.4993
Purity : Min 98%.

vii) Beta Ionone :

Appearance : Slightly Yellow Liquid
Odour : Fruity - Woody
Sp. Gravity at 27°C : 0.940 to 0.946
Refractive Index at 27°C : 1.5163 to 5188
Purity : Min. 95%.

viii) Methyl Ionone:-

Appearance : Clear pale yellow to yellow liquid.
Odour : woody - violet powdery and floral odour.
Sp. Gravity at 27°C : 0.926 to 0.931
Refractive Index at 27°C : 1.4980 to 1.5030
Purity : Min. 92%.

6. Estimated World Demand and Current Market Prices

<u>S. No.</u>	<u>Item</u>	<u>Demand</u>	<u>Price per kg.</u>
1.	Isoeugenol	100 tonnes	US.\$ 11.00
2.	Isoeugenol Acetate	10 tonnes	US.\$ 20.00
3.	Benzyl Isoeugenol	20 tonnes	US.\$ 40.00
4.	Methyl Isoeugenol	20 tonnes	US.\$ 20.00
5.	Citral	2000 Tonnes	US.\$ 10.00
6.	Alpha Ionone	250 tonnes	US.\$ 40.00
7.	Beta Ionone	100 tonnes	US.\$ 35.00
8.	Methyl Ionone	250 tonnes	US.\$ 35.00

The projection of demand and prices is based on current patterns of production and currency values and any future changes will have to be incorporated from time to time.

In the estimation of demand for Beta Ionone, the quantities required for pharmaceutical use have not been taken into account.

7. Project Parameters for a Typical Installation.

a) Production Capacity

- i) Isoeugenol : 15 tonnes per annum.
- ii) Isoeugenol Acetate,
Benzyl Isoeugenol and
Methyl Isoeugenol : 5 tonnes per annum

- iii) Citral : 30 tonnes per annum
- iv) Alpha Ionone, Beta Ionone and Methyl Ionone : 15 tonnes per annum

b) Factory Accomodation:-

- Production Plant : 30m x 15m
- On site storage for Raw Materials & Solvents : 15m x 12m

c) Machinery & Equipment

- i) S.S. Reactors
- ii) Glass Lined Reactors
- iii) Distillation & Fractionation Equipment.
- iv) Vacuum Pumps.
- v) Water Pumps.
- vi) Chilling Plant
- vii) Oil Heating System.
- viii)GLC & Other analytical equipment
- Total cost US\$ 100,000/-

d) Raw Materials(Annual Requirement)

- i) Cinnamon Leaf Oil : 25 Tonnes
- ii) Lemongrass Oil : 70 Tonnes.
- iii) Acetone : 10 Tonnes.
- iv) Methyl Ethyl Ketone : 10 Tonnes.
- Other Chemicals such as kids, Alkali and solvents : 60 Tonnes.

e) Utilities:

- Power Requirement : 300 K.V.A.
- Estimated Power consumption per year (Connected Load 200 KW) : 5,00,000 Kw-Hr.

f) Water: For Processing : 1000 litres per day
Also for personal hygiene,
drinking and small services.

g) Employment

Unskilled Workers	:	5
Semi Skilled Workers	:	15
Skilled Workers	:	3
Scientists	:	2
Office Staff	:	2
		<hr/>
		27
		<hr/>

h) Return on Investment

Approximately : 30%.

ANNEXURE 4

METHOD FOR CREATION OF AN OLFACTORY ASSESSMENT AND SENSORY EVALUATION LABORATORY FOR NATURAL SYNTHETIC PERFUMERY MATERIALS.

Background:

1. Natural and synthetic perfumery materials such as essential oils, aromatic chemicals, etc, are used primarily for their odour appeal. Although the analytical characteristics which are commonly determined may provide some assurance regarding the chemical purity of an odoriferous substance, they do not necessarily indicate the "purity" of odour. Hence, olfactory evaluation has been practised for centuries and, in the perfumery trade, it has formed the basis of acceptance or rejection of odoriferous materials.

This methodology has been formulated with a view to introduce standard methods of testing for olfactory assessment of natural and synthetic perfumery materials.

2. Olfactory assessment has been the target of some criticism as it is a subjective test. Numerous attempts on basic odour research and, more particularly, on objective measurement techniques have been made from time to time but none of these has so far wide acceptance. Whereas objective methods are the goal of all odour research, there is, at present, no technique which may replace sensory detection and evaluation of odours.

Terminology

1. **Top note:** The initial and primary odour effect perceived by the olfactory nerves on smelling a strip freshly impregnated with the material being tested. The top note(s) is (are) usually of a short duration and may or may not be coperceived along with the middle note.

2. **Middle note:** The secondary overall odour effect experienced by the olfactory nerves on smelling a strip impregnated with the material after the initial top note has evaporated. It lasts for a longer time on the strip than the top note.

3. **Residual note (Dry-out Note):** The tertiary odour effect experienced by olfactory nerves on smelling a strip impregnated with a material after the top and the middle notes have disappeared. Besides indicating the lasting character and strength of the material, it may also reveal the nature of the lesser volatile materials.

4. **By note:** An odour effect, additional to the normal pattern of odours associated with the material, experienced by olfactory nerves on smelling an impregnated strip during any stage of evaporation. It is generally regarded as an index of foreign odour and/or undesirable adulterant and alien.

5. **Odour Description:** Due to the absence of precise terms, descriptive words which are subjective in nature are commonly used to express the odour sensations perceived in the top, middle, residual and by-notes. Some of these terms are given below but the list is not intended to be exhaustive:

acid
acrid
aldehydic
amber
animal
balsamic
bitter
burnt
camphoraceous
choking
citrus
cloying
cool
dry
dull
earthy
exalting
faecal
fatty
fishy
floral
fungal
fresh
fruity
goaty
grassy
green
heavy
herbal
honey
intense
leafy
leathery
minty
mossy
mushroomy
musky
musty
nauseating
nutty
oriental
peppery
persistent

phenolic
pincy
powdery
pungent
refreshing
sappy
sharp
sickly
smokey
sour
spicy
stemlike
still odour
sulphuraceous
sultry
sweet
tarry
tart
woody

Requirements

General Requirements: The following general precautions are required to be noted.

Selection and Training: Better results are obtained if individuals with a keen sense of smell and ability to distinguish between different odours are selected for training in olfactory assessment.

Fatigue: Continuous smelling causes olfactory fatigue and decreases critical odour perception. To avoid this, the number of samples assessed during a session should be limited as far as is practical. Further, during smelling, the body should be relaxed. Resting for an interval between smelling different samples is also advantageous. If the number of samples to be tested is fairly large, it is advisable to examine last those materials which are known to be pungent or strong in odour.

It should be borne in mind that inability to correctly identify certain odours may arise from natural deficiencies such as specific anosmia. For instance, some people are unable to perceive musky odour.

Bias: The necessity of minimizing all differences between samples other than that of odour in order to prevent the prejudicing of results is stressed. 'Blind' tests should be conducted by ensuring that the markings on the smelling strip do not disclose the origin of the samples.

Time of Olfactory Assessment: The evidence relating to the most favourable time for conducting olfactory assessment is somewhat conflicting. However, the morning appears to be generally favoured. In general, olfactory assessment should be done after a reasonable interval of time has elapsed after a meal or a beverage has been taken.

Freedom from Contaminating Odours: It is necessary to ensure that the hands, nose and smelling strips are free from contaminating odours as these are likely to vitiate the results. It is recommended that the individual responsible for assessing odour should wash his/her hands several times during a smelling session as well as clear his /her nose.

Material Requirements: The following materials, apparatus and environmental conditions are required.

Library of Standard Samples: For each essential oil, aromatic chemical or other perfumery material, there shall be a standard sample of approved odour value.

The standard samples shall be kept in well-stoppered, air-tight, neutral amber-coloured glass bottles and when not in use, they shall be stored in a refrigerator at about 5°C.

The odour characteristics of standard samples are likely to change over a period of time however well they may be stored. Some materials improve in odour as a result of maturing while others deteriorate because of minute oxidative changes. An alteration in the odour characteristics of standard samples is not desirable and, in such cases, fresh standards should be adapted. Generally, all perfumery materials recommended shelf life and the sample should be changed thereafter.

Ethyl alcohol: Perfumery grade.

Diethyl Phthalate: Perfumery grade.

Smelling strips: These shall preferably be 1 cm wide and 15 cm long. They shall be made from odourless, thin, absorbent paper and shall be sufficiently stiff so that the strips do not bend under their own weight when held in a horizontal position.

Absorbent paper of substance ranging from 100 to 280 g/m² is commonly used. Paper is made entirely from the best cotton material, and is usually in the form of cotton or linnen fibre or a mixture of both. It should be free from any trace of chemicals. Also the water used in making such paper should be pure and completely free from odours, chemicals or salts. The paper should be neutral and should have been kept away from odorous materials and environment all the time. These considerations should be useful in evaluating the quality of the paper used for preparing smelling strips.

Smelling strips shall be packed in air-tight, odour-free containers and stored in a clean odour-free room. Those intended for daily use shall preferably be kept in a wide-mouthed glass bottle covered by a beaker.

Strips Stand: A cruciform patterned 3-clip stand, approximately 21 cm high, or any other suitable device, to hold impregnated smelling strips.

Environment: A well-ventilated room, as free as possible from all outside disturbances. Ideally, the temperature and humidity suited are about 20°C and 80 percent RH (Relative Humidity), respectively. The colouring of the room shall be sober and the furnishing restricted. The general environment shall have a restful rather than a distracting effect.

Procedure

One end of each smelling strip shall be clearly marked before use. Dip the unmarked end of one strip (about 0.5 to 1.0 cm) in the material under examination and of another strip to the same depth in the standard sample after it has attained room temperature. For certain perfumery materials, such as fatty aldehydes, absolutes and solids, use 1 to 10 percent solutions in ethyl alcohol or diethyl phthalate for olfactory assessment.

For semi-solids, solids and strong-smelling substances, use the procedure as given below.

For semi-solid materials: The odour of semi-solid materials such as guaiacwood oil, oakmoss resinoid and absolute, labdanum resinoid and absolute, etc, should be taken on smelling strips but only after melting the contents completely under controlled temperature below 100°C preferably on water-bath.

For strong smelling materials: In order to have a better perception, strong smelling substances irrespective of their physical appearance may also be smelt after dilution to about 1 to 10 percent such as indole, fatty aldehydes, etc, using ethanol or diethylphthalate as a diluent.

Hold the strip impregnated with the standard sample at such a distance from the nose that there is incipient yet distinct perception of odour. While smelling, concentrate wholly on the sensations received and make mental observations. Repeat the procedure with the strip impregnated with the test sample. After about a minute's rest, repeat the comparison reversing the order of smelling the two strips. Finally, compare the two strips for their odour in a "blind" test. If a difference in odour is observed, repeat the "blind" test on the two strips five times. Record the observations of each "blind" test.

It is important to note that although the room shall be well-ventilated, the strips kept under examination should not be exposed to a direct draught.

After this initial assessment for top notes, fix the two strips on a stand keeping them sufficiently apart to avoid inter-contamination. Examine the strips periodically by the "blind" test and note the changes in quality and intensity of odour. Continue in this manner as long as the odour on each strip remains perceptible.

