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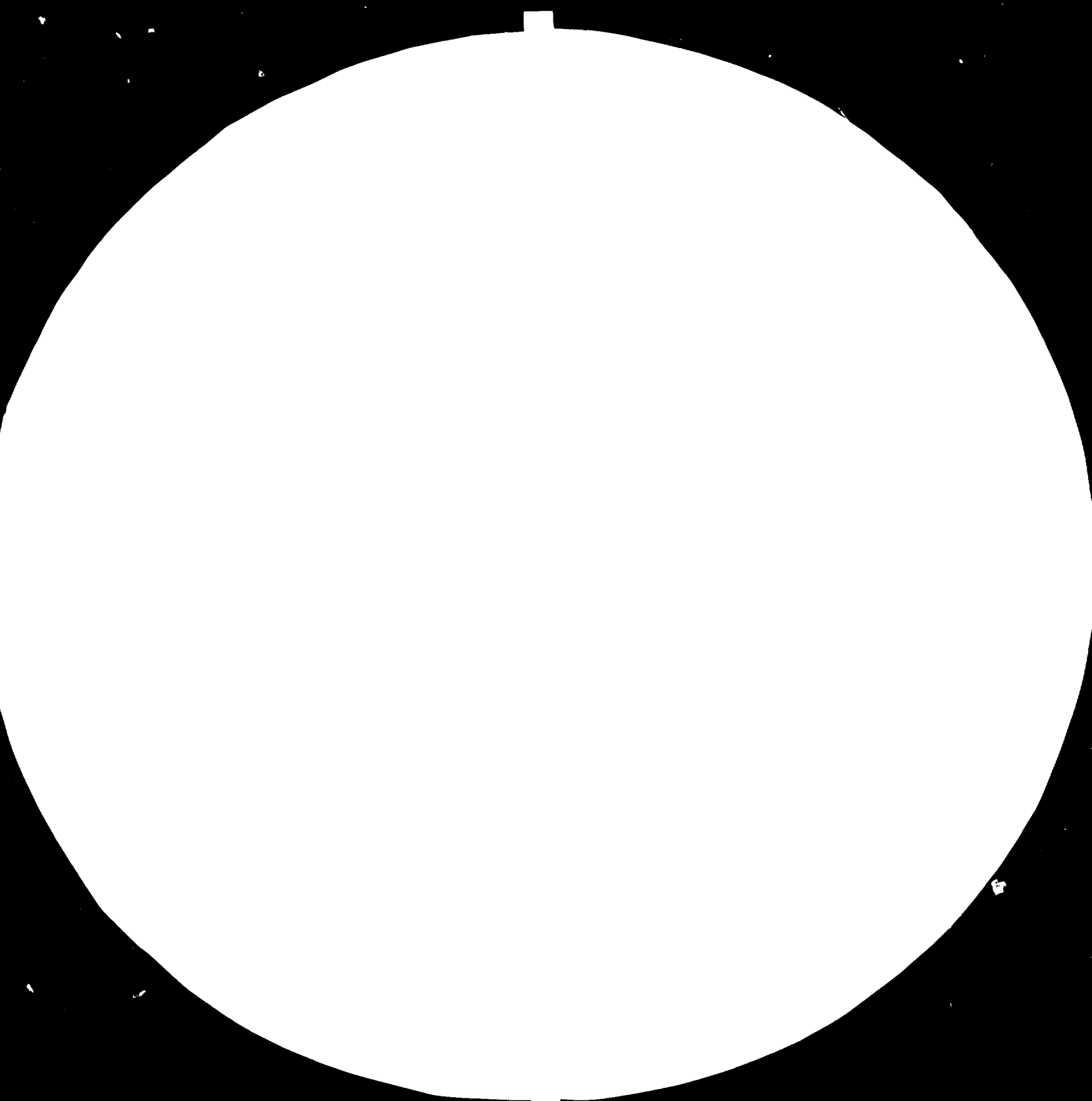

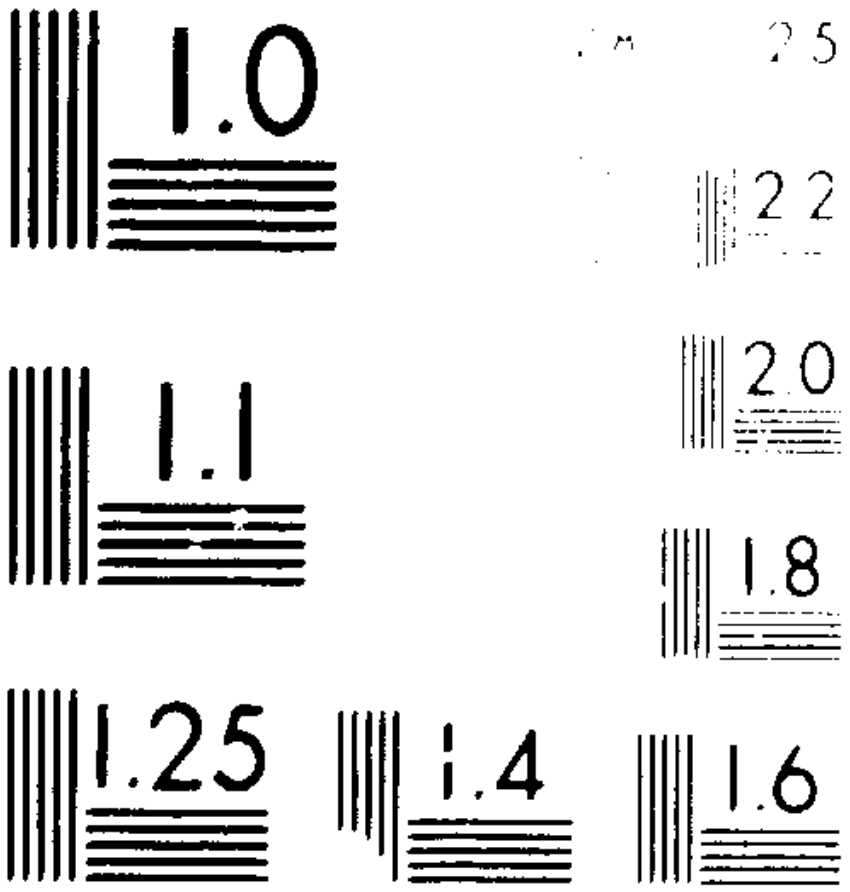
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PRICING OF ESSENTIAL BULK DRUGS AND INTERMEDIATES FOR DEVELOPING COUNTRIES

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UNIDO-Paper
for
Second Consultation Meeting
on the Pharmaceutical Industry
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PRICING OF ESSENTIAL BULK DRUGS AND INTERMEDIATES FOR DEVELOPING COUNTRIES

**

1. Introduction :

This paper seeks to analyse and assess the costs of production of certain selected bulk drugs, and to evaluate the prices at which these drugs and their intermediates are internationally available; the objective being to explore the areas which offer room for effecting reduction of costs of drug manufacture in developing countries.

2.1 Selection of Drugs :

Nine essential bulk drugs have been identified by UNIDO for this purpose - out of a model list of 26 drawn out by the WHO. (Table no.1)

2.2 The selection of these drugs is in conformity with the criteria laid down by the UNIDO Panel of Industrial Experts for the production of drugs in developing countries. Further, these drugs cover therapeutic groups of utmost importance to the developing countries, based on the most common diseases prevailing in them, and are the ones needed