UNIVERSITY OF COCHIN

B. Tech. Course.
In Rubber Processing and Technology.

PROJECT REPORT
ON A SMALL SCALE UNIT FOR MANUFACTURE OF RUBBER GLOVES FOR HOUSEHOLD AND OTHER GENERAL USES.

DISSERTATION REPORT

Submitted by

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In Partial fulfilment of
B.Tech. Degree.

FORWARD

This Project Report is prepared and submitted in the form of a dissertation, unlike projects to procure loans to start new industries. The primary mission is the partial fulfilment of my technical degree. This, I believe, will justify the inclusion of technical informations.

I take this opportunity to express my thanks to all who helped me in my work, particularly to Mr. C.M. George, Project Officer, Mr. P.V. Thomas, Deputy Director, Mr.P.U. George, Cost Accounts Officer, and Mr. M.K.B. Nair, Chemical Engineer, of Rubber Board.

Kottayam-9,
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Section A. INTRODUCTION

The production of relatively thin walled articles by the external deposition of elastomeric compounds is an old process of which gloves were one of the main items. Before the use of latex such products were made from solutions of rubber compounds in solvents. With the advent of concentrated latex the solvent cement dipping procedures were revised and applied to latex. Since its introduction latex based industries grew stead fast exploiting its adventages over dry rubber process such as less capital requirement, less hazardous operations and better physical properties.

At present a wide range of rubber products are made by latex dipping. Possibly the most practically significant of these are the various types of gloves: surgeon's gloves, Household gloves, Electrician's gloves, Industrial gloves, Postmortem gloves, Ward-dressing & Porters gloves etc. The other products are contraceptives, teats, nipples, balloons, etc.

Object

The proposed unit is for the production of gloves for household and other general purpose uses. However it can be made use of for the production of other types of gloves with little or no change in process, machinery and/or equipment.

Section B. MARKET SURVEY

A survey is done with a view to finding out the present position of household gloves in the market. The data collected are summarised below:

1. The Domestic Market:

   1) The consumers: At present the major users of household gloves are people in urban areas, for protecting their hands while

undertaking domestic work. Gloves of this type are also used by workers in food processing factories. In suburban and village areas this has very little consumption.

(ii) Availability: The product is not readily available. In urban areas isolated shops are there which have gloves in their list. In latter areas fewer shops sell this, but the quality of sales is very low.

(iii) The Existing Product and Prices

Below given table gives some idea of the existing product in the market.

Size	Thickness	Colour	Price per pair	Structur
Gents Size 10"	0.3-0.4	Black & red	Rs.5.25/=	Plain
Lale Ladies Size 8"	0.3-0.4	"	Rs.4.75/=	Plain
6, 6½, 7, 7½, 8	0.2-0.3	No colour	Rs.3.50/=	Roughening in palm

Mostly available type is the last one in the table. Consumers have a preference to this, may be due to its lower price.

(iv) ~~At-Present~~ Sales & Distribution:

The sales and distribution is through general stores and medical shops.

(v) Present Production:

According to the licences issued up to 1975, there are 18 units in India licenced to produce household gloves. Since no statistics are avilable regarding household gloves, it is difficult to estimate the present production.

2. Export Market

Export statistics doesn't say any-thing specific about the export of household gloves. But gloves like surgical gloves have

export, the quantity of which in 1973-74 being 35 lakh numbers. (Monthly statistics of Foreign Trade of India). In developed nations household gloves have very good demand. In the light of the export of surgical gloves, it may not be wrong to state that there is a good export potential for household gloves.

Section C. FEASIBILITY AND PROSPECTS

Based on the previous chapter it can be seen that gloves of the proposed type are not very popular in India. In such a situation will it be feasible to start a unit for its production? In the following paragraphs an attempt is made to study the feasibility and prospects.

1. Fields of use and advantages

(i) For kitchen use - Rubber gloves is the ideal one because it can be easily cleaned, nontoxic and comfortable to wear. Expecially during winter when water is very cold wearing of gloves is helpful for washkng purposes. Flocked gloves are especially useful for this.

(ii) For other household use - Rubber gloves finds use in cleaning purposes. It gives protection against diseases like Ecema, which is caused by repeated milking of cattle and cleaning of cattle sheds.

(iii) In agriculture - To labourersfor protection against diseases caused by handling of dirty materials, and other corrossive and allergic materials.

(iv) To people working in Laborataries - For protection against

corressive and other harmful chemicals.

(v) To workers in food processing industries where neatness and tideness are essential.

(vi) To two-wheeler drivers, for protection of palm against chilling during a winter ride. Flocked gloves have more advantages for this purpose. At present woolen gloves are used for this purposes. But rubber gloves will be better due to its light weight and good grip with the vehicle handle.

A number of such fields where gloves find use can be pointed out. A In developed countries extensive use of gloves can be observed.

2. Feasibility:

The advantages offered by rubber gloves compared with other gloves are

a) Lesser weight and thickness and hence good feel

b) Can be easily cleaned.

c) Can be cleaned while wearing.

d) No water absorbtion tendancy.

e) Resistance to detergents and many other materials.

Even having all the above advantages household gloves have little demand in India? The reasons can be given as follows:

(i) The price of the gloves available now-a-days are a bit higher; beyond the reach of a common man.

(ii) Poor quality of the gloves available - After two or three washings it develops tackiness. Also it has draggy surfaces and hence will not permit them to be easily pulled on and off the hands.

(iii) Lack of giving education - Majority of the people in India

do not know anything about gloves and they havn't even seen gloves. Lack of advertising and other sales promotion programmes can be said as a reason for this.

(iv) Inefficient marketing methods ~~by~~ of the present manufacturers- the product is not available near the consumers.

If these can be solved and rectified there will be a good demand for the product. The enterpreneur has to take necessary steps for these things. Appropriate considerations for this are given in cost calculations and manufacturing process in this report.

India ranks fer behind in the per capita consumption of rubber, as depicted in the following table.

Country	Per capita rubber consumption, kg.
U S A	14.90
Canada	11.14
Australlia	8.97
France	~~8.96~~ 9.90
Japan	8.96
India	0.26
Brazil	1.97
Italy	9.64

The quick development programmes undertaken by the government to increase the national income and hence the purchasing capacity of the people will surely aid in raising the per capita rubber consumption to a level comparable with that of other developing countries. So there is a good chance that consumption of gloves can be

increased.

The real potential demand for gloves is in the rural areas and very high growth rate will be observed in the event of satisfactory growth in the agricultural output which will increase the rural purchasing power.

The above facts shows that it is feasible to start a new unit for producing gloves for household and other general purposes. It can be further emphasized by the growth of similar consumer products; products which can ~~sh~~e show the civilization of a nation. Such products selected for comparison are foot wear and garments.