Report

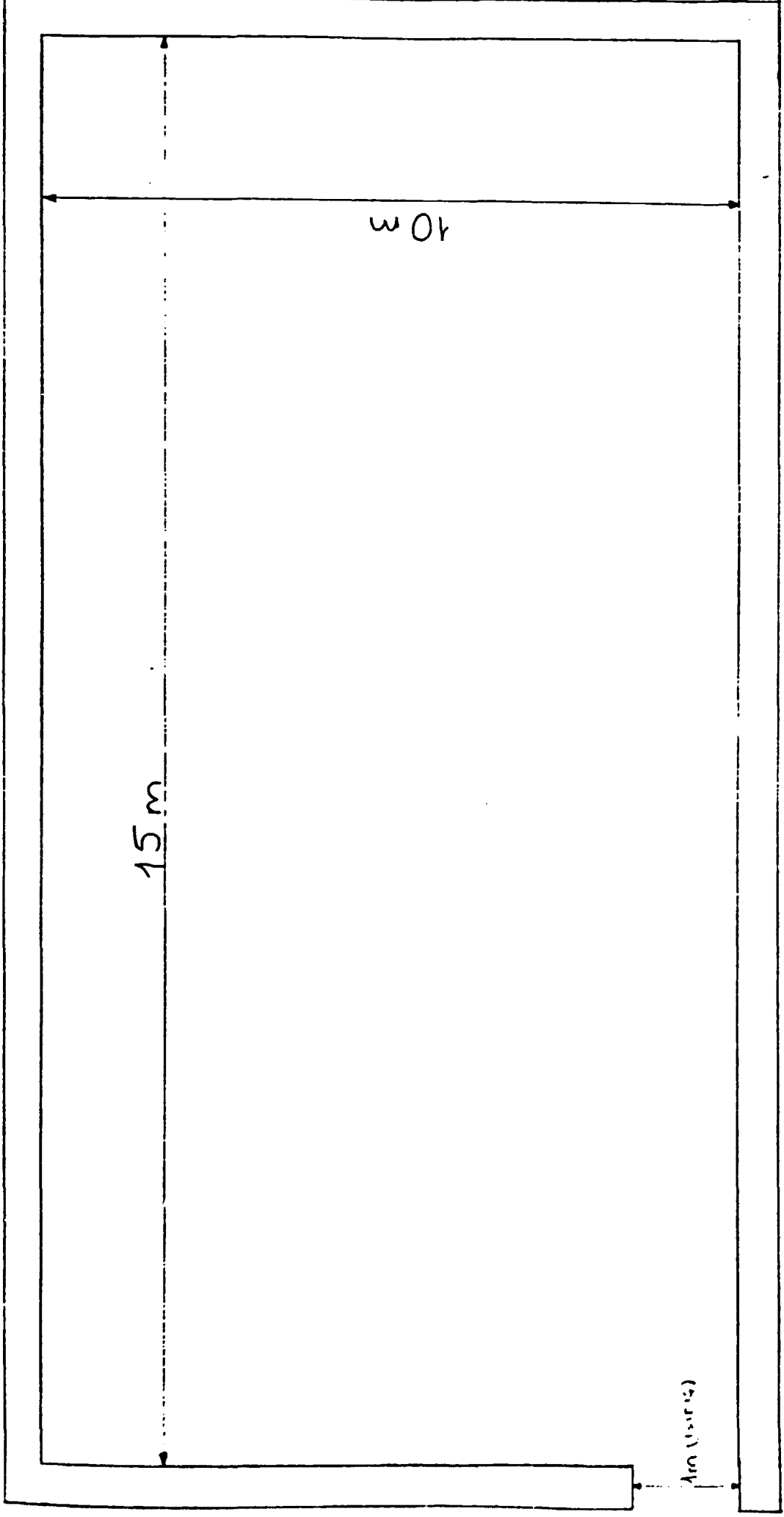
Report the top, middle and residual odour assessment of the test sample as compared with the odour of the standard sample at corresponding stages of assessment.

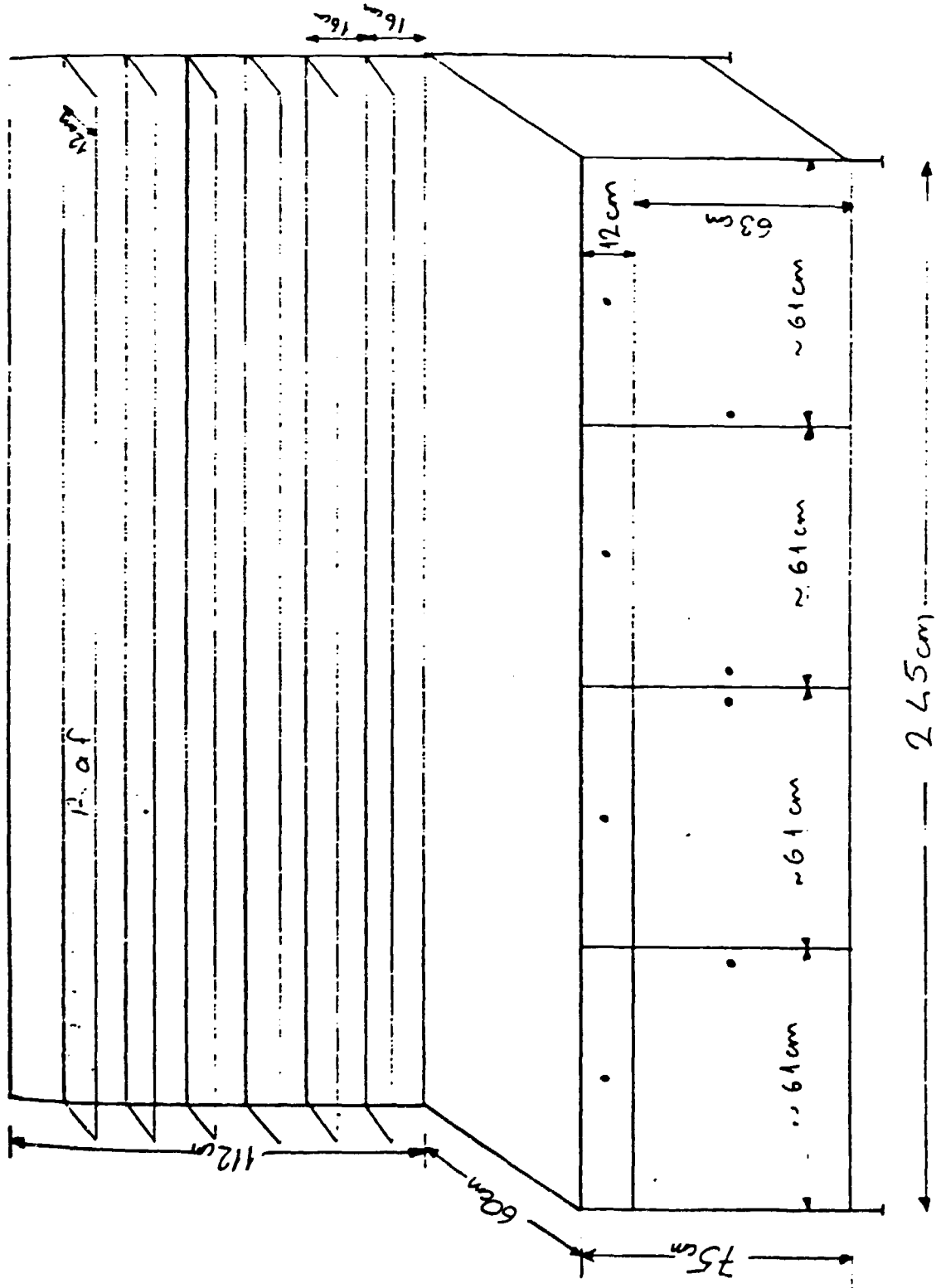
Criterion for Judgement of Quality: The odour of the material under examination shall correspond to that of the standard at all stages of assessment. If it does not and the pattern of odour is considered to be inferior to that of the standard, the quality of the material shall be regarded as not satisfactory.

Referee Test: In case of dispute, present the individual assessing odour with three suitable coded smelling strips, two of which have been dipped in the material under examination and the remaining one in the standard sample (or *vice-versa*). If the 'odd' sample is consistently picked five times in a 'blind' test, the material shall be deemed to have a pattern of odour different from that of the standard sample.

DETAILS OF FACILITIES REQUIRED IN THE SENSORY EVALUATION AND FRAGRANCE CREATION LABORATORY

1. Refrigerated storage of standard samples of raw materials and finished products.
2. Samples of raw materials in bottles of proper design for daily working.
3. Weighing balances of accuracy to third decimal place.
4. Magnetic stirrer and heater.
5. Water bath
6. Working tables with shelves up the eye level.
7. Efficient exhaust and ventilation system
8. Wash basin
9. Conical flasks, beakers, pipettes, droppers, funnels and aluminium foil.
10. Detached smelling room free from all odours for odour evaluation fitted with an efficient exhaust and filtered air inlet system.





Yapım malzemesi: Sunta (Fildisi formika kaplanmış)

ANNEXURE 5

LIST OF RAW MATERIALS AND THEIR SOURCES REQUIRED FOR
THE FRAGRANCES AND FLAVOURS CREATION LABORATORY

<u>Materials</u>	<u>Supplier</u>
1. Acetanisole	International Fragrances and Flavours Inc., 521, West 57 Street New York N.Y. 10019
2. Acetyl Iso Eugenol	
3. Aldehyde C-8	
4. Aldehyde C-9	
5. Aldehyde C-10	
6. Aldehyde C-11	
7. Aldehyde C-12 Lauric	
8. Aldehyde C-12 MNA	
9. Allyl Amyl Glycolate	
10. Allyl Caproate	
11. Alvanone Extra	
12. Amber Alva	
13. Ambrain	
14. Ambrettolide	
15. Amyl Butyrate	
16. Alpha Amyl Cinnamic Aldehyde	
17. Amyl Phenyl Acetate	
18. Amyl Propionate	
19. Amyl Salicylate	
20. Amyl Valerate	
21. Amyl Vinyl Carbinyl Acetate	
22. Andrane	
23. Anisyl Acetate	
24. Arbrensa	
25. Auralva	
26. Bacdanol	
27. Balsam Pern Alva Essence	
28. Benzyl Butyrate	
29. Benzyl Formate	
30. Benzyl isovalerate	
31. Benzyl Isopropionate	
32. Benzyl salicylate	
33. Bergomal	
34. Beta Naphthyl Iso Butyl Ether	
35. Biflor	
36. Bourgeon D'Avana	
37. Cashmeran	
38. Castoreum Absolute 50BB	
39. Cedarwood oil white	
40. Cedraclaire	
41. Cedramber	
42. Cedrenol	
43. Cedrenyl Acetate	
44. Celestolide	
45. Cinnamyl Acetate	
46. Citral	

47. Citralva
48. Citronellal
49. Citronellol
50. Citronellyl Acetate
51. Citronellyl Formate
52. Civet Concentrate 50 PPG
53. Coniferan
54. Cycloctal
55. Cycloctal
56. Decave
57. Decyl Methyl Ether
58. Dihydro Floralate
59. Dihydro Linalol
60. Dihydro Myrcenol
61. Dihydro Myrcenyl Acetate
62. Dihydro Terpeneol
63. Di Jasmone
64. Dimethyl Benzyl Carbinol
65. Dimethyl Benzyl Carbinyl Acetate
66. Dimethyl Octanol
67. Dimethyl Phenyl Ethyl Carbinol
68. Dimyrcetol
69. Dulcinyll Recrystallized
70. Ethyl Caproate
71. Ethyl Iso-valerate
72. Ethyl Methyl Phenyl Glycidate
73. Eugenol
74. Fleuremone
75. Floralozone
76. Fructose
77. Galaxolide 50
78. Galbanum couer
79. Galbiffex
80. Gelsol F
81. Geraldehyde
82. Geraneol
83. Geranyl Acetate
84. Geranyl Butyrate
85. Geranyl Ethyl Ether
86. Geranyl Formate
87. Grisalva
88. Guaiyl Acetate
89. Hawthanol
90. Helional
91. Hexadecanolide
92. Hexalon
93. Cis-3-Hexenol
94. Cis-3-Hexenyl Salicylate
95. Hexyl Acetate
96. Hexyl Cinnamic Aldehyde
97. Hydratropic Aldehyde
98. Hydroxy citronellal
99. Indolarome
100. Intreleven Aldehyde

101. Ionone Alpha
102. Ionone 100%
103. Iso butyl phenyl acetate
104. Iso Butyl Quinoline
105. Iso E. Super
106. Iso Eugenol
107. Iso Methyl Ionone
108. Labdanex
109. Labdanum Resin Absolute
110. Leaf Acetal Extra
111. Lemorale
112. d-Limonene
113. Lyrar
114. Maritima
115. Massada
116. Merion
117. Gamma Methyl Ionone A
118. Methyl Phenyl Ethyl Ether
119. Muguet Aldehyde 50
120. Myrac Aldehyde
121. Myrrh coeur
122. Nepalva
123. Nerol
124. n-Nonyl Acetate
125. Oenanthic Ether
126. Olibanum Coeur 50
127. Opoponax Alvana
128. Orafleur
129. Oxyphenylon
130. Para Cresyl iso butyrate
131. Para Methyl Quinoline
132. Para Tertiary Butyl Quinoline
133. Peach Aldehyde Coeur
134. Peru Balsam Alva Essence
135. Petitgrain Absolute
136. Phenoxaflor N
137. Phenoxanol
138. Phenyl Ethyl Acetate
139. Phenyl Ethyl Alcohol
140. Phenyl Ethyl Formate
141. Phenyl Ethyl Iso Butyrate
142. Phenyl Ethyl Methyl Ethyl Carbinol
143. Phenyl Ethyl phenyl Acetate
144. Phenyl Propyl Acetate
145. Prenyl Acetate
146. Rhodinol Coeur
147. Rosalva
148. Rosamusk
149. Roseate
150. Rosemarel
151. Rosetal A
152. Styrallyl Acetate
153. Styrax Alva Essence
154. Tetrahydro para Methyl Quinoline

155. Tolu Resin Absolute 50
156. Tonquitone
157. Trans decahydro beta Naphthol
158. Triplal
159. Vamba
160. Veramoss
161. Verdox
162. Verdural Extra
163. Vertenex
164. Vertofix Coeur
165. Vetiverol Extra
166. Vetivert Acetate Extra
167. Ambergris T Oliffac
168. Benzoin Oliffac 63
169. Bergamot LCNP
170. Bergamot NPT
171. Bergamot Super Oliffac
172. Bitter orange oliffac 301
173. Civet 241 Oliffac
174. Costus Oliffac
175. Geranium Bourbon Oliffac 563
176. Jasmine Absolute Oliffac
177. Lavender Oliffac
178. Lime Expressed NPT
179. Mandarin Oliffac
180. Neroli Oliffac
181. Oakmoss Oliffac 924
182. Olibanum Resin Oliffac
183. Orange Flower Absolute Oliffac
184. Rose Absolute Oliffac
185. Sage Clary Oliffac
186. Sandalwood Oliffac
187. Tuberose oliffac
188. Ylang extra Oliffac P

Materials

Supplier

1. Adoxal	L. Givaudan & Cie SA
2. Aldehyde iso C-11	Vernier - Geneva
3. Aldehyde C-18	SWITZERLAND
4. Allyl cyclohexyl Propionate	
5. Ambersage	
6. Anisic Aldehyde	
7. Baccartol No.2	
8. Isopropyl Quinoline	
9. Benzyl Methyl Ether	
10. Crysolide	
11. Cyclal C	
12. Cetonal	
13. Cetone Alpha	
14. Cetone V	
15. Cinnamic Alcohol	
16. Cinnamic Aldehyde	
17. Cyclamen Aldehyde	
18. Dimethyl Octenone	
19. Dimethyl Hydroquinone	
20. Dimethyl Anthranilate	
21. Dimetol	
22. Estragol	
23. Farnesol	
24. Fixolide	
25. Folrosia	
26. Freskomenthe	
27. Givescone	
28. Indole	
29. Iso camphyl cyclohexanol	
30. Jasmonyl	
31. Lime oxide	
32. Linalyl Propionate	
33. Lillial	
34. Linalol	
35. Linalyl Acetate	
36. Lavendulyl Acetate	
37. Methyl Beta Naphthyl Ketone	
38. Methyl Heptenone	
39. Methyl Heptenone	
40. Methyl Heptin Carbonate	
41. Methyl Trimethyl Cyclopentenyl Pentanol	
42. Methyl Octine Carbonate	
43. Musk Ambrette	
44. Musk CPD	
45. Musk Ketone	
46. Musk Xylol	
47. Nerolidol	
48. Nerone	
49. Para cresyl phenyl acetate	
50. para tertiary butyl cyclohexyl acetate	

51. Phenyl acetaldehyde dimethyl acetal
52. Phenyl acetaldehyde 50%
53. Phenyl propyl alcohol
54. Rhodinol 70
55. Rosacetol
56. Sandex
57. Thibetolide
58. Verdyl Acetate
59. Verdyl Propionate
60. Vernaldehyde

Materials

1. Vert de Jasmin
2. Brahamanol F
3. Sandranol
4. Mahagonate
5. Romaryl
6. Corps Eglantine
7. Isodamascone
8. Fantosal
9. Buccoxime
10. Herbate
11. Florazon

Supplier

DRAGOCO Gerberding &
Co. GmbH
D-3450 Holzminden

Materials

1. Terpeneol Alpha Supra
2. Rhodinol G
3. Tetrahydrolinalyl Acetate
4. Arbanol
5. Dihydromyrcenol
6. Citroneallyl Nitrile
7. Fenchol Alpha
8. Geranyl Nitrile
9. Plinol
10. Plinyl Acetate
11. Terpinyl Acetate
12. Isobornyl Acetate
13. Dimethyl octanol
14. Menthone
15. Pluviyl Acetate
16. Anethole USP
17. Limonene D
18. Methyl Chavicol
19. Myrcene P&F
20. Nerolex

Supplier

SCM GLIDCO ORGANICS
CORP.
P.O. Box 389
389, JACKSONVILLE
FLORIDA 32201, USA

Materials

1. Veloutone
2. Trimenal
3. Damascone Alpha
4. Damascone Beta
5. Methyl Jasmonate
6. Mayol
7. Rose oxide
8. Ambrox 10%
9. Hedione
10. Neroi oxide
11. Aldehyde Mandarin 10%
12. Dorinia
13. Exaltex
14. Fixateur 404

Supplier

FIRMEMICH SA

Materials

1. Methyl Anthranilate
2. Diphenyl oxide
3. Dimethyl Hydroquinone
4. Para Cresyl Methyl Ether
5. Citronellol
6. Phenyl Ethyl Alcohol
7. Benzyl Acetate
8. Amyl Salicylate
9. Eugenol
10. Aldehyde C-14
11. Geraneol
12. Benzyl Salicylate
13. Isobornyl Acetate
14. Phenyl Ethyl Methyl Ether
15. Geranyl Acetate
16. Neryl Acetate
17. Diethyl phthalate
18. Alpha Amyl Cinnamic Aldehyde
19. Cinnamic Alcohol
20. Heliotropin
21. Iso Eugenol
22. Methyl Ionone
23. Borneol
24. Dipentene
25. Resinoid Olibanum
26. Styrallyl Acetate
27. Phenyl Ethyl Acetate
28. Phenyl Acetic Acid
29. Patchouly oil
30. Bergamot synthetic
31. Ethyl vanillin
32. Rose crystals
33. Resinoid Labdanum
34. Eugenol
35. Aldehyde C-16

Supplier

Gupta & Co Ltd
Sader Bazar
Delhi - 110006

36. Resinoid Galbanum
37. Resinoid Benzoin
38. Musk Ambrette
39. Orange oil
40. Vanillin
41. Hydroxy citronellal
42. Coumarin
43. Ethylene Brassylate
44. Evernyl
45. Iso Nonyl Acetate
46. Longifolene
47. Citronellyl Acetate
48. Geranyl Acetate
49. Ionone Beta
50. Ionone Alpha
51. Isopropyl Acetate
52. Vetiveryl Acetate
53. Bergomot oil
54. Lavender oil
55. Lemon oil
56. Orange oil bitter
57. Petitgrain oil
58. Ylang Ylang oil
59. Sandalwood oil
60. Vetiver oil
61. Azalat
62. Farenal
63. Freesiol
64. Fruitinate
65. Iso Galbanate
66. Lactojasmane
67. Magnolan
68. Oranginal
69. Oryclon
70. Profarnesal
71. Profarnesol
72. Palisandin
73. Aurantine Extra
74. Civet synthetic
75. Dipropylene glycol
76. Musk xylol
77. Hexyl salicylate
78. Vetyvenal
79. Yara Yara
80. Clove Leaf Oil rect
81. Orange oil
82. Anisic Aldehyde
83. Cumin oil
84. Phenylacet aldehyde 50%
85. Heliotropin
86. Cedrol
87. Geranium oil
88. Lavandin oil
89. Lavender oil

90. Resinoid oakmoss
91. Resinoid balsam tolu
92. Beeswax Absolute
93. Jasmine Absolute
94. Gamma Decalactone
95. Kephalis
96. Methyl Salicylate
97. Cassia oil
98. Galbanum oil
99. Sandalwood oil
100. Absolute Cassis
101. Resinoid Castoreum
102. Para cresyl acetate
103. Damacenone
104. Para cresol
105. Ginger oil
106. Mandarin oil
107. Black Pepper oil
108. Tagette oil
109. Benzyl propionate
110. Veltol
111. Geranyl Butyrate
112. Dihydro iso jasmone
113. Ethyl Acetyl Acetate
114. Boisambreine Forte
115. Resinoid castoreum
116. para cresyl phenyl acetate
117. Amyl Benzoate
118. Methyl Benzoate
119. Benzyl Benzoate
120. Methyl Tuberate
121. Celery seed oil
122. Valeric acid
123. Birch Tar oil
124. Caprylic Acid
125. Benzaldehyde
126. Armoise oil
127. Methyl Phenyl Acetate
128. Phenylate
129. Musk Alpha
130. Phenyl Ethyl Phenyl Acetate
131. Ethyl oxyhydrate
132. Ald C-13-13
133. Irotyl
134. Jasmacyclate
135. Melusat
136. Boisambreine Forte
137. Dihydro rose oxide
138. Citronellyl Formate
139. Guaiacwood oil
140. Elemi oil
141. Mentha Piperita oil
142. Amyl Phenyl Acetate
143. Spearmint oil

ANNEXURE 6

LIST OF SOAPS, COSMETICS, TOILETTERIES & JOSS STICKS
SOLD IN THE SRI LANKA MARKET

BABY SOAP AND TOILET SOAP

Name of the Product	Size	Manufacturer	Price (Rs)
1. Rebecaa Lee Baby Soap	60g	International Cosmetics Ltd	8.50
2. Johnson's Baby Soap	85g	Chemical Industries (Colombo) Ltd	9.00
3. Pears Baby Soap	80g	Lever Brothers (Ceylon) Ltd	5.75
4. Angel Baby Soap	80g	B.C.C. Lanka Ltd	5.60
5. Lux Beauty Soap	85g	Lever Brothers (Ceylon) Ltd	5.50
6. Night & Day Toilet Soap	80g	B.C.C. Lanka Ltd	5.20
7. Khomba (new fragrance)	80g	The Swadeshi Industrial Works Ltd	5.00
8. Rani Sandalwood Soap (new fragrance)	80g	- do -	5.50
9. Suvendra	80g	B.C.C. Lanka Ltd	4.75
10. Rexona (new fragrance)	85g	Lever Brothers (Ceylon) Ltd	4.80
11. Tingle	80g	Upali Consumer Products Ltd	3.60
12. Visaka Herbal Toilet Soap	40g	Hettigoda Industries (Pvt) Ltd	4.75
13. Dettol Medicated Soap	35g	Reckitt & Colman of Ceylon Ltd	4.50
14. Coal Tar Germicidal Soap	80g	B.C.C. Ltd	5.85
15. Shaving Cake	50g	B.C.C. Ltd	5.85
16. Sandalwood Soap		Harischandra Co.	

BABY EAU DE COLOGNE

Name of the Product	Size (ml)	Manufacturer	Price (Rs)
1. Pears Baby Cologne	55ml	Lever Brothers (Ceylon) Ltd	33.50
2. Classic Baby Cologne	110ml	Markys Ltd	35.00
3. Baby Cheramy	54ml	Hemas (Drugs)Ltd	31.90
4. Cuddles Baby	55ml	Venture Aromatiques and Fragrances	29.50
5. Channel 7	55ml	Eau de Flora (Sri Lanka)	22.00
6. Morison's Baby Cologne	30ml	M.S.J. Industries (Ceylon) Ltd	24.50
7. Seimens Baby Cologne	55ml	Seimen Brothers	27.50
8. Kold - X Baby Cologne	110ml	Koldex Pharmaceu- ticals Lanka	48.00
9. H.C. Baby Eau de Cologne	50ml	Hope's Chemicals	14.00
10. Baby Eau de Cologne			8.50
11. Markys Eau de Cologne	55ml	Markys Ltd	25.00
12. Rebecca Lee English Lavender Cologne	50ml	International Cosmetics Ltd	38.00
13. Kold- X ICI Eau de Cologne	110ml	Asian Cosmetics (Lanka)	58.00
14. Cherish	55ml	Venture Aromatiques and Fragrances	26.00
15. No. 9	50ml	International Cosmetics Ltd	39.75
16. Debutante (new fragrance)	100ml	Lever Brothers	62.00

HAIR CREAM, SHAMPOO AND SKIN CARE PRODUCTS

Name of the Product	Size	Manufacturer	Price (Rs)
1. Timotei Shampoo	100ml	Lever Brothers (Ceylon) Ltd	25.00
2. Rebecaa Lee, Lime Shampoo, Lime, Egg	130ml	International Cosmetics	24.00
3. Super Soft Lime Shampoo	100ml	Reckitt & Colman of Ceylon Ltd	25.00
4. Sunsilk Shampoo Egg protein	100ml	Lever Brothers(Ceylon) Ltd	26.00
5. Optimum Shampoo	100ml	International Cosmetics Ltd	28.00
6. Duart Cool Lime Shampoo	125ml	Care Products (Pte)Ltd	22.30
7. Loxene Medicated Shampoo	50ml	Reckitt & Colman of	26.50
8. Amanda Moisturising Body Shampoo	200ml	Chemical Industries (Colombo) Ltd	36.00
9. Vaseline Intensive Care (Body Lotion)	100ml	Lever Brothers (Ceylon) Ltd	45.00
10. Mystique Aloe vera moisturizer	80ml	Environmental Laboratories Ltd	78.00
11. Black Knight Hair Cream	150g	International Cosmetics Ltd	48.50
12. Duart Soft Music	100g	Care Products (Pte) Ltd	60.25
13. Soft Hair gel		- do -	

FLOOR POLISH AND AIR FRESHENER

Name of the Product	Size	Manufacturer	Price (Rs)
1. Cardinal	400g	Reckitt & Colman of Ceylon Ltd	47.00
2. Ronuk - Red Tile	400g	Mason's Mixture Ltd	68.50
3. Ronuk - Brown Tile	400g	- do -	47.00
4. Ronuk - Wax	400g	- do -	68.50
5. Drummer Air Freshener Jasmine	475ml	Reckitt & Colman of Ceylon Ltd	65.00
6. Drummer - English Rose	45g	- do -	13.50
7. Drummer - Jasmine	45g	- do -	13.50
8. Drummer - Sandalwood	45g	- do -	13.50
9. Drummer - Araliya	45g	- do -	13.50