The growth rate of foot wear use in India was very fast during the past few years. A couple of decades back only few people in India were used to wear footwear. But now the situation has changed very much. Even in wrural areas footwearc is used extensively. Foot wears are now available in plentiful designs and decorations which shows the growth of the industry. A very similar trend can be seen in the case of garments also. A pecularity of these items is that once people start using it, they will never abandon its use. The above facts clearly shows that use of gloves will also increase fastly, if proper promotion steps are taken.

3. Production Estimation

The usual techniques of projecting the ~~c~~ consumption and subsequent fixation of units to ~~b~~e produced cannot be adopted here due to the unavailability of ststistics. However an approximate production estimation can be done as below.

The p~~o~~pulation of India is 60 crores and approximating on an an average 6 members in a family, the number of families in India

is 10 crores. ~~&~~ If two percent of the families uses one pair of gloves per year the consumption will be 20 lakh pairs per annum.

Adding up the total yearwise production of Scooters and Motor cycles in India during 1970-'75, the total ~~nym~~ number of scooters are 4,65,681 and that of motor cycles ~~2~~,02,827. These will add to 768508 (Oil statistics, Jan - Mar 1976). Assuming 5 percent of the two wheeler drivers using rubber gloves, the annual consumption will be 39,000 pairs.

The number of recognized colleges in India in 1970 ~~i~~ was 3604 (Times of India ~~Diary,-19~~ Directory 1974). Assuming on an average 100 students per college working in laborataries (Chemistry & Zoology) and 3 percent of them using rubber gloves, the annual consumption will be around 10,000 pairs.

Adding ~~et~~ up the consumption figures given in the above three paragraphs, the total estimated consumption will be 20,50,000 pairs per annum. Hence a production of 5,00,000 pairs annually would be feasible.

4. Prospects of the Unit:

~~Products of gloves of~~
Production of gloves of consistent good quality, adequate sales promotion and product development programmes and selling at a price within the reach of common people will enable the unit to thrive forward. It has been emphasized that the quality and consistency in quality should be clearly established initially for a distinctive brand to be established in the market.

5. Competitive Products

No other material is likely to substitute rubber gloves due to its unique elastic properties. Hence the enterpreneur will not have any

difficulty in continuing production.

6. Competitive Situation

When gloves will get popularised, other existing dipping units and also other new units will start producing it. The ~~s~~ enterpreneur should give due consideration to this and must develop newer designs. Also one can diversify the production to other types of gloves and/or other dipped products.

7. Export Possibilities

The enterpreneur shall exploit export possibilities which will also improve the demand of the particular brand in the domestic market. Export promotion council will give adquate assistance for this.

Section D - PRODUCT DISCRIPTION

1. Product Discription

The proposed type of gloves shall have a thickness in the range of 0.35 to 0.45 mm. and sizes 6, 6½, 7, 7½ and 8. Dimensions of the above types are given in Appendix VI.

There are different types of gloves based on designs.

Type	Features
1. Plain gloves	Both sides plain. This is the usually seen type in India.
2. Roughened gloves	The outer surface at the inside palm is roughed. This gv gives better grip
3. Treated gloves	The inner or bt both surfaces are chlorinated, brominated or treated with a silicone oil to get a non-draggy surface. Easier to wear.
4. Flocked gloves	The inner side is flocked with cotton or other fibrous flocks. Gives more comfort.
5. Foamed gloves	Inner surface has a thin foam lining. Gives comfort. This type is not very popular.

Coloured and multicoloured gloves can also be produced.

2. Volume of Production

The present scheme is for ~~reughed~~ roughned treated gloves of different sizes and colours. Sizes having more demand will be 7, 7½ and 8. However during subsequent years other types of gloves can

also be manufactured.

The estimated production is 5,04,000 pairsper year, with a daily production of 1680 pairs in two shifts. (asuming 300 working days per year)

Estimated production of different sizes are shown in the below given table.

Size	Estimated production in pairs/year
6	50,000
6½	54,000
7	1,00,000
7½	2,00,000
8	1,00,000

Size 7½ is taken for cost ~~el~~ calculations.