BABY CREAM, PERFUMED COLOGNE AND AFTER SHAVE

Name of the Product	Size(ml)	Manufacturer	Price (Rs)
1. Capri	50ml	Hemas Marketing	99.00
2. Black Rose Perfume (Goya) Cologne	28ml	Reckitt & Colman of Ceylon Ltd	42.00
3. Black Knight Cologne	100ml	International Cosmetics Ltd	79.50
4. Green Grass	100ml	F D & C Laboratories	72.00
5. Cedar Wood Cologne	98ml	Reckitt & Colman of Ceylon Ltd	73.00
6. Playboy After Shave	55ml	F D & C Laboratories	58.00
7. Cuddles Baby Cream	40ml	Venture Aromatiques & Fragrances	16.90
8. Baby Cheramy Cream	100ml	Hemas (Drugs) Ltd	24.25
9. Pears Baby Cream	100ml	Lever Brothers (Ceylon) Ltd	39.00
10. Nivea Cream	30ml	M S J Industries (Ceylon) Ltd	39.50
11. Pond's Vanishing Cream	25g	Lever Brothers (Ceylon) Ltd	31.50
12. Lakme		Lakme Ltd	

JOSS STICKS

Name of Product	Manufacturer	Price (Rs)
1. New Sumudu Joss sticks	Sumudu Industries	2.50
2. Pradeepa Bathies		2.00
3. Hare Rama	Das Industries	2.50
4. Rosa Incense Sticks		2.00
5. Kishan	Chrishan Industries	3.00
6. Jayarani Dedunu Incense Sticks	Jayarani Industries (Pvt)Ltd	2.50
7. Devapooja Joss Sticks		
8. Samannegini Bathies		2.50
9. Delika	Delika Products	2.50
10. Pichchamal Joss Sticks		2.50
11. Mogra Bathies		
12. Amla Incense Sticks		2.50
13. Samindu Bathies	Samindu Industries	3.75
14. Sambrani - Lanka		
15. Sambrani - Singapore		
16. Bobby		

LIQUID CLEANER AND CLEANING POWDER

Name of the Product	Size	Manufacturer	Price (Rs)
1. Clean O-pine	290ml	Reckitt & Colman of Ceylon Ltd	26.55
2. Vim	475g	Lever Brothers (Ceylon) Ltd	17.00
3. Ezi - Dishwash	500ml	Chemical Industries (Colombo) Ltd	24.00
4. Trax Liquid Toilet Bowl	400ml	Agro Chemical Industries Ltd	21.50
5. Britol-Window Cleaner	200ml	- do -	14.50
6. Britol-Cleaning Powder	500g	- do -	13.50
7. Care-Jet Creme Cleaner	430ml	Care Products (Pvt)Ltd	30.80
8. Zip - Cleaner	250g	Lankem Ceylon Ltd	22.00
9. Teikasol - car wash		Syndet Company Pte Ltd	18.00
10. Clean All - Liquid Cleaner	750ml	Mason's Mixture Ltd	48.50
11. Harpic Fresh - Toilet Bowl Cleaner	500ml	Reckitt & Colman of	42.00
12. Care Liquid Toilet Soap		Anja Products ltd	41.55
13. Harpic Fresh - Toilet Bowl Cleaner	400ml	Reckitt & Colman of Ceylon Ltd	22.50
14. Cleaners		Anglo Asian Fertilizers Ltd	

CARBOLIC SOAP AND LAUNDRY SOAP

Name of the Product	Size	Manufacturer	Price (Rs)
1. Life Buoy	130g	Lever Brothers (Ceylon)Ltd	4.30
2. Sportsman	130g	The Swadeshi Industrial Works Ltd	4.20
3. Sal	130g	Harischandra Mills Ltd	4.15
4. Sunlight Laundry Soap	130g	Lever Brothers (Ceylon)Ltd	4.80
5. Sno-wite	130g	B.C.C. Lanka Ltd	4.50
6. Wonderlight	260g	Shiek Industries	8.50
7. Soverign Bar Soap	700g	B.C.C. Lanka Ltd	25.00
8. Sal Bar Soap	700g	Harischandra Mills Ltd	24.95
9. Snow Flakes laundry soap flakes	400g	B.C.C. Lanka Ltd	23.90
10. Rinso - Laundry Powder (New)	275g	Lever Brothers (Ceylon)Ltd	14.40
11. Foam - Detergent soap powder	225g	Sundet Company (Pte) Ltd	7.90
12. Whitol	500g	Chemical Industries (Colombo) Ltd	42.00
13. Bubble			
14. Attack			

BABY POWDER AND PERFUMED TALC

Name of the Product	Size	Manufacturer	Price (Rs)
1. Morison's Baby Powder	100g	M S J Industries (Ceylon) Ltd	14.50
2. Pears Baby Powder	100g	Lever Brothers (Ceylon) Ltd	17.50
3. Johnson's Baby Powder	100g		65.00
4. Cussons Baby Powder	100g		59.75
5. Cuddles Prickly Heat Powder	100g	Venture Aromatiques & Fragrances	14.00
6. Romia Talc	100g	Reckitt & Colman of Ceylon Ltd	19.50
7. Amanda Fragrant Talc	100g	Chemical Industries (Colombo) Ltd	23.90
8. No. 5 Perfumed Talc (Goya) Rose, Lavender, Jasmine	100g	Reckitt & Colman of Ceylon Ltd	32.00
9. Rebecca Lee Talc (New)	100g	International Cosmetics Ltd	16.75
10. Calamine Powder	68g	M S J Industries(Ceylon) Ltd	21.00
11. Gold Talc	125g	Reckitt & Colman of Ceylon Ltd	32.50
12. Sayonara Talc	125g	Ratnasiri Cosmetics (Pvt) Ltd	22.00
13. Voodoo Talc - Rebacca Lee	125g	International Cosmetics Ltd	32.50
13. Beauticura Talcum Powder		Mirando Industries	16.50
14. Minerva Jasmine	80g	Minerva Industries	10.90

LIST OF POPULAR FRAGRANCES SOLD IN
THE SRI LANKAN MARKET

COAT PERFUME - PRICE LIST

<u>SUVENDRA</u>	Joss stick, Talcum, Edc 450ml Rs. 900/=
<u>GARDINIA 44</u>	Edc, Talcum 450ml Rs. 400/=
<u>SANDALWOOD</u>	Joss stick, Edc, Talcum 450ml Rs. 750/=
<u>KEWDA</u>	Joss stick 450ml Rs. (J.S.)
<u>LUX</u>	Joss stick, Edc, Talcum 450ml Rs. 375/=
<u>ROSE</u>	Edc 450ml Rs. 250/=
<u>NIGHTQUEEN</u>	Joss sticks 450ml Rs. (J.S.)
<u>JASMIN</u>	Joss sticks 450ml Rs. 325/=
<u>FOGOURE 573</u>	Joss stick, Talcum, Edc 450ml Rs. 650/=
<u>B.A.</u>	450ml Rs. 90/=
<u>SOLAR</u>	Joss sticks 450ml Rs. 550/=
<u>CHARLEY</u>	Talcum, Edc. 450ml Rs.1100/=
<u>B.B.</u>	450ml Rs. 70/=
<u>SILVER FLOWER</u>	Joss sticks, Talcum, Edc. 450ml Rs. 700/=

ANNEXURE 7

PROJECT REPORT

PRODUCTION OF FRAGRANCES & FLAVOURS

C O N T E N T S

1. Introduction
2. Raw Materials
3. Process of Manufacture
4. Production and Packing Equipments
5. Formulation and Test Trials
6. Determination of the Factory Lay Out
7. Financial and Economic Aspects

ANNEXURE 7

Project Highlights

The project envisages the production of Fragrances and Flavours for industrial use, which will utilise some of the indigenously produced natural essential oils supplemented by imported aromatic chemicals, natural essential oils, resinoids and solvents, for meeting the domestic market needs.

During the course of field investigations, the variety of fragrances and flavours being sold in the Sri Lankan market were studied in depth alongwith the variety of commercial products in which the said fragrances and flavours were ultimately destined to be used.

The salient particulars of the project are as follows:-

- | | | |
|---|---|--|
| (a) Production Capacity | : | 1 M/T per day of fragrances and flavours |
| (b) Employment | : | 25 (Semi Skilled and Unskilled) |
| (c) Nett foreign exchange Saving | : | Approx. SLR 10 million |
| (d) Total investment | : | SLR 14 million (including land and building) |
| (e) Annual turnover on a production of 50 tonnes of fragrances and flavours | : | SLR 50 million |
| (f) Return of investment | : | 18% (minimum) nett. |

1. Introduction

Fragrances and Flavours are an essential ingredient of a great variety of consumer and industrial products, which have become part and parcel of modern life. Some of the more common and important products are:-

1. Soaps and Detergents
2. Air Fresheners
3. Joss Sticks
4. Cosmetics
5. Toilet and Beauty Preparation
6. Perfumes and Toilet Waters
7. Confectionery
8. Ice-Creams
9. Areated Waters
10. Liquors

All the aforementioned consumer products are made in Sri Lanka and represent industries which consume fragrances and flavours. The entire Sri Lankan requirement of fragrances and flavours is today met by imports from primarily European Companies and there is not a single indigenous manufacturer of these essential intermediate raw materials - namely fragrances and flavours of various kinds. The value of imports is estimated to be over SLR 100 million. The main suppliers are located primarily in the U.K., France, West Germany, China and India.

The intrinsic advantages of starting a Fragrance and Flavours Industry in Sri Lanka may be listed as follows:-

1. There is no other unit in the country at the moment, hence the first unit to commence manufacture will acquire the greatest hold over the market and also earn the maximum goodwill.
2. Small customers which always constitute a sizeable proportion of the market can be easily serviced by a local unit. At present they are either unable to import because of small requirements or else they have to pay very high prices to local dealers for the material. As a result this segment of the economy is under a constant constraint.
3. A local unit can through its creative division design products exclusively for the local market in accordance with local tastes and needs.
4. Since European Companies generally work on the basis of 200% margin on Raw Material costs, substantial savings can be effected all round by import substitution. The import bill of the country can be brought down by nearly 60% as far as fragrance materials are concerned. The benefit of reduction in costs can be passed on to the consumer, thus stimulating the consumer goods industry.
5. Since Sri Lanka is already a leading producer of spices and Essential Oils, the establishment of an integrated unit making Essential Oils, Aromatic Chemicals, Fragrances and Flavours is a distinct possibility. Such a unit would already have the basic infra-structure and as such pre-operative costs would thus be negligible. In addition, the locally distilled essential oils could be consumed by such an industry leading to greater viability of the essential oils sector. Apart from this, a large number of raw materials are available from neighbouring countries such as India, Singapore, Malaysia and Indonesia.
6. Technical know-how regarding manufacture of end products could be disseminated to prospective entrepreneurs through the Applications Division of such a unit, thus spurring the growth an important segment of the industry. In due course of time, such a unit would form the nucleus for general growth of the Essential Oils, Aromatic Chemicals, Fragrance and Flavours Industry in Sri Lanka.

Samples of fragrances and flavours being currently sold in the Sri Lankan market were collected from the market and from consumers, and analysed by the consultant. As a result of the analyses, new samples were prepared and submitted to the consumers and dealers in the market and a favourable response was received from them. This practical exercise was considered to be a prerequisite for generating confidence in the project and financial authorities towards taking up the implementation phase of the project.

2. Raw Materials

The only raw materials which are produced indigenously in Sri Lanka are:-

- i) Cinnamon Leaf Oil.
- ii) Citronella Ceylon Oil.
- iii) Lemongrass Oil.
- iv) Nutmeg Oil.
- v) Ginger Oil.
- vi) Clove Bud Oil.
- vii) Pine Oleoresin.
- viii) Black Pepper Oil
- ix) Capsicum Oleoresin.
- x) Ginger Oleoresin.

Of these the production of the following will be required to be augmented so as to provide a viable and continuing source of raw materials for the production of various aromatic chemicals vital for the production of fragrances and flavours:-

1. Cinnamon Leaf Oil.
2. Lemongrass Oil.

The processing of these natural essential oils will lead to the production of the following aromatic chemicals:-

A. Cinnamon Leaf Oil

- i) Eugenol.
- ii) Isoeugenol.
- iii) Methyl Eugenol.
- iv) Acetyl Eugenol.
- v) Methyl Isoeugenol.
- vi) Acetyl Isoeugenol.
- vii) Benzyl Isoeugenol.

B. Lemongrass Oil

- i) Citral.
- ii) Ionones - Alpha, Beta and Pure.
- iii) Methyl Ionone.

The cultivation of these essential oil bearing plants should be increased to the greatest extent possible. This will result in the following benefits:-

- (i) Increase in Agricultural Production and subsequently industrial production.
- (ii) Increase in employment in the agricultural sector and subsequently in the industrial sector.
- (iii) Import substitution of aromatic chemicals which will be procured from outside the country and consequent saving of valuable foreign exchange.
- (iv) Establishment of local sources of supply for the Fragrances and Flavour Project.

Apart from these the other raw materials required for the manufacture of Fragrances and Flavours may be detailed as under:-

(i) Aromatic Chemicals

- (a) Hydro carbons : Diphenyl Methane
- (b) Terpene Alcohols : Linalool, Terpeneol,
Geraneol, Citronellol
- (c) Diols : Propylene Glycol
- (d) Cyclic Alcohols : Menthol, Thymol,
Isopulegol

- (e) Aromatic Alcohols : Benzyl Alcohol, Phenyl
Ethyl Alcohol, Phenyl
Propyl Alcohol, Cinnamic
Alcohol
- (f) Phenols : Eugenol, Isoeugenol,
Paracresol.
- (g) Ethers : Phenyl Ethyl Methyl
Ether, Para Cresyl-Methyl
Ether, Diethylene Glycol
Mono Ethyl Ether, Beta
Naphthyl Methyl Ether
- (h) Acetals : Phenyl Acetaldehyde
Dimethyl Acetal
- (i) Aldehydes : Aldehyde C-9, Aldehyde C-
10, Aldehyde C-11,
Aldehyde C-12,
Benzaldehyde, Phenyl
Acetaldehyde, Vanillin,
Ethyl Vanillin, Hydroxy
Citronellal.

- j) Ketones : Camphor, Benzophenone, Ionones, Methyl Ionones.
- k) Acids : N. Butyric Acid, Isovaleric Acid, Caprylic Acid, Capric Acid, Phenyl-Acetic Acid.
- l) Esters : Ethyl Acetate, Butyl Acetate, Benzyl-Acetate, Isobornyl Acetate, Diethyl-Fthalate, Ethyl Laurate.
- m) Nitrogen Function Compounds : Musk Ambrette, Musk Xylol, Musk Ketones.
- n) Lactones : Coumarin, Methyl Coumarin, Aldehyde C-14.

Natural Essential Oils and Resinoids:-

- a) Citrus Oil : Bergamot Oil, Orange Oil, Lemon Oil.
- b) Others : Geranium Oil, Lavender Oil, Lavandin Oil, Peppermint Oil, Vetiver Oil, Petitgrain-Oil, Ylang Oil.
- c) Resinoids : Resinoid Benzoin, Resinoid Olibanum, Resinoid Oakmoss, Resinoid Labdanum.

This list is only indicative in nature and all these raw materials and many more would have to be imported from foreign sources as there is no indigenous production of aromatic chemicals and of essential oils other than those named above.

In comparison to the import of Fragrances and Flavours which is the current practice, import of raw materials and their subsequent blending into Fragrances and Flavours, inspite of import duty being the same would still result in substantial quantities of foreign exchange being saved because of the fact that European Companies work on the basis of a 200% margin on raw material costs and as such if only raw materials are imported into the country, this profit margin which constitutes 60% of the cost of any given product need not be paid out in foreign exchange.

The project particulars are elaborated in this report and relate to a manufacturing capacity of 50 M.T. per annum of the fragrances and flavours at an estimated capital cost of SLR 6,000,000/-. The value of production per annum of the output of fragrances and flavours is SLR 50,000,000/- at full capacity production which should be achieved within six to twelve months of operation.

The direct employment is 25 (semi-skilled and un-skilled) the benefits to local agriculture are substantial, and the value added as well as benefits in terms of import substitution can be assessed from the following calculation:-

	(Indigenous)
Total value of Production of fragrances and flavours (Imported)	: SLR 50 million
Total value of raw materials reqd	: SLR 25 million
Total value of equivalent quantity of Imported fragrances and flavours	: SLR 25 million

The expert will provide:-

- (i) Formulations of acceptable blends of Fragrances and Flavours.
- (ii) An Action Plan encompassing economic and technical parameters for the establishment of a viable production facility.
- (iii) Guidance for the identification and procurement of suitable production and packaging equipments.
- (iv) Practical technical assistance towards setting up a regular production facility and provide hands on training for local operators.

The formulations which will be used by the entrepreneur for production, will in the interest of commercial secrecy, be submitted to the entrepreneur separately.

The formulations used later on in the report for the purposes of costing and determining profitability are only illustrative in nature and fully indicative of the situation as will actually exist during the course of commercial production.

3. Process of manufacture:

A fragrance or a flavour may be defined as follows:

"Mixtures of odouriferous substances and mixtures (including alcoholic solutions) with a basis of one or more substances, of a kind used as raw material in industry."

- i) Of a kind used in the food or drink industries - Flavour
- ii) Others - Fragrances

Different kinds of Fragrances & Flavours are prepared by blending together a varying mixture of odouriferous substances each such mixture being governed by a fixed formulation.

The process of manufacturer of fragrances and flavours may be detailed as under:-

The heart of a flavour or a fragrance is the " FORMULATION ". A formulation is prepared by either studying and analysing the fragrance/ flavours to be duplicated or by imagining within the mind a fantasy of odours and smells in much the same way as a musician would imagine a symphony and put it down on paper as a musical score. In exactly the same way a perfumer perceives a fragrance or a flavour as a harmonious blend of various odours and puts it down on paper as a formulation.

1) Determination of the formulation:

This is done by mixing together very small experimental batches of the type of product desired to be made and then varying the formulation in small steps till the desired product is obtained. The formulation is said to be finalised at this stage and will always yield the same quality of product provided the raw materials used in the blending are of constant quality.

2) Blending of Raw Materials as per the formulation:-

The given formulation is taken and the raw materials mentioned there in are carefully weighed on a very accurate balance. The weighed quantities are added to a blending vessel and stirred for 4-5 hours under mild heating. This serves to ensure complete blending of the raw materials and maturity of the product. After maturity, the blended product is evaluated against the standard sample and if found to be acceptable, is packed and despatched to the customers.

3) Packaging:-

The types of packages used in this industry are generally as follows:-

- 1) 25 Gms. Glass bottles.
- 2) 100 Gms. Glass Bottles.
- 3) 500 Gms. Glass Bottles.
- 4) 5 Kilo H.D.P.L. Plastic Cans/G.I. Drums.
- 5) 10 Kilos H.D.P.L. Plastic Cans/G.I. Drums.
- 6) 25 kilos H.D.P.L. Plastic Cans/G.I. Drums.

The type of package to be used depends on the market for which the goods are destined.

The 25 Gms, 100 Gms and 500 Gms packs are generally taken by dealers who sell the same in turn to small manufacturers unable to buy large quantities at a time.

The 500 Gms, 5 Kg, 10 Kg and 25 Kg. packs are generally taken by the consumers themselves for self consumption.

The glass bottles are sealed with pilfer -proof caps using an appropriate machine and then labelled and further packed in card board cartons to ensure safe transit to their destination.

The establishment of a manufacturing facility for fragrances and flavours may be achieved in the following systematic steps:-

1. Establishment of a blending laboratory which contains all the available raw materials and facilities to weigh the same in small quantities.
2. Finalisation of the 'Formulations' to be used for the manufacture of fragrances & flavours by trying out various combinations of raw materials and selecting those found to be most suitable.
3. Procurement of all the raw materials occurring in the final formulations.

4. Establishment of the blending unit in neat and clean premises which are fully protected from dust, pests and flies and/or any other type of contamination. Provision within the premises of weighing, blending and packaging equipment.

Quality Control:

Quality control of fragrance and flavour substances as well as products derived from them, includes comparison of sensory and analytical data with standards and specifications.

In addition to organoleptic evaluation, analytical determination of identity and purity is used to establish the acceptability of fragrance and flavour materials. Single fragrance and flavour compounds are characterised by generally accepted physical constants such as density, refractive index, optical rotation and melting point. Determination of content by chemical data such as ester value and Carbonyl content are supplemented by spectroscopic techniques such as UV, IR & NMR, and by chromatographic procedures such as GC and HPLC.

Standardisation of complex flavour and fragrance materials such as essential oils are more difficult. In addition to organoleptic and physical properties, the content of certain typical components is determined. In addition modern chromatographic & spectroscopic analytical techniques are applied.

2. Production and Packing Equipments:-

The equipment required has been determined to be as follows for the Fragrance and Flavours manufacturing facility:-

Facilities Required:

1. FRAGRANCE AND FLAVOUR RAW MATERIAL STORAGE:-

2' deep racking all along the walls, floor to ceiling
1 no. each desk, chair and filing cabinet.

2. FRAGRANCE MANUFACTURING AREA:

Racks for storage of chemicals in use.
1 no safe of secure filing cabinet for keeping formulations.
1 no 6'x4' steel desk with laminated top and drawers which can be locked.
1 no stool or steel chair.
1 weighing balance 0 - 10 kg. Accuracy 0.1 gm.
1 weighing balance 0 - 30 kg. Accuracy 1 gm.
Aluminium bottles 5, 10, 25 litres for handling liquid chemicals
25 Cans for storage of powders.
Mugs/scoops/spatulas for transferring materials.
Weighing beakers/jars.
Tubs. Trays.
Mixing vessels with heating facility (tilting type + bottom outlet).
Blending Vessels (bottom outlet).

3. FRAGRANCE PACKING AREA + FINISHED GOODS STORAGE

Aluminium bottles 5, 10, 25 ltr for storage of compounds.
Weighing balance 0 - 5 Kg. Accuracy 0.1 Gm for packing.
Mugs beakers for handling.
25 ml, 100 ml and 500 ml glass bottles.
P.P. Caps for all three sizes of glass bottles.
P.P. Cap sealing machines with dies for all the sizes of P.P. Caps.
Labels.
Cartons.
Racks for storage of finished goods.
Working Tables.
Stools.
Trays/Trolleys.

FLAVOUR MANUFACTURING AREA

Racks for storage of chemicals in use.
1 no Safe or secure filing cabinet for keeping formulations.
1 no 6'x4' steel desk with laminated top and drawers which can be locked.
1 no stool or steel chair.
1 weighing balance 0 - 10 Kg. Accuracy 0.1 gm.
1 weighing balance 0 - 30 Kg. Accuracy 1 gm.

Aluminium bottles 5, 10, 25 litres for handling liquid chemicals.

SS Cans for storage of powders.

Mugs/scoops/spatulas for transferring materials.

Weighing beakers/jars.

Tubs. Trays.

Mixing vessels with heating facility (tilting type + bottom outlet).

Blending Vessels (bottom outlet).

(HOMOGENISER + BRUX METER IS REQUIRED EXTRA).

FLAVOUR PACKING AREA

FLAVOUR FINISHED GOODS STORAGE

Aluminium bottles 5, 10, 25 ltr for storage of compounds.

Weighing balance 0 - 5 Kg. Accuracy 0.1 Gm for packing.

Mugs beakers for handling.

25 ml, 100 ml and 500 ml glass bottles.

P.P. Caps for all three sizes of glass bottles.

P.P. Cap sealing machines with dies for all the sizes of P.P. Caps.

Labels.

Cartons.

Racks for storage of finished goods.

Working Tables.

Stools.

Trays / Trolleys.

DISPATCH AREA

WOOLEN/CARLBOARD CARTONS
PACKING GRASS / PAPER WASTE ETC.
NAILS, HAMMER
PEOX STRAPPING
STRAPPING MACHINE
STENCILS, MARKERS.

FRAGRANCE DEVELOPMENT LAB.

Weighing balance 0 - 1 Kg. Accuracy .001 Gm.
Glass conical flasks, beakers.
Aluminium Foil.
Self Adhesive Labels.
Magnetic stirrer with heating arrangement.
Reagent bottles.
Smelling Strips.
Working surface with shelves for storage of chemicals etc.
Exhaust, Ventilation and air conditioning.

FRAGRANCE STANDARD SAMPLES STORAGE

SAMPLE BOTTLES
REFRIGERATORS / COLD ROOM
SELF ADHESIVE LABELS
SMELLING STRIPS

FLAVOUR DEVELOPMENT LAB

Weighing balance 0 - 1 Kg. Accuracy .001 Gm.
Glass conical flasks, beakers.
Aluminium Foil.
Self Adhesive Labels.
Magnetic stirrer with heating arrangement.
Reagent bottles.
Smelling Strips.
Working surface with shelves for storage of chemicals etc.
Exhaust, Ventilation and air conditioning.

FLAVOUR STANDARD SAMPLES STORAGE

SAMPLE BOTTLES

REFRIGERATORS / COOL ROOM

SELF ADHESIVE LABELLS

SMELLING STRIPS.

G C + G L C LABE

GLC, Columns, Gases - Hydrogen and Nitrogen.

Refractometer

Optical rotation meter

Test Tubes, Beakers, Conical Flasks, R.B. Flasks, Heating mantle.

Water Bath, Stirring assembly, reflux condensers, thermoeters, addition.
flasks, funnels, petri dishes etc.

Analytical reagents.

Air conditioned & odour and dust free atmosphere.

Exhaust and ventilation to be very efficient., Working Surface,

Racking, Comfortable desk & Chairs.

Of the listing made above the following equipment will be procured from local sources:-

1. Slotted Angle racking
2. All furniture, safes and filing cabinets.
3. Glass Bottles.
4. P.P. Caps.
5. P.P. Cap Sealing Machine
6. Labels.
7. Cardboard Cartons
8. Wooden Crates.
9. Packing Grass / Paper wads.
10. Nails, Hammers, Box Strapping, Strapping Machine, Stencils, markers.
11. Exhaust Fans.
12. Air Conditioners.
13. Refrigerators.

All the other pieces of equipment listed above will be required to be imported.

5. Formulation and Test Trials:-

A fragrance or a flavour is a blended product and innumerable varieties may be produced by varying the mix of ingredients:-

Although theoretically an infinite number of permutations and combinations are possible, given the large variety of Fragrance and Flavour Raw Materials now available, in practice both Fragrances and Flavours can be divided into a certain number of classifications which form the fundamental building blocks all types of more complex fragrances and flavours.