Section E. DESCRIPTION OF THE MANUFACTURING PROCESS

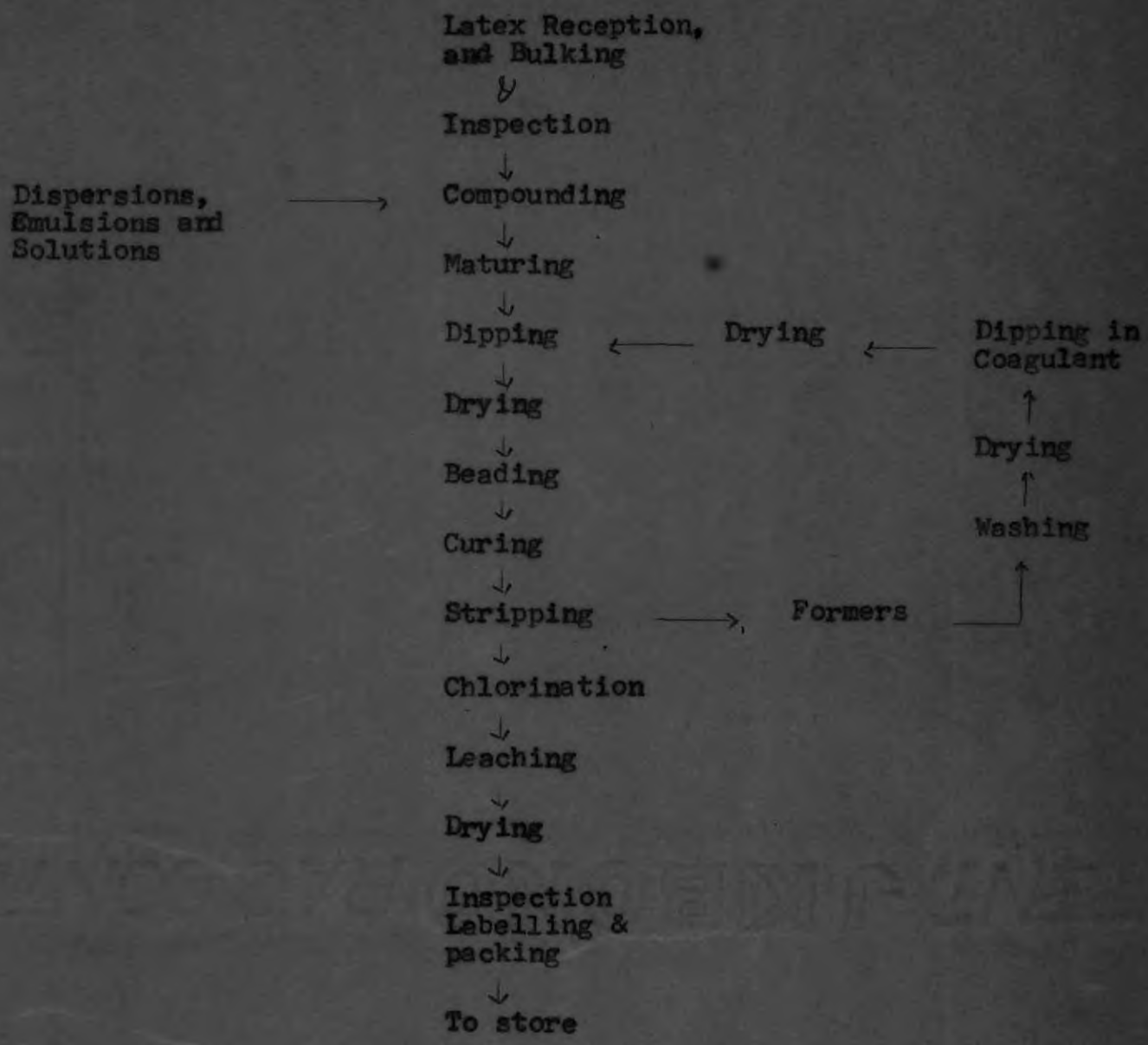
1. Introduction

The dipping process consists essentially in the immersion of a former into suitably compounded latex, followed by slow withdrawal in such a way as to leave a uniform deposit of latex on the former. The process is completed by drying, leaching and volcanizing the product. A bead is also rolled at the neck of the article, in order to reinforce the thin rubber film against tearing.

2. The Flow Diagram

A flow diagram for the process is given in fig.1

Fig. 1 - Flow Diagram



Each step in the flow diagram is explained below.

a) Latex Reception, & Bulking & Inspection

Latex for a week's production is purchased and bulked in the bulking tank. Samples are taken and tested for ammomia content, total solids content, VFA No., and dry rubber content. ~~If the~~ If the test results comes within the limits accept the latex.

b) Compounding

(i) Preparation of Dispersions and Emulsions - Solid water-

insoluable ingredients like Sulphur, ZDC & ZNO ZnO are to be dispersed in water before adding to latex. Liquid water - insoluable ingr are to be emulsified in water. The formulations for dispersions and emulsions are given in Appendix II. Water soluable ingr ts are to be added as solutions.

(ii) Compounding

Take sufficient quantity of t latex into the compounding tank. Add the stabilizers and then other ingredients with continuous stirring of the contents.

C) Maturing

Transfer and allow the latex to remain in the maturing tank for 24 hrs. with constant stirring. The lid of the tank is to be kept opened slightly to liberate ammonia. After maturation the ammonia content should be 0.1 - 0.15 percent.

d) Pre treatment of formers

Wash the formers throughly in cold water. No speck of talc shall remain on the former. Dry it by placing in the drying oven. Dip the warm formers in the coagulant tank, to the required depth, withdraw after the required dwell time and send to the dipping tank. While reaching the dipping section it shall be dry. The coagulant on the former must not be too dry or wet. A suitable criteria is given below.

Glistening appearance	-	too wet
Dull sheen	-	OK
Shiny	-	too dry

e) Dipping

Before starting dipping adjust the position of the limit switch

as per the dipping depth required. The dipping depth should be slightly higher than that to which it is dipped in the coagulant. Al adjust the position of the timer to the required dwell time.

Fit the former frame on the dipping tank. Start the motor. The formers will be withdrawn automatically after the adjusted dwell time. When withdrawn, transfer the frame to the rail leading to the drying oven. Invert the frame through 180°C just after taking fro- out from the dip unit and place on the rail. Add to the d latex sufficient potassium hydroxide when P^H comes down.

f) Drying

Push the frame to the drying oven. The washed formers can also be dried in the same oven. At every 2½ minutes one di former frame and one washed former frame is to be intriduced into the oven. From the other end of the oven send the dipped frame for beading and the other for dipping in the coagulant.

g) Beading:

Roll down the bead (manmually) and push the formers to the curing oven.

h) Curing

Curing of the deposite will take place while the formers pass through the curing oven. From the end far end of this ove takeout the former frame from the rail and send to the stripping section.

i) Stripping

Place former frame in the inverted position on the str stand and strip off the gloves from it by applying talc. Do the stripping in such way that after stripping the gloves su be inside out.

j) Chlorination

Remove the talc from the stripped gloves as far as possible by hand tumbling. Take 25-30 pairs and put into the chlorination bath, agitate by hand, take out after 20 to 30 seconds, allow drawin off and put into the bleaching tank.

k) Leaching

About 100 pairs can be placed in the leaching tank. Allow to leach for 20 to 30 minutes. Take out the gloves, allow to drain and place inside the rotary dryer.

l) Drying

Allow to dry for 20-30 minutes.

m) Inspection, Labelling & Packing

Inspect the gloves for defects such as pinholes, craters and blisters. Label the trade name and size near the free end with the aid of a suitable paint and a stamp. Pack each pair (left hand and right hand gloves) in polythene covers and send to the store room.

3) Quality Control operations

For getting gloves of consistent quality the following steps are to be enforced.

a) Raw latex - Test the latex for total solid content, ammonia content, dry rubber content and VFA No.

b) Dispersions - Test for total solids and P^H.

c) Matured latex - Test for ammonia content and, total solids and P^H.

d) Latex in dipping tank - Test for P^H 4 to 5 times a day

e) Coagulant - Test for total solids content.

f) Chlorination bath - Test for chlorine content 2 to 3 times a day. Add sufficient cholorine when concentration decreases.

h) Gloves - Inspect for pin holes, blisters, surface finish etc. Also check the thickness.

i) Temperature - Inspect tempts of ovens and dryers occassionally. Adquate standards are to be fixed for each of the above steps.

4. Defects, Causes & Remedies

a) Pinholes, craters and blisters.

These are due to air bubbles entrapped in the latex compound and dust & dirt particles etee settling the formers. Remedy - allow sufficient maturing time, avoid careless stirring and pouring of latex, clean the formers thoroughly, enclose the stripping section so that talc may not fly about.

b) Transverse Striations

It is due to uneven wetting of the former during dipping. Uneven wetting is caused by uneven movement of the former or by too slow a rate of immersions. In either event the remedy is clear.

c) Blank spots

Due to traces of greace or oil upon the surface of the former, use of over stable latex, and uneven coagulant film on the former, ~~using latex of appropriate stability, and using a wetting agent in the coagulant respectively~~. Remedies are proper cleaning of former, using latex of appropriate stability and using a wetting agent in the ~~d) Lum~~ coagulant respectively.

d) Lumpy deposits

The usual cause is skin ⅓ on the surface of the latex in the

dipping tank. Remove surface skin, if any, that have formed.

e) Lines on fingers

Due to webbing of latex between fingers. Use an antiwebbing agent like silicone antifoaming agent, capryl alchohol or milk.

5. Process Loss

This can occur due to skin formation on the latex, defective gloves due to air entrapment and other similar reasons, in latex and destabilisation of latex. The latex in the dip tanks are to be changed once in two weeks. This will also contribute to the process loss. In cost calculations the process loss is averaged to the 5% of the total compounded latex requirement.