Fragrances

The main categories are:-

1. Aldehydic
2. Floral.
3. Chypre
4. Fougere
5. Oriental
6. Green
7. Citrus

Using one or more of these, nearly every type of fragrance can be created. Each of these types is characterised by the use of certain typical ingredients.

All fragrance creations are made with the end product and end use always being kept in mind. This is necessitated by the fact that perfumes behave differently in different media and as such to achieve a satisfactory result, even within a given category, the same note may have to be created using different raw materials. For example Soaps are alkaline whereas shampoos are acidic. Furthermore, a fragrance does the job not only of giving the product in question a good smell, it also does the job of suppressing and disguising the malodour of the ingredients making up the product.

Thus to sum up it may be said that Fragrances have to be by and large tailor made products, designed especially for a given end product and thus to achieve the greatest success it becomes necessary to service each customer individually.

Flavours: The major categories are:-

1. Fruity
2. Vegetable
3. Spicy
4. Proteaceous
5. Fatty
6. Emphyreumatic
7. Fermented

What has been said above regarding fragrances is equally true of flavours and thus similarly the successful commercial application of flavours entails the production of custom made products.

The field investigation carried out by the expert established that a project to produce 50 M.T. a year of fragrances and flavours in assorted varieties is commercially viable. The estimated capital cost of the project is SLR 6,000,000/- out of which SLR 1 million is attributed to cost of machinery and equipment and the balance being the cost of building and civil works. The working capital is estimated at about SLR 8,000,000/-. The main machinery and equipment required are Racks for storage, weighing balances, mixing vessels, blending vessels, P.P. Cap, sealing machines, laboratory glass equipment, air conditioners, refrigerators, Gas Liquid Chromatographs, requisite furniture. Of these the weighing balances, mixing and blending vessels, laboratory glass equipment and Gas liquid chromatographs would be required to be imported and the balance equipment will be produced/fabricated locally.

The project generates a nett rate of return of 18% and is therefore commercially feasible. Initially raw materials would need to be imported, but foreign exchange savings would still be in excess of SLR 10,000,000/- per annum. Establishment of this project would also give a fillip to increase local agricultural output of Lemongrass Oil and Cinnamon Leaf Oil to be utilized for the manufacture of vital raw materials needed for the manufacture of Fragrances and Flavours, with a correspondingly larger impact on the foreign exchange balance.

The detailed layout of the fragrance and flavour sheds has been marked out to scale and the plan is also attached herewith,

The following areas have to be demarcated in these sheds:-

1. Fragrance and Flavour Raw Material Storage.
2. Fragrance Manufacturing Area.
3. Fragrance Packing Area.
4. Fragrance Finished Goods Storage.
5. Fragrance Development Lab.
6. Fragrance Standard Sample Storage.
7. Quality Control and QC Lab.
8. Flavour Manufacturing Area.
9. Flavour Packing Area.
10. Flavour Finished Goods Storage.
11. Flavour Development Lab.
12. Flavour Standard Samples Storage.
13. Despatch Section.

8. Financial and Economic Aspects:-

In order to be able to quantify the viability, the following calculations of costing, inclusive of interest, depreciation and general overheads have been made.

A typical formula - Jasmine 541 is used to illustrate the working of the unit:-

Jasmine 541

Raw Materials

Item	CIF Price Per Kilo (SLR)	Landed Cost per kilo (CIF Value + Duty) + BTI (SLR)	Parts per 100 Kg. of Compound	Cost (SLR)
1. Benzyl Acetate	100	146	30	4380
2. Amyl Cinnamic Aldehyde	250	365	20	7300
3. Aldehyde C-14	550	805	5	4025
4. Aldehyde C-16	550	805	5	4025
5. Benzyl Propionate	200	290	10	2900

6. Hydroxy Citronellal	600	875	10	8750
7. Linalool	450	660	5	3300
8. Hedione	2100	3070	2	6140
9. Methyl Anthranilate	225	330	8	2640
10. Yara Yara	250	365	5	1825
			<u>100</u>	<u>45285</u>

The cost of raw materials for

100 Kg. of Fragrance	SLR 45,285
Add 2% Spoilage Loss	906
Add 10% margin for depreciation of the rupee	<u>4,620</u>
	<u>SLR 50,811</u>

Therefore cost of raw material
per kilo of fragrance

SLR 508.11 (A)

Other inputs (per annum) (250 working days)

i) Labour	: 25 (Semi-skilled workers)	SLR 437,500
ii) Electricity	: (25 KWh per day - 8 Hour Shift)	SLR 87,500
iii) Freight & Factory overheads	:	SLR 1,000,000
		<u>SLR 1,525,000</u>

Targetted Annual Production : 50,000 Kilos

Therefore, cost of other inputs per
kilo of fragrance : SLR 30.50 (E)

Packaging:

Proposed packs for the packaging of fragrances are as follows:-

- i) 500 Gms. (Glass Bottles)
- ii) 5 Kg. (Plastic Cans)
- iii) 10 Kg. (Plastic Cans)

For the sake of costing, it is assumed that half the production is sold in 500 Gm bottles and of the balance, half is sold in 5Kg. packs, and half in 10Kg. packs.

The breakup of the total number of packs produced per annum is, therefore, as follows:-

Quantity packed in 500 Gms. bottles	:	25,000 Kg.
No. of bottles required	:	50,000
Quantity packed in 5 Kg. Cans	:	12,500 Kg.
No. of Cans required	:	2,500
Quantity packed in 10 Kg. Cans	:	12,500 Kg.
No. of Cans required	:	1,250

Cost per bottle/can is as follows:-

i) 500 gm glass bottle (inclusive of P.P. Cap)	SLR 6.70
ii) 5 Kg. Plastic Can	SLR 49.00
iii) 10 Kg. Plastic Can	SLR 79.00

Total packaging cost per annum is calculated as under:-

1) <u>In 500 Gms bottles</u>	=	SLR 335,000
50,000 x 6.70		
ii) <u>In 5Kg. Cans</u>	=	SLR 122,500
2,500 x 49.00		
iii) <u>In 10Kg. Cans</u>	=	SLR 98,750
1,250 x 79.00		
TOTAL:-		<u>SLR 556,250</u>

Therefore average packaging cost per kilo = SLR 11.12 (C)

To these costs of raw material, manufacturing and packaging, the following costs have been added:-

- i) Interest
- ii) Depreciation
- iii) General Overheads
- iv) Management Overheads.

1) Interest

Projected Investment:-

Plant, machinery, furnitures and fixtures	SLR 1,000,000
Land and Building	SLR 5,000,000
Working Capital requirement for raw materials for two montns	SLR 4,000,000
Working Capital requirement for finished goods for one month	SLR 4,000,000
	<hr/>
TOTAL	SLR 14,000,000

Interest @18% on term loan of SLR 6,000,000
(For land, building, machinery,
equipment, furniture & fixtures) = SLR 1,080,000

Interest @21% on working capital
limit (overdraft) of SLR 8,000,000
= SLR 1,680,000
TOTAL = SLR 2,760,000

Total cost of interest per kilo of fragrance = SLR 55.20 (D)

ii) Depreciation

Depreciation on fixed assets of

SLR 6,000,000 @15% = SLR 900,000

Cost of depreciation per kilo
of fragrance = SLR 18.00 (E)

iii) General Overheads (Per Annum)

Machinery Repair)
Building Repair } = SLR 1,000,000
Vehicle Repair }
Miscellaneous }

Therefore cost of general overheads per kilo of
fragrance = SLR 20.00 (F)

iv) Management Overheads

No part of overall organisational management overhead will be debited to the head of this industry since it will form a part of an existing company with the requisite staff already in place.

Total Cost per kilo of Fragrance:

may now be computed as under:-

(A)	Raw Material	SLR 508.11		
(B)	Other Inputs	SLR 30.50		
(C)	Packaging Cost	SLR 11.12		
(L)	Interest	SLR 55.20		
(E)	Depreciation	SLR 18.00		
(F)	General Overheads	SLR 20.00		
	Total	<u>SLR 642.93</u>	or say	643.00

The whole sale selling prices are calculated as under:-

<u>Item</u>	<u>List Price</u>
Jasmine 541	SLR 1000.00 per kilo

Discount Structure

On annual turnover of	SLR 50,000	-	2½%
On annual turnover of	SLR 100,000	-	5%
On annual turnover of	SLR 250,000	-	10%
On annual turnover of	SLR 500,000	-	15%
On annual turnover of	SLR 1,000,000	-	20%

If we assume allowance of maximum discount to all customers the gross profit may be calculated as under:-

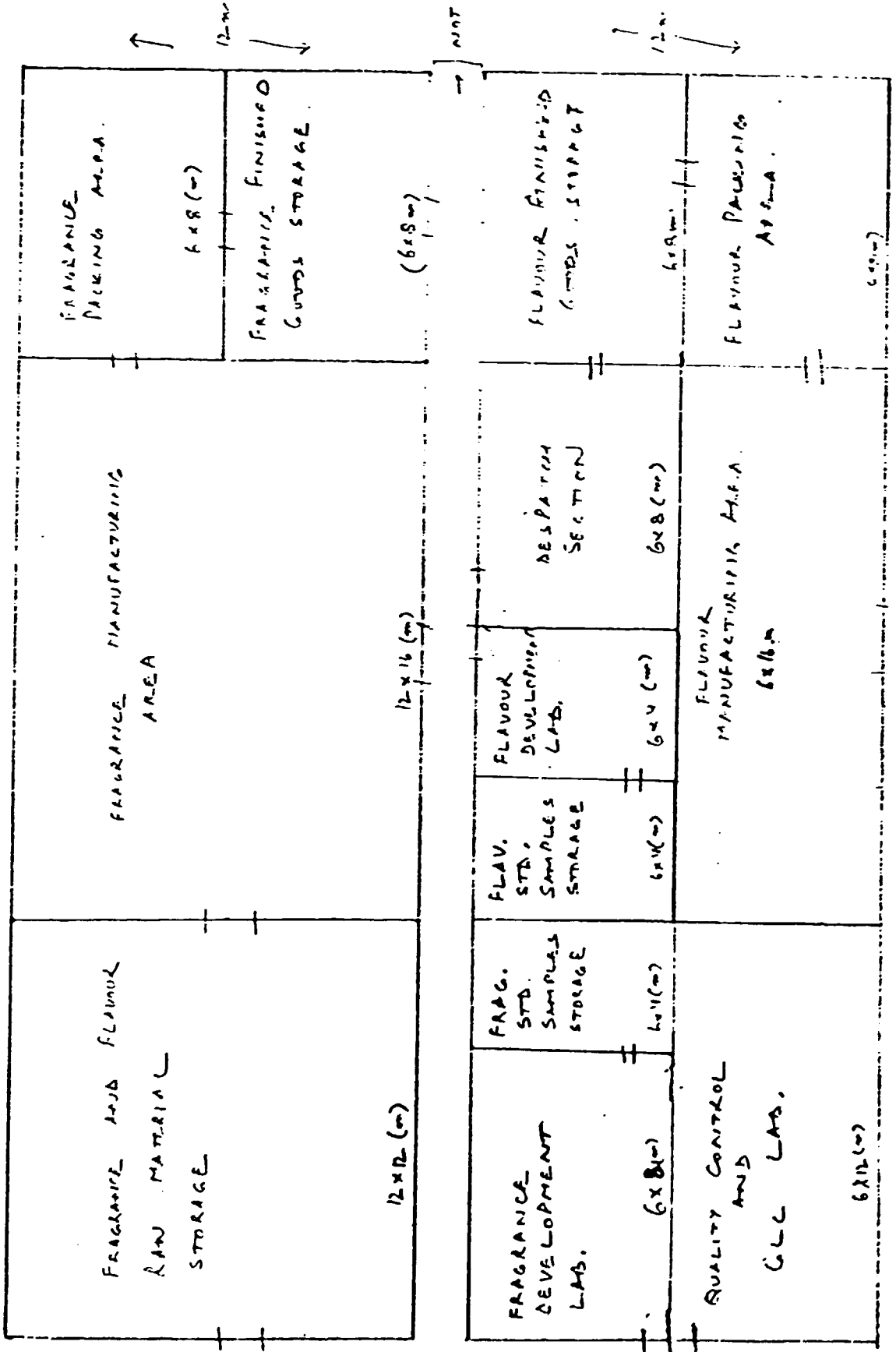
Total Annual Production	:	50,000 Kg.
Selling Price per kilo as per price list	:	SLR 1000.00
Less: Discount allowed C2G.	:	SLR 200.00
Nett effective sale price	:	SLR 800.00
Total Sales Revenue per annum	:	SLR 40,000,000
Total cost of production per kilo	:	SLR 643.00
Total cost of production per annum	:	SLR 32,050,000
Annual Gross Profit	:	SLR 7,850,000

All costs and figures have been worked out on the basis of a targetted annual production of 50,000 Kilos.

ANNEXURE 7A

SCALE 1cm → 1.5m

34m



ANNEXURE 8

LIST OF FRAGRANCE FORMULATIONS FINALISED DURING THE MISSION

1. Detergent Perfume

Borneol rich fraction	-	2
Terpeneol	-	3
Alpha Fenchyl Alcohol	-	3
Citral	-	1
Musk xylol	-	1
DEP	-	5
		<hr/>
		15
		=====

2. Fresh Lemon Fragrance

Terpeneol	-	1
Bergamot oil	-	1
Citral	-	5
Limonene	-	2
Linalyl Acetate	-	1
Aldehyde C-8	-	0.5
		<hr/>
		10.5
		=====

3. Detergent Fragrance A

Citronella oil ceylon	-	5
Geraneol Rich Portion	-	3
Musk xylene	-	1
Cedarwood oil	-	1
Aldehyde C-12 Lauric	-	1
Ionone 100%	-	2
Phenyl Ethyl Alcohol	-	1
		<hr/>
		14
		=====

4.	<u>Rose Fragrance</u>		
	Terpeneol	-	2
	Aldehyde C-9	-	0.5
	Geranyl Acetate	-	0.5
	Phenyl Ethyl Alcohol	-	10
	Linalol	-	0.5
	Nerol	-	1
	Geraneol	-	10
	Iso Eugenol	-	1
	Citronellyl Acetate	-	1
	Citronellol	-	20
	Dimethyl Octanol	-	10
	Rose crystals	-	2.5
			<u>59</u>
			=====
5.	<u>Fruity Fragrance</u>		
	Allyl Heptylate	-	2
	Ald C-16	-	2
	Lime oil	-	2
	Citral	-	0.5
	Amyl Acetate	-	0.5
	Amyl Butyrate	-	0.5
	Heliotropin	-	0.5
	Methyl Cinnamate	-	1
	Prunolide	-	1
	Coumarin	-	0.5
	Methyl Ionone	-	1
	Vanillin	-	1
			<u>9</u>
			=====
6.	<u>Lilac Fragrance</u>		
	Terpeneol	-	15
	Aldehyde C-11	-	0.5
	Aldehyde C-12 Lauric	-	0.5
	Alpha Amyl Cinnamic Ald	-	5
	Benzyl Propionate	-	5
	Citronellol	-	10
	Phenyl Ethyl Alcohol	-	10
	Coumarin	-	1
	Vanillin	-	1
	Eugenol	-	1
	Methyl Ionone	-	15
	Iso Eugenol	-	1
	Heliotropin	-	0.5
	Anisic Aldehyde	-	0.5
	Hydroxy citronellal	-	10
	Linalol	-	5
	Sandalwood oil	-	5
	DMBCA	-	5
			<u>91</u>

7. Aldehydic Fragrance

Aldehyde C-11	-	2
Aldehyde AA	-	1
Aldehyde C-12 lauric	-	1
Aldehyde C-9	-	1
Cedryl Acetate	-	3
Hydroxy citronellal	-	7
Citronellol	-	2
Heliotropin	-	1
Anisic Aldehyde	-	0.5
Vanillin	-	0.5
Clove Bud Oil	-	1
Linalol	-	1
Linalyl Acetate	-	1
DMBCA	-	3
		<hr/>
		22
		<hr/>

8. Jasmine Fragrance

Benzyl Propionate	-	10
Benzyl Acetate	-	10
Amyl Cinnamic Aldehyde	-	5
Linalyl Acetate	-	1
Jasmine Absolute	-	2
Aldehyde C-16	-	1
Benzyl Iso Valerate	-	1
Hydroxy Citronellal	-	3
Methyl Anthranilate	-	1
Musk Ketone	-	1
Civet	-	0.5
Indole	-	0.5
		<hr/>
		36
		<hr/>

9. Lavender Perfume

Lavender oil	-	10
Linalyl Acetate	-	3
Linalol	-	2
Aldehyde C-9	-	0.5
Aldehyde C-11	-	0.5
Coumarin	-	1
Vanillin	-	0.5
Musk Ketone	-	0.5
		<hr/>
		18
		<hr/>

10. Sandalwood Perfume

Aldehyde C-11	-	0.5
Arbanol	-	0.5
Cedryl Acetate	-	0.5
Cedarwood oil	-	1
Eugenol	-	0.5
Methyl Ionone	-	1
Iso Eugenol	-	0.5
Musk Ketone	-	0.5
Patchouli oil	-	0.5
Vetiveryl Acetate	-	0.5
Sandalwood oil	-	15
		<hr/>
		21
		===

11. Toilet Cleaner Perfume

Eucalyptus oil	-	5
Terpenyl Acetate	-	3
Limonene	-	1
Alpha Fenchyl Alcohol	-	2
Borneol Rich Fraction	-	5
Musk xylol	-	1
DEP	-	3
		<hr/>
		20
		====

ANNEXURE 8A

**INDUSTRIAL APPLICATION OF BY-PRODUCT FRACTIONS
OF SRI LANKAN ESSENTIAL OILS**

The major product areas in which the by-product fractions of Sri Lankan essential oils can be utilized are;-

1. Floor polishes
2. Air fresheners
3. Joss sticks
4. Liquid cleaners
5. Cleaning/Scouring Powder
6. Laundry Soap
7. Carbolic Soaps

TYPICAL FORMULATIONS

1. Detergent Perfume

Borneol Rich Fractions	-	2
Terpeneol	-	3
Alpha Fenchyl Alcohol	-	3
Citral	-	1
Musk Ketone	-	1
DEP	-	5
		<hr/>
		15
		===

2. Detergent Fragrance 'A'

Citronella oil Ceylon	-	5
Geraneol Rich portion	-	3
Musk Ketone	-	1
Cederwood oil	-	1
Aldehyde C-12 Lauric	-	1
Ionone 100%	-	2
Phenyl Ethyl Alcohol	-	1
		<hr/>
		14
		====

3. Toilet Cleaner Perfume

Eucalyptus oil	-	5
Terpenyl Acetate	-	3
Limonene	-	1
Citronella oil Terpenes	-	2
Alpha Fenchyl Alcohol	-	2
Borneol Rich Fractions	-	5
Musk xylol	-	1
DEP	-	3
		<hr/>
		22
		===

4. Anti-Mosquito Oil

Citronella oil Ceylon	-	15
Citronella oil Terpenes	-	5
DEP	-	5
Paraffin Liquid	-	5
		<hr/>
		30
		==

5. VIM Type Fragrance

Citral Rich Portion	-	3
Hydroxy Citronellal	-	7
Petitgrain oil	-	1
Citronellol	-	2
		<hr/>
		13
		===

ANNEXURE 9

CONDUCT OF TRAINING COURSE FOR TECHNICIANS OF CISIR

The course was attended by the following personnel of CISIR:-

1. Miss. S de Costa
2. Mr. K R Dayananda
3. Mrs. Kamani de Silva
4. Miss. S Jayakody

The details of the topics covered were as follows:-

1. Fragrance - Industrial

(a) Definition : Any mixture of two or more odouriferous substances, of a type used in industry.

- | | |
|----------------------------|------------|
| (i) Of a type used in food | FLAVOUR |
| (ii) All others | FRAGRANCES |

Thus it was explained that for the purposes of the programme which was mainly concerned with the industrial use of fragrances, it was necessary to abide by the aforementioned definition which is now used internationally as per the Brussels Trade Nomenclature.

(b) Uses: Since the programme was concerned with the use of industrial fragrances, the possible use of such fragrances were explained and are listed below:-

(i) Household Products

Soaps and Detergents
Cleaners
Disinfectants
Polishes
Paints
Adhesives
Air Fresheners

(ii) Personal products

Cosmetics : Make up products
Toilet and Beauty preparations
Perfumes and Toilet Waters

(iii) Industrial Products

Dry cleaning
Leather & Rubber Articles
Artificial Leather
Linoleum
Plastics
Printing inks, Perfumed Board & Paper
Textiles

(iv) Agricultural Products

Insecticides
Insect and Animal Repellents
Animal Baits & Attractants
Veterinary Products
Cattle Feeds

(c) Classification

After detailing the uses of various fragrances, the major classes/categories into which fragrances can be divided were described and the same are detailed below:-

1. Green Fresh
2. Green Balsamic
3. Fruity Fresh
4. Floral Fresh
5. Floral Rose
6. Jasmine
7. Floral - sweet (Lilac)
8. Aldehydic - Floral
9. Aldehydic - Floral-woody-powdery
10. Fresh - Mossy - Aldehydic (CHYPRE)
11. Floral - Mossy - Animalic (CHYPRE)
12. Mossy - Fruity (CHYPRE)
13. Oriental
14. Leather
15. Fougere
16. Citrus - classic
17. Citrus - Fixed
18. Cool - Floral
19. Lavender Notes
20. Spicy Notes
21. Woody
22. Musk Notes

2. Raw Materials used in Fragrance Industry

The variety of raw materials used in the fragrance industry was discussed and the diversity of sources from which these raw materials are derived was discussed and explained. The technical classification of raw materials was also discussed and explained.

3. Proper Methods of Odour Evaluation

The importance of precise and correct odour and sensory evaluation in the industry was discussed in detail. The importance thereof in industry from the technical as well as the commercial points of view was explained.

4. Terminology used in Fragrance/Flavour Industries

The technical and commercial terms used in the international perfumery industry were explained and a full glossary of the terms used was prepared and explained.

5. Combinations and Accords used in Fragrance & Flavour Industries

The formulations used to produce fragrances as per the classification mentioned above were discussed and typical formulas for each category were provided.

6. Production of Fragrances and Flavours

The practical procedures used in production, the correct methodology for the same, the equipment required and the precautions to be taken were explained and discussed in detail.

7. Use of Odour Evaluation Ability to do Compounding and Blending as well as Quality Control

Olfactory assessment and instrumental quality control methods and their technical and commercial importance was explained. The methodology of selection of a fragrance for any particular applications and the technical and commercial considerations involved were explained.

Concepts of standardization as well as custom production were explained.

ANNEXURE 10

GLOSSARY OF TERMS RELATING TO NATURAL AND SYNTHETIC
PERFUMERY MATERIALS

In the preparation of this glossary, most of the terms currently in use in natural and synthetic perfumery trade and industry together with their synonyms and more common terms in vogue internally and also in other countries have been included.

Terminology

1. **Absolutes:** An ethanolic extract of a concrete or a resinoid which contains the maximum concentration of odoriferous components and is free from natural waxes and/or any solvent used in the processing.
2. **Acid Value:** It is numeric value equivalent to the number of milligrams of potassium hydroxide required to neutralize the free acids present in 1 g of the material.
3. **Alcohol Perfumery Grade, Denaturated:** Rectified ethyl alcohol, specially denaturated for perfumery industry, and by the addition of denaturants it thus not at any undesirable by-odours to it.
4. **Aldehydic Blend:** See 13
5. **Amber Note:** A heavy full-bodied warm ambergriss like note.
6. **Animal Note:** Odours or notes with a sensuous character.
7. **Aromatic Chemicals/Aroma Chemicals:** Organic chemicals derived by organic synthesis or as isolate from natural essential oils possessing distinct aroma. Used as raw material for the preparation of perfumery blends or flavours.
8. **Aromatic Plants:** See 92
9. **Aromatic Water:** Aqueous odoriferous condensate of hydro-distilled and/or steam-distilled material of vegetable origin containing fully dispersed essential oil.
10. **Attar (Indian):** A perfume concentrate characteristic of single flower or a mixture of flowers and/or other materials of plant or animal origin with oil of sandalwood as the base.
11. **Balsam:** An odoriferous exudate from plants/trees which flows naturally or is artificially induced by incision
12. **Blend:** Harmonious combination of two or more odouriferous materials.
13. **Blend Aldehydic:** Blend deriving their unique character from the predominance of aldehydic notes.
14. **Blend, Cologne:** Any harmonious combination of fragrances, the main characteristics of which are derived from citrus oils.
15. **Blend, Oriental:** A blend with heavy, full-bodied sweet balsamic and animal note.
16. **Blend, Spicy:** Any fragrance combination having spicy overtone.
17. **Blend, Woody:** Any fragrance dominated by a woody character.

18. **Body:** Main fragrance theme.
19. **Boiling Range:** See 40
20. **Bouquet:** Generally a harmonious combination of two or floral notes.
21. **By-Note:** A temporary or permanent odour effect additional to the main pattern of odour effect additional to the main pattern of odour associated with the material.
22. **Carbonyl Value:** It is numerically equivalent to the number of milligrams of potassium hydroxide, that is, equivalent to the amount of hydroxylamine required to oximate the carbonyl compounds present in 1 g of material.
23. **Cell:** A unit of the plant tissue
24. **Cellular:** Composed of cells.
25. **Chypre:** A mossy-woody fragrance, complex with a characteristic sweet citrus top note, frequently encompassing some floral tones.
26. **Citrus:** Odours reminiscent of citrus fruits, such as orange, lemon, bergamot, grapefruit, etc.
27. **Cologne:** Name used traditionally for solution of citrus perfume blends in aqueous ethanol (also see 113).
28. **Cologne Blend:** See 14
29. **Concentration:** See 94
30. **Concentrated Perfume:** See 86
31. **Concrete:** A material derived from a single source of vegetable or animal origin by extraction with a suitable solvent. It generally contains non-odouriferous constituents, such as waxes, coloring matter etc, in addition to odoriferous components and is free from any solvent used in the process.
32. **Condensate:** Vapours that have been condensed .
33. **Condenser:** Part of distillation apparatus where the hot vapours are cooled and condensed for recovery.
34. **Congearing Point:** It is the maximum constant temperature at which liquefied solid resolidifies.
35. **Deterpenized Oil:** Natural essential oils which are free from terpenes and/or sesquiterpenes.
36. **Diffusion:** The ability of a fragrance to radiate and permeate the environment.
37. **Distillation:** A process of evaporation and recondensation used for purifying liquids.
38. **Distillation, Dry:** Distillation of semi-solid and solid materials in the absence of steam, water, or any other solvent.
39. **Distillation, Hydro:** Distillation of a substance carried out by indirect contact with boiling water.
40. **Distillation Range:** It is the range of temperature within which a specified percentage of the material distils.
41. **Distillation Steam:** Distillation of a substance by passing steam through it.
42. **Distillation, Vacuum:** Distillation of a substance under reduced pressure.
43. **Distillation, Water:** See 39.