Utilisation of Scrap

Latex changed from dipping tank can be sold to the rubber bank band manufacturers.

Scrapped product can also be sold to rubber band manufactures.

Section F. PRODUCTION REQUIREMENTS

Location of the plant, layout of the factory and selection of equipment and of theprocess of manufacture are important decisions because of their long term nature and commitment of capital.

1. Plant location:

Site selection is important because of two factors.

a) A factory is relatively immobile and when once constructed and/or occupied, it is difficult to abandon the site.

b) The impact of plant location on operating costs and ~~erifits~~ profits are considerable. Operating costs may vary upto 25% or

even 50% from one location to another.

A site to be selected must satisfy the following requirements.

a) Proximity to raw materials and venders of spareparts, general store items, tools etc.

b) Facilities for transportation

c) Proximity to market

d) Availability of skilled labour

e) Availability of raw materials.

f) Availability of utilities

By giving comparative weightages to the above factors, it can be seen that Kerala is a good location for the present concern.

This small concern can conveniently be located in an industrial estate because of the following advantages.

a) Land and building are avilable at a very reasonable rent

b) Utilities are avilable without delay and without any preliminary expenditure.

c) Availability of suitable labours.

d) Availability of testing facilities and training facilities

e) Inter servicing and inter trading due to proximity with other units

The enteroreneur can go for a backward area where concessions from the Govt. are available. This selection must be done after compa with the other locations and if found more profitable.

For cost calculations in this report the location is selected an industrial estate in Kerala.

2. Plant Layout

The important points to be remembered in fixing and lay

are:

1. Easy and minimum material handling
2. Less fatigue for workers in walking about
3. Balanced plant operations and inplant inventories
4. Expansion at a later date which should devetail into existing operations
5. Maximum utility of space.

A layout of the present unit is given in Appendix. It is recommended to arrange for gravity feeding of latex from storage tank to compounding tank, from compounding to maturing tanks and from maturing tanks to dipping tanks.

Space requirement

The total space requirement is estimated to be 4 200 m^2. The floor space for individual sections are shown in the layout in Appendix. Shed of approximately 200 m^2 is available in Industrial Estates at a rent of R.300/= pm.

3. Plant and Machinery Requirement

a) Latex Storage Tank

The capacity of the storage tank is to be that for storing one week's latex requirement, ie. 1000 littres. (1m x 1m x 1m). Two storage tanks are required. The tanks shall be made of bricks lined inside with glazed porcelein, with suitable vents for transfering latex from it. The tanks should be provided with lids.

b) Compounding tank - 1 No.

200 litre capacity, brick made lined inside with glazed porcelein.

c) Maturing tanks - 200 litre capacity, 4 Nos., brick made and lined inside with glazed procelin, provided with lid and stirrors ($\frac{1}{2}$HP).

The tanks should be connected to the respective dipping tanks by rubber hoses and provided with automatic values for maintaining a constant level in the dipping tank.

d) Dipping tank - 2 Nos. It shall consist of a wooden tank (95 cm x 30cm x 35) painted inside with a bituminous paint, with suitable device for holding the former frame for dipping. The dipping and withdrawl is done by a motor and suitable gears attached with the holding device. It shall be provided with a timer and adjustable limit switch to control the dwell time and depth of dipping respectively. The speed of dipping and withdrawlshould be between 2-3 ft/minute.

A stainless steel tank (75 x 30 x 35) should be fitted inside the wooden tank touching only with the length-sides, one of the width-side is fitted with a wire mesh at the top. A stirror is to be fitted at the gap between the side having the wire mesh and the corresponding side of the outer tank, which circulates the latex from the inner tank to the outer tank. Any coagulated particles and air bubbles will be retained behind the wire mesh, thus keeping the latex at the dipping region clean.

The arrangements should be in such a way that when the stirror is worked, the latex from the inner tank passes through the gap between the tanks, comes through the bottom to the region where stirror is working and passes to the inner tank through the wire mesh, thus holding back any air bubbles and coagulated particles.

e) Coagulant tank - 1 No. 75 cm x 30 cm, brick tank lined inside with glazed porcelein.

f) Drying oven - 1 No. 320x90x90 cm^3 insidr volume, provided with rails to traverse the formers, electric heaters to work at 70-80°C,

forced air circulation system and thermostatic controles and thermometers. Doors shall be there at each end.

g) Curing oven - 1 No. 260x 90x 90 cm^3 inside volume. Should be provided with electric heators to work at 120-130°C and other features as that of the drying oven.

h) Stripping stand A stand to hold the formers in the inverted positior and a wooden box beneaths it to keep talc. Should accommodate two former frames at a time.

i) Chlorination tank

1 No. 50x50x50 cc., brick built with porcelein lining inside.

j) Leaching tank - 2 Nos. 70x60x60cc iron tank with heating elements for a tempt. of 40-50°c and thermostatic controls.

k) Rotary dryer - The roating member shall have a volume of 250 littres, hexagonal prism in shape, made of a 1 mesh wire gauze and rotating about an axis perpendicular to the hexagon. This member is enclosed in a chamber provided with electric heaters, blowers, thermostatic controls and thermometer.

l) Formers - Wooden formers of appropriate sizes, roughened at the inside of palm. Five pairs shall be fitted on a wooden frame of 70cm length and 30 cm width in two rows. The frame must be so constructed that can be easily fitted in dipping unit and stripping stand. Also it shall be fitted with wheels to move on the rails in the ovens.

m) Former washing unit - A stand similar to the stripping stand. Provision for spraying water on formers should be provided.

n) Ball mill - 2 Nos. each consists of 6 porcelain pots of 6 littre capacity driven by a 3 HP motor.

o) Emulsification equipment - one No., driven by a ½ HP motor.

p) Weigh scales and screwgauges - Weigh scales of 50 kg, 10 kg and 5kg

capacity, one No. each and 2 screw gauges.

q) Lab equipments

Macham still, analytical balance, liquid measuring equipments, equipment for distilled water preparation and containers.

r) Others - Containers of sufficient volume for keeping coagulant, chlorine water etc.

Sources of supply

No regular manufactures of some of the above machines are not in India. However concerns are there which can manufacture these. The enterpreneur has to place order with the necessary specifications, with the aid of an experienced engineer. A list of manufactures who can produce the machines are listed in Appendix.

Terms of Purchase

Terms of purchase may vary slightly from one manufacturer to another However the general rules can be summarised as below.

a) Quotation prices are exclusive of packing, transportation, sales tax, excise duty etc.
b) 30% of the price should be paid in advance and the remaining at the time of purchase.
c) Purchaser has the right to inspect the machinery.
d) Supplier has the right for cancellation, changing delivery time and price, due to unforeseen reasons.
e) Warranty against manufacturing defects assured.
f) Liabilities passes to customer immediately after despatch.
g) Payments can be done through banks.

4. Raw Material Requirement

The per shift production is estimated to be 840 pairs. Assuming an average weight of 40 gms.per pair, the compound (dry) requirement is 33.6 kgs. Adding 5% as process loss, the total requirement per shift is 35 kgs. Assuming 300 working days per annum and double shift working in a day, the total annual compound (dry) requirement is 21,000 kgs.

The approximate annual requirement of different raw materials are given below.

	item	Kgs.
1.	Concentrated latex, 60%, HA type	31398.5
2.	Pot. Hydroxide	84.00
3.	Sulphur *	379.65
4.	ZDC *	190.89
5.	Zincoxide*	286.33
6.	Styrenated Phenol	189.00
7.	Mineral Oil	934.50
8.	Colours	94.50
9.	Stabilizer like Vulcastab VL	9.50
10.	Dispersing agent like Dispersol F conc	15.97
11.	China clay	11.30
12.	Oleic acid	67.41
13.	Ammonia 25%	167.56
14.	Unhydrous Calcium Chloride	900.00
15.	Calcium nitrate tetra hydrate	900.00
16.	Industrial spirit	3000.00

17.	Wetting agent like 2. ethyl hexanol	15.00
18.	Talc	3000.00
19.	Liquid Chlorine	300.00
20.	Polythene bag, 25cm x 10cm	5040.00 Nos.
21.	Pot. hydroxide - for adjusting P^H of compounded latex if necessary	10
22.	Laboratary Chemicals	

* Quantity inclusive of approximately 1% process less which may stick to the pot and balls of ball mill.

Source of supply

A list of the sources of supply of raw materials are given in Appendix.

5. Manpower Requirements

a) Labour Force

Job	Working Shifts	No. per shift			Total
		Skilled	Semi-skilled	unskilled	
Latex bulking compounding and compounding and maturing	1	1	--	1	2
Dipping	2	1	--	1	4
Beading	2	--	2	--	4
Sending formers from curing oven to stripping section	2	--	--	1	2
Stripping	2	--	--	2	4
Chlorination	2	--	--	1	2
Leaching & drying	2	--	--	1	2
Coagulant dipping	2	1	--	--	2

Inspection, labelling & Packing	2	1	--	1	4
Former washing	2	--	--	2	4
					30

b) Managerial, Technical and other personnel

Manager Cum Technologist	1
Foreman Cum Engineer	1
Supervisor	2
Clerk Cum Typist	1
Accountant Cum Cashier	1
Storekeeper	1
Lab Assistant	1
Sweeper	1
	9

Training Programme

Adequate ~~training~~ Trainning must be given to the workers which can be done with the aid of common facility service centers and other service laborataries. It is desirable to appoint people having experience as skilled labourers and managerial and technical staff.

6. Utilities:

1. Electricity requirement

Approximate electrical requirement of various machinery and equipments are given below:

Item	KW	No. of hrs. working per day
Maturing tanks	1.5	24
Dipping tank	0.75	15
Drying oven	1500	16
Vulcanizing oven	20.00	16
Rotary dryer	8.00	14
Leaching tank	2.00	16
Ball mill	4.50	24
Emulsification equipment	0.18	4
Distillation equipment	2.00	3
Lighting fans & Lab. equipments	2.00	8

2. Water requirement

Water is required for washing formers & tanks, ~~le~~ for leaching, chlorination, and aminities. The approximate per day consumption of water will be 20 kilo littres.

3. Other consumable stores like paint for labelling the gloves etc.

Section G. SELLING AND DISTRIBUTION

1. Pricing Policy:

Generally the price of a product is fixed by the cost plus method, or according to the demand or competition in the market. From the ~~market~~ market survey it is clear that the present consumption of gloves is little and the high price may be attributed as a reason for this. Since the product is to be forced to move in the market it is desirable to sell it at a reasonable price, which is within the reach of a common man. When the demand and consequently competetion ~~oriented.--The qual~~ increases the pricing should be competetion oriented. The quality and price of the competetor's productis to be studied and price and quality to be fixed accordingly.

2. Selling arrangements

At present gloves are available only in cities and towns. It needs no emphasise that it should be introduced in towns as well as rural areas, more concentrating to educational institutions and regions of cold climate. The best method to distribute the gloves is through sales agents on a commission basis.

The gloves can be sold through general stores, medical shops, super markets, departmental stores, two wheeler shops etc.

To hold the export market services from the Export Production Council can be utilised.

3. Distribution Arrangements

Distribution outside the state can be done through trains on ~~for basis~~ f.o.r. basis. Inter-state distribution may be done through local parcel services.

Section H. CAPITAL REQUIREMENT

The financial requirement of the firm can be classified as below

1) Fixed Capital Requirement
2) Working Capital Requirement
3) Total Capital Requirement
4) Total Cost of Production
5) Sales and Administrative Expenditure

1. Fixed Capital Requirement

It is the sum of the expenses ~~eir~~ incurred for machinery, equipments and preoperative expenses. The estimated fixed capital requirement is as follows.

Plant & Machinery	Rs.99,400.00
Preoperative Expenses	Rs.14,727.50
Miscellaneous fixed expenses	Rs.7,500.00
Total Fixed Capital Requirement	Rs.1,21,600.00

Details of fixed capital is shown in Annexure I

2. Working Capital Requirement

Since all materials are available indeginiously one months raw material inventory is enough for the present unit. The duration involved in the manufacturing, marketing, stocking, selling and cash payment is usually 2 months. So the working capital may be taken for 3 months. The following table shows the total working

capital requirement.

1. Annual Raw material cost	Rs.2,72,500.00
2. Annual Utility cost	Rs.29,400.00
3. Salaries and Wages	Rs.2,40,120.00
4. Administrative and other overheads	Rs. 23,200.00
Annual working capital Requirement	Rs.5,65,220.00
Working Capital for 3 months	Rs.1,41,300.00

Details of Working Capital requirements are given in Annexure II

3. Total Capital Requirement

It is the sum of the fixed capital requirement and working capital requirement and working capital requirement and is the total investment on the scheme. Details are given in Annexure III.

4. Cost of Production

It involves all the direct and indirect costs involved in the manufacturing operation.

Annual cost of production may be classified as below.

	Rs. Ps.
1. Raw material cost	2,72,500.00
2. Utilities	29,400.00
3. Salaries and Wages	2,40,120.00
4. Administrative and other overheads	23,200.00
5. Other fixed costs and interests	44,000.00
Total cost of production	6,09,220.00
Round off	6,09,200.00

Details of total cost of production is shown in Annexure IV.

5. Sales and Sales Administrative Expenses

Sales and administrative expenses involves commission to be paid to the selling agents, cost of stocking, freight, distribution etc. personnel cost, indirect marketing expenses like advertising, and other sales promotion programmes etc. Details of the expenses under this head are given in Annexure V.

Section I. FINANCING PLAN

The financial requirement of the unit ~~is~~ is high and so the entrepreneur cannot be able to meet the whole expenses. Financial institutions will aid in financing the project. A brief discription of the aids offered by the financial institutions are as follows.

1. State financial Corporations

Loans of upto 10 lakhs for a period of 12 years can be obtained from this institution. They provide 100% of machinery cost, 75% of building cost and 40% of working capital at 7.5% interest. Repayment starts only after two years.

2. Kerala State Small Industries Corporation

Machinery worth upto Rs.10 lakhs can be obtained on hire purchase scheme on a marginal money deposit of 20% (10% for technically qualified personnel). Repayment should be started after two years and should be complete within 7 years. Interest is 7.5%.

3. National Small Industries Corporation

Indegeneous and imported machinery can be obtained on hire purchase scheme from this institution.

4. Commercial Banks

Nationalised Banks provide entire working capital at 16% interest and loans for machinery on 25% margin money and at 12% interest.

5. Kerala Employment Promotion Corporation

Cost involved in the purchasing, servicing, taxes, Insurance and transportation of all machinery and equipments will be provided by this institution on an interest of 7%.

In the present scheme it is proposed to take the cost of plant and machinery from State Financial Corporation and working capital from Nationalised Banks. Initial expenditure required for procuring machimery and sales and sales administration expenses can be taken from banks as block loans for 6 months.

Section J. PROFITABILITY

Profitability of the concern can be evaluated fron the rate of return on own capital, rate of return on capital employed, percent of profit on sales turn over, and level of operation and break even point. These are

1. Rate of return on own capital = 188.16%
2. Rate of return on capital employed = 28.35%
3. Percent of profit on sales turnover = 8.2%
4. Break even point = 66.15%

The details are shown in Annexure

The above values are satisfactory that the entrepreneur can get loans without much difficulty.

Section K. ECONOMIC VIABILITY

The Economic Viability of the concern can be assessed from the ability to pay back the borrowed funds of the total profit approximately 25% is retained and 75% used for paying back the term loans. Since part of the money is paid back in the first year, the ability to pay

back loans will increase, due to decrease in interest commitments.

The pay back period is calculated to be round about 3.5 years which is quite satisfactory. Details are shown in Annexure IX.

Section L. SOCIAL BENEFITS

This small scale industry based on rubber gloves provide the following benefits to the nation and to the entrepreneur.

1. To the Entrepreneur

   It gives (a) Profit
   (b) Opportunity to use his ideas

2. To the Nation

   It gives (a) Increases the revenue earnings of the nation
   (b) Facilitate an effective mobilisation of local resources and skills
   (c) Larger employment with less investment
   (d) Ensures a more equitable distribution of the National Income.

Section M. CONCLUSION

The proposed project can be concluded in the following manner.

1. Total Capital investiment	Rs.2,89,200
2. Working Capital requirement	Rs.1,41,300
3. Working shifts/day	2
4. Labour strength	30
5. Other staffs	9
6. Annual production	5,04,000 pairs
7. Annual sales	Rs.9,97,300
8. Net profit	Rs.82,000
9. Return on investment	28.35%
10. Break Even Point	66.15%

ANNEXURE I

A. Plant and Machinery

	Item	No.	Rs.
1.	Latex storage tanks @ Rs.500/=	2	1,000.00
2.	Compounding tank	1	250.00
3.	Maturing tanks @ Rs.500/=	4	2,000.00
4.	Dipping tanks @ Rs.5250/=	2	10,500.00
5.	Coagulant tank	1	100.00
6.	Drying oven	1	16,000.00
7.	Curing oven	1	19,000.00
8.	Stripping stand & talc box	1	150.00
9.	Chlorination tank	1	100.00
10.	Leaching tank @ 1,500	2	3,000.00
11.	Rotary dryer	1	8,000.00
12.	Formers @ 70/= per pair	175	12,250.00
13.	Ball mill @ Rs.3000/=	2	6,000.00
14.	Emulsification equipment	1	500.00
15.	Weigh scales and screw gauges		4,500.00
16.	Former washing stand		50.00
17.	Distillation equipment	1	250.00
18.	Laboratary equipments		4,500.00
19.	Containers		250.00
	Total		88,350.00
	Provision for price escallation @ 5%		4,417.50
	Sales Tax @ 7.5%		6,626.25
	Total Plant & Machinery		99,393.75
	Round off		99,400.00

Note: The price given are inclusive of freight and dis installation char

B. Preoperative Expenses

		Rs.
1.	Interest on block loan @ 7.5% for 6 months for Rs.99,400/=	3,727.50
2.	Rent, establishment & Training programme	5,000.00
3.	Taxes	750.00
4.	Travelling expenses	2,000.00
5.	Communications	500.00
6.	Legal charges	750.00
7.	Advertising, Printing & Stationary	2,000.00
	Total	14,727.50

C. Miscellaneous Fixed Expenses

1.	Misc. tools, spares & equipments	1,000.00
2.	Fire fighting equipments	1,000.00
3.	Office machinery & equipments	4,000.00
4.	Office furniture	1,500.00
	Total	7,500.00

Total Fixed Capital requirement (A+B+C)	1,21,627.50
Round off	1,21,600.00

ANNEXURE II

Working Capital Requirement

A. Raw Material Cost (Annual)

Item	Annual Requirement Kgs.	Cost/ Kg.	Rs.
1. Concentrated latex	31398.5	6.25	1,96,240.25
2. Pot. Hydroxide	94.0	17	1,598.00
3. Sulphur	379.65	2.30	873.20
4. ZDC	190.89	32.20	6,146.60
5. Zinc Oxide	268.33	17.70	4,749.40
6. Styrenated phenol	189.00	24.20	4,573.80
7. Mineral Oil	934.50	10.00	9,345.00
8. Colours	94.50	75.00	7,087.50
9. Stabilizer (Vulcastab VL)	9.50	12.00	114.00
10. Dispersing agent (Dispersol F Conc)	15.97	15.00	239.55
11. China clay	11.30	0.40	4.50
12. Oleic Acid	67.41	22.00	1,483.00
13. Liquour Ammonia	167.56	9.00	1,508.00
14. Unhydrous Calcium Chloride	900.00	0.75	675.00
15. Calcium nintrate tetra-hydrate	900.00	10.65	9,595.00
16. Industrial spirit	3000.00	3.00	9,000.00
17. 2. ethyl hexanol	15.00	25.00	375.00
18. Talc	3000.00	0.75	2,250.00
19. Liquid chlorine	300.00	0.75	225.00
20. Polythene bags (25cmX10cm)	504000 Nos.	0.02	10,080.00
21. Lab. Chemicals			1,000.00
		Total	2,67,140.80
Cost of purchasing, freight and warehousing @ 20% 2%			5,352.00
Total raw material cost			2,72,492.80
		G Round off	2,72,500.00

Note: The prices are inclusive of taxes.

B. Utilities (Annual)

a) Electricity

	Machinery/ equipment	KW	Average hrs. working per day	Assumed % of rated capacity	Total KWH
1.	Maturing tanks	1.5	24	60	6480
2.	Dipping tanks	1.5	15	60	4050
3.	Drying oven	15.0	15	70	47250
4.	Curing oven	20.0	15	70	63000
5.	~~T~~e Rotary dryer	8.0	14	70	23520
6.	Leaching tank	20.0	16	70	6720
7.	Bal mill	4.5	24	60	19440
8.	Emulsification equipment	0.18	4	60	133
9.	Distillation equipment	2.00	3	70	1260
10.	Fans, lighting, lab equipments	2.00	8	60	2880
				Total KWH per year	175133
				Electricity Cost @ 15 ps KWH	Rs.26,269.95

B) Water 20 Kilo litres per day @ 35 Ps.	2,100.00
C) Consumable stores	1,000.00
Total utility cost	29,369.95
Round off	29,400.00

C. Salaries and Wages (Annual)

a) Salaries of Managerial, Technical & Other staff

Staff	Monthly rate.Rs.	Annual sum Rs.
Manager Cum Technologist	1,000	12,000
Foreman Cum Engineer	750	9,000
Supervisors	600	14,400
Clerk Cum Typist	480	5,760
Accountant Cum Cashier	450	5,400
Store Keeper	450	5,400
Lab.Assistant	450	5,400
Sweeper	250	3,000
Total		60,360

b) Labour Charges

Type	Monthly rate Rs.	Annual Sum Rs.
Unskilled	380	36,640.00
Semi skilled	430	20,640.00
Skilled	490	41,160.00
	Total	1,48,440.00
	Grand Total	2,08,800.00
	Benefits @ 15%	31,320.00
	Total Salaries and Wages	2,40,120.00

D. Administrative and other overheads (Annual)

	Rs.
1. Repairs and maintainance of Plant and Machinery @ 5%	4,970.00
2. Advertising and travelling	5,000.00
3. Insurance @ 1% on fixed capital	1,216.00
4. Taxes etc.	1,000.00
5. Audit fees	3,000.00
6. Legal charges	2,00000
7. Communications	3,000.00
8. Miscellaneous	3,000.00
Total	23,186.00
Round off	23,200.00

E. Annual Working Capital requirement

1. Raw material cost (a)	2,72,500.00
2. Utilities (B)	29,400.00
3. Salaries and Wages (C)	2,40,120.00
4. Administrative and other overheads (D)	23,200.00
	5,65,220.00
F. Working Capital for Three Months	1,41,305.00
Round off	1,41,300.00

ANNEXURE III

Total Capital Requirement

	Rs.
1. Fixed Capital requirement	1,21,600.00
2. Working Capital for 2 3 months	1,41,300.00
	2,62,900.00
3. Contingencies @ 10%	26,290.00
Total Capital requirement	2,89,190.00
Round off	2,89,200.00

ANNEXURE IV

Total Cost of Production (Annual)

1. Working Capital (annual)	5,65,220.00
2. Other fixed costs & interests (IV A)	44,000.00
	6,09,220.00
Round off	6,09,200.00

ANNEXURE IV A

Other Fixed Costs & Intersts

1. Factory rent @ 300 pm	3,600.00
2. Depreciation on plant & Machinery @ 10%	9,940.00
3. Depreciation miscellaneous fixed capital @ 5%	375.00
4. Interest on working capital loan @ 16%	22,608.00
5. Interest on loan for Plant & Machinery @ 7.5%	7,455.00
Total	43,978.00
Round off	44,000.00

ANNEXURE V
Sales & Sales Administration Expenses

	Rs.
1. Commission @ 15% on sales	1,49,600.00
2. Annual freight and distribution charges	45,000.00
3. Annual personnel cost	18,000.00
4. Indirect Marketing expenses (Advertising, Displays, sales promotion etc)	50,000.00
5. Interest @ 7.5% for 6 months for Rs.1,13,000/=	8,475.00
Total	2,71,075.00
Round off	2,71,000.00

ANNEXURE VI
Annual Sales Turn over

Annual production (Pairs)		5,04000
Less 2% defectives		10080
No. of pairs for sales		493920
Sales turnover @ Rs.2/=	Rs.	9,87,840.00
Income from sale of scrap latex		7,000.00
Income from sale of defectives		2,500.00
Total		9,97,340.00
Round off		9,97,300.00
Annual sales turn over		9,97,300.00

ANNEXURE VII
Annual Income & Profit

Total Sales Turn over	9,97,300.00
Less sales and administrative expenses	2,71,000.00
Annual sales income	7,26,300.00
Less cost of production	6,09,200.00
Annual gross profit	1,17,100.00
Less provision for tax incidents @ 30%	35,130.00
Net profit	81,970.00
Round off	82,000.00

ANNEXURE VIII

Profitability Analysis

A. Rate of Return on Own Capital	Rs.
Preoperative expenses	14,727.00
Miscellaneous fixed capital	7,500.00
Other fixed expenses, interests, & depreciation	44,000.00
Contingencies	26,290.00
Total Own Capital	92,517.00
Round off	93,000.00
Net profit	82,000.00
Percent return on own capital	88.16

B. Rate of Return on Total Capital Employed	
Total capital	2,89,200.00
Net profit	82,000.00
Percent return on total capital employed	28.35

C. Percent Return on Sales Turnover	
Total annual sales turnover	9,97,300.00
Net profit	82,000.00
Percent Return on sales turnover	8.22

D. Break Even Analysis

$$\text{Break even point} = \frac{\text{Fixed costs}}{\text{Contribution}}$$

1. Variable costs	Rs.
Raw Materials	2,72,500
Utilities	29,400
Labour charges	1,70,600
Repairs & Maintenance	4,970
Interest on working capital	22,600
Commission on sales	1,49,600
Total	6,49,670.
Round about	6,49,600

2. Contribution = Sales - Variable costs
= 9,97,300 - 6,49,600
= 3,47,700

3. Fixed costs = Contribution - Profit
= 3,47,700 - 1,17,100
= 2,30,600

Break even = 66.15%

ANNEXURE IX
Ability to Pay Back Loans

	Rs.
Net profit	82,000.00
Depreciation	10,315.00
Available Surplus	92,315.00
Less, drawings	23,000.00
Sum available for repaying	69,315.00
Loans to be repayed	
Working Capital	1,41,300.00
Plant & Machinery Cost	99,400.00
	2,40,700.00

The loans can be payed back with in - 3.5 years

APPENDIX I

FORMULATIONS

1. Formulation for Latex Compound	Dry weight
Natural Rubber latex, 60%, HA type	100.00
Potassium Hydroxide (as 10% solution)	0.45
Sulphur (as 50% dispersion)	2.00
Vulcastab CL (as 20% solution)	0.05
ZDC (as 50% dispersion)	1.00
Zinc Oxide ⊖ (as 50% dispersion)	1.50
Styrenated Phenol (as 50% emulsion)	1.00
Mineral Oil (as 50% emulsion)	5.00
Colour (as 25% dispersion)	0.50

APPENDIX II

TENTATIVE LAYOUT OF THE PLANT.

ALL DIMENSIONS IN METRES

2. Formulations for Dispersions and Emulsions

a) Sulphur dispersion

Sulphur	50
China clay	1
Dispersing agent	1
Distilled water	48

b) ZDC Dispersion

ZDC	50
China clay	1
Dispersing agent	1
Distilled water	48

c) Zinc Oxide Dispersion

ZnO	50
Dispersing agent	1
Distilled water	49

d) Colour dispersion

Colour	50
dispersing agent	1
Distiled water	199

Colour is also available as a paste which can easily be dispersed in water.

3. Ball milling time for Dispersions

a) For Sulphur and Colour	48 hrs
b) For ZDC, and Zinc oxide	24 hrs

4. Formulation for Emulsions

a) Styrenated phenol or mineral oil	47	A
Olic acid	3	A
Distilled water	48	B
90% Ammonia	2	B

Add A to B in small quantities with stirring

5. Formulation for Coagulant

Unhydrous Calcium Chloride	15
Calcium Nitrate tetrahydrate	15
Industrial spirit	50
Water	20
Wetting agent	0.25

- -

APPENDIX III
PRODUCTION SEQUENCE AND RECOMMENDATIONS

1. Compounding of latex - Add pot. hydroxide and stabilizer first and then other ingredients

2. Maturing - Mature for at least 24 hrs., Ammonia content of matured latex should be 0.1 - 0.15%

3. Coagulant Dipping	-	Give one dip, dip while former is warm Dwell time 10-15 sec. Dry to ~~dwell~~ dull sheen appearence
4. Dipping	-	Give one dip. Dwell time - 1.5 minutes Immersing speed - 2-3 ft/min. withdrawing speed 2-3 ft/min., Dip to two frames in 5 minutes
5. Drying	-	Dry for 10 minutes at 70-80°C.
6. Curing	-	15 minutes at 130°C
7. Chlorination	-	Immerse in chlorine water for 20-30 Sec.
8. Leaching	-	Leach for 20-30 minutes at 40-45°C
9. Drying	-	Dry for 20-30 minutes at 50-60°C
10. Inspection	-	Inspect for defects

APPENDIX IV
List of Machinery Suppliers or Fabricators

1. Dipping tank & Maturing tank, Ball mill	a) Sohal Engineering works, LBS Marg, Bombay 78. b) Kelachandra Iron & Steel Works, Changanaserry, 686531.
2. Ovens, drayer and leaching tank	a) Thermo Elec, Kamal Kunj, Bombay 50 b) Indmac Engineers Pvt. Ltd., 6-B Saklat Place, Culcutta-13
3. Formers	V. Prabha & Bros., 107, 1st Pathan Street; Near Moti Talkies, Bombay-4.
4. Emulsification & other equipments	Lab Equipments, 341 Pancha Ratna, Near Roxy, Bombay-4.

APPENDIX V
Raw Material Suppliers

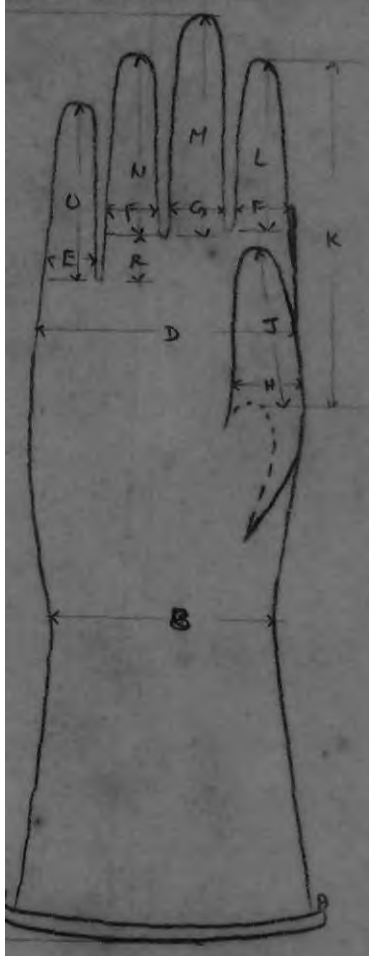
1. Latex	a) Padinjarekara Agencies, Kottayam, Kerala. b) Plantation Corporation of Kerala Ltd., Kottayam-4.

2. Pot. Hydroxide	Atul Products, P.O. Atul, Bulsar, Gujarat.
3. Sulphur, ZDC, ZnO	Rubo - Chem Pvt. Ltd., Near CMS College, Kottayam.
4. Colours	Colour Chem Ltd, Ravindra Annexue, Din Shaw Vachha Rd., Bombay-20.
5. Stabilizer, Dispersing agent, Styrenated phenol	A.C.C.I., 34, Chowringhee Rd., Culcutta-16.
6. Calcium Chloride	Frontier Chemical Works, A/63, Thilmal, G T Road, New Delhi-32
7. Chlorine	T.C.C. Ltd., Alwaye, Kerala.
8. Calcium nitrate	Hif chem Pvt. Ltd., Kolshet Rd., Balkum, Thana.
9. Olic acod	Bombay Oil Industires Pvt. Ltd., Kanmoor House, 218/287, N.N. Street, Bombay-9.
10. Talc	Industries Minerals & Chemicals, Bombay.
11. China clay	H.C.C. Works, Pappinisseri, Cannanore, Kerala.
12. Industrial Spirit	Brihan Maharastra Sugar Syndicate Ltd., Meharashtra.
13. Ammonia	FACT Ltd., Alwaye, Kerala.

APPENDIX VI

Recommended Dimensions of Gloves

All Dimensions in Millimetres.



Description	Size					Tolerance
	6	6½	7	7½	8	±
Perimeter at A	180	185	190	200	210	5
Perimeter at B	132	138	152	164	170	3
Perimeter at D	160	170	185	195	205	3
Circumference at F	48	50	52	55	58	2
Circumference at F	52	54	56	58	60	2
Circumference at G	52	54	58	60	62	2
Circumference at H	60	64	68	72	69	2
Length at J	52	54	57	60	62	2
" at K	105	110	115	120	120	3
" at L	60	62	65	69	74	2
" at M	74	76	80	82	84	2
" at N	62	64	68	71	74	2
" at O	56	58	60	62	64	2
" at P	275	280	285	290	290	5
" at Q	480	485	490	495	200	-5
" at R	8	8	8	8	9	1

Bead diameter	2-3 mm
Thickness	0.3 to 0.4 mm
Weight of gloves/ pair	35 to 45 gms.