44. **Dry Distillation:** See 38.
45. **Dry Out:** Final phase of the main fragrance after the main volatile constituents have evaporated.
46. **Enfleurage:** Process of extracting fragrance of fresh flowers by intimate contact with mixture of purified fats preferably at low temperatures.
47. **Essential Oil:** It is volatile perfumery material derived from a single source of vegetable or animal origin by a process, such as hydrodistillation, steam distillation, dry distillation or expression.
48. **Essential Oil, Synthetic:** It is a composition generally consisting of natural essential oils, aromatic chemicals, resinoids, concretes, absolutes, etc, but excluding animal or vegetable non-essential oils and not having a non volatile residue in excess of 10 percent by mass. It is so composed that it bears a close resemblance primarily in odour to a naturally occurring essential oil.
49. **Ester Value:** It is numerically equivalent to the number of milligram of potassium hydroxide required to neutralize the acids liberated by the hydrolysis of the esters present in 1 g of the material. It represents the difference between the saponification value and the acid value of the material.
50. **Ester Value After Acetylation:** It is numerically equivalent to the number of milligrams of potassium hydroxide required to neutralize the acids liberated by the hydrolysis of 1 g of acetylated material.
51. **Evaporation Residue:** Represents the percentage of perfumery material which is not volatile when heated on a steam-bath under specified conditions.
52. **Expression:** The process of extracting essential oil from the plant cells by application of mechanical pressure.
53. **Extract:** A concentrated product obtained by treating a natural perfumery material with a solvent which is subsequently evaporated.
54. **Extraction:** The process of isolating essential oil with the help of a volatile solvent.
55. **Extrait, Alcoholic:** A French word, now universally used in perfumery, meaning an alcoholic extract of odorous parts of a pomade. It is generally used to mean alcoholic solution of a perfume concentrate.
56. **Fixative:** A substance which is compatible with and provides body and substantivity and rounds off a perfume composition by regulating the rate of evaporation of its volatile constituents.
57. **Flavour:** A combined organoleptic sensation of aroma and taste in a flavouring material is also called a flavour.
58. **Floral:** The fragrance characteristic of an existing known flower type.
59. **Fore Runnings:** Initial fractions of the distillate obtained during a distillation process.
60. **Fougere:** Perfume composition having a citrus/lavender top note with sweet powder rosaceous body with mossy/woody background.

61. **Fractionation:** The process of distillation by which an essential oil is separated into various fractions.
62. **Fruit Flavour/Essence:** Suitably blended mixtures of flavouring materials, permitted chemicals and food colours, in a solvent medium of either ethanol or the permitted non-alcoholic solvents.
63. **Fruity Note:** The impression of fruit odours within the fragrance theme.
64. **Full Bodied:** A well-rounded-out fragrance that possess depth and substantivity.
65. **Green Note:** Notes that recall fresh-cut grass, leaves and stems or other parts of plants.
66. **Gum:** A natural water soluble anionic material, often of glycoside-like structure and of high molecular mass which collects in or exudes from certain plants. It forms neutral or slightly acidic solution or a sol with water and has a typical mild odour.
67. **Gum Resin:** Natural exudation from plants and trees consisting of gums and resin with very small amounts of essential oils.
68. **Harmonius:** Order, accord and symphony in a fragrance.
69. **Heavy:** Oriental balsamic as against floral/green.
70. **Hydro Distillation:** See 39
71. **Infusion:** A process of treating a substance with water or organic solvent
72. **Isolate:** Either a single constituent or a multi-component fraction or a composited fraction, rich in desired odoriferous components and derived from a natural perfumery material.
73. **Lasting Qualities:** The ability of a fragrance to retain its character over a given period of time.
74. **Leathery Note:** Any fragrance conveying the dominant characteristic of tanned leather.
75. **Melting Point:** The temperature at which the material melts and becomes liquid throughout as shown by the formation of a definite meniscus.
76. **Melting Range:** The range between temperatures at which the material begins to form droplets and at which it becomes liquid throughout.
77. **Middle Note:** The main overall odour effect experienced by olfactory nerves on smelling a strip impregnated with a material and exposed to the atmosphere for some time.
78. **Mossy Note:** The notes that recall to mind moist dark forest having moss on the trees.
79. **Natural Perfumery Materials:** Perfumery materials of natural origin.
80. **Odour:** That property of a substance which stimulates and is perceived by the olfactory sense.
81. **Oleoresin:** Exudations from tree trunks or barks of trees and are characterized by the fact that these consist of entirely or mainly resin accompanied with an essential oil in varying percentages, soluble in organic solvents.
82. **Oleoresin Gum:** An exudation from plants mainly consisting of essential oil, resin and gum.

83. **Oleoresin, Spice:** Extractables of spice having resin and essential oil obtained by solvent extraction.
84. **Oriental Blend:** See 15.
85. **Perfume:** A solution of perfumery compound/compounds in ethanol or other suitable solvents meant for use as a personal adornment. Here ethanol or other suitable odourless solvents are used as carriers for the fragrances.
86. **Perfume Concentrate:** A non-alcoholic concentrated perfume blend.
87. **Perfumery Compound:** A concentrated base which is further diluted with or without toning and further modifications to suit various end-uses.
88. **Perfumery Grade Alcohol:** See 3
89. **Perfumery Material:** A naturally occurring substance, or a derived material, or a preparation obtained by physical and/or chemical means, which diffuses or imparts an odour or a flavour.
90. **Perfumery Materials, Natural:** See 79.
91. **Perfumery Materials, Synthetic:** See 107.
92. **Plant, Aromatic:** Plant bearing a characteristic aroma.
93. **Pomade:** Refined and deodorized animal fat (s) saturated with volatile oils present in and exhaled from the flowers especially the rose and the jasmine.
94. **Rectification:** Method of separation of undesirable substance to improve the quality of the materials.
95. **Relative Density:** The ratio of density of material at 27°C to that of distilled water at 27°C or 4°C when all masses are made in air is called relative density at 27°C or 4°C. Originally, it was known as specific gravity.
96. **Residual Note (Dry Out Note):** An odour effect experienced by olfactory nerves on smelling a strip impregnated with a material and exposed to the atmosphere for a period of time when the top and the middle notes have disappeared.
97. **Resin:** Solid or semi-solid translucent exudation from trees of plants. These are soluble in organic solvents.
98. **Resinoid:** A semi-fluid or a solid material obtained from a single resinous source of vegetable or animal origin by extraction with a suitable solvent and is free from solvent used in the process.
99. **Saponification Value:** It is numerically equivalent to the number of milligrams of potassium hydroxide required to neutralize the free acids liberated by hydrolysis of the esters present in 1 g of the material. It represents the sum of acid value and ester value.
100. **Saponification Value After Acetylation:** It is numerically equivalent to the number of milligrams of potassium hydroxide required to neutralize the free acid and the acids liberated by hydrolysis of the esters present in 1 g of the acetylated product.
101. **Sesquiterpene:** Term denoting a hydrocarbon composed of one-and-a-half terpene units, a single terpene unit being equal to two isoprene units.

- 102.Sesquiterpeneless Oil:** An isolate obtained by suitably removing the sesquiterpenes ($O_{15}H_{24}$) from an essential oil.
- 103.Specific Gravity:** See 95.
- 104.Spice Oleoresin:** See 83.
- 105.Spicy Blend:** See 16.
- 106.Steam Distillation:** See 41
- 107.Synthetic Perfumery Materials:** Man-made single perfumery materials, by chemical processes.
- 108.Tail Running:** The last fraction of distillate obtained in a distillation process.
- 109.Terpeneless Oil:** An isolate obtained by removing almost all monoterpenes ($C_{10}H_{16}$) from an essential oil.
- 110.Thin:** The lack of body, richness and substantivity.
- 111.Tincture:** A cold alcoholic extract of the soluble part of a natural fragrant material of vegetable or animal origin, the solvent being left in the extraction as a diluent.
- 112.Tissue:** Plant structure composed of cells.
- 113.Toilet Water:** See 27.
- 114.Top Note:** The first odour effect experienced by olfactory nerves on smelling a strip freshly impregnated with a perfumery material.
- 115.Vacuum Distillation:** See 42.
- 116.Vacuum Distillation Residue:** It is the percentage of material left behind undistilled when a known quantity of the material is distilled in vacuum at specified temperature and pressure.
- 117.Volatile:** A material is said to be volatile when it has the property of evaporating at room temperature when exposed to atmosphere.
- 118.Water Distillation:** See 39.
- 119.Woody Blend:** See 17.
- 120.Woody Note:** The impression of wood or woody odours within the fragrance theme.

ANNEXURE 11

NATIONAL WORKSHOP IN ODOUR EVALUATION AND
CREATION OF FRAGRANCES

Introduction

This report sets out in detail the structure of such workshops which should be conducted in future to achieve the following objectives:-

- (i) Utilization of indigenously available raw materials and their derivatives to produce fragrances, using local expertise developed through the medium of such workshops.

Background

The expert conducted a training course on Odour Evaluation and Development of Local Expertise in creation of fragrances using locally available raw materials in Colombo during the mission. As a result of this training course, a number of workable formulations were evolved which were almost wholly based on the utilization of Sri Lankan essential oils and the isolates and derivatives produced from them. These formulations were found to be suitable for use in local industries such as detergents and laundry soaps.

Objective & Achievement

The objective of this exercise in Colombo was to enable the local technicians to gain further experience and knowledge in Product Development and Creation of Downstream value added products of immediate relevance to the local industry. This project which is concerned with the processing of Sri Lankan Essential Oils to produce Aromatic Chemicals would directly benefit from the incorporation of such an objective and its achievement.

Conclusion

It is concluded that such an input via the medium of workshops should be provided to every technical institution and private industry concerned with the production and processing of essential oils, to enable the beneficiaries to learn to utilise the essential oils and start the manufacture of value added products thus directly contributing to the national growth and development.

Such workshops should be structured on the following pattern, covering the undernoted topics:-

1. Odours and sense of smell; Odour Description and classifications.
2. Aromatic Materials from Natural Sources
3. Aromatic Chemicals
4. Derivatives of Essential oils & Aromatic specialities
5. The Historical Development of Perfumery
6. Extrait Perfumes & Toilet waters

7. Perfume briefing; perfume creation and compounding
8. Application of Perfumes
9. Quality Control & Quality assurance
10. The Perfume Industry

The workshop should be intended to be a foundation course primarily for new entrants to the perfume industry who wish to undertake the study of the principles and practice of perfumery.

A programme of sensory work should form an integral part of the course and for this purpose students should be provided with a set of Aromatic materials and smelling strips.

ANNEXURE 12

**ACTION PLAN FOR THE INTEGRATED DEVELOPMENT OF THE
ESSENTIAL OILS, AROMA CHEMICALS AND
FRAGRANCE/FLAVOUR INDUSTRIES**

The following steps should be taken to ensure the development of essential oils and related industries:-

1. Establishment of new essential oil bearing crops such as lemongrass oil, citronella jawa oil, Litsea cubeba oil, turpentine oil, palma rausa oil and eucalyptus citriodora.
2. Establishment of a properly equipped facility for the production of isolates and derivatives from local essential oils.
3. Establishment of a fragrance/flavour research and development laboratory specializing in both quality control as well as creative perfumery.
4. Establishment of a properly equipped facility for the production of fragrances/flavours.
5. Establishment of Applications laboratories for cosmetics, soaps and related products.
6. Establishment of courses for Sri Lankan entrepreneurs to absorb, assimilate and use the essential oils, aroma chemicals, fragrances and applications technology.
7. Development of a complimentary course to acquaint the entrepreneurs with international trading and marketing practices.

**RELATED BENEFITS LIKELY TO ACCRUE TO SRI LANKA
DUE TO THE ESTABLISHMENT OF
AFOREMENTIONED FACILITIES**

- (i) Establishment of a new pioneering industry directly leading to the introduction of new technology.
- (ii) Generation of new employment opportunities in both industrial as well as agriculture sector.
- (iii) Production of import substitution items and consequent saving in foreign exchange.
- (iv) Establishment of the market for locally produceable raw materials due to local consumption in addition to exports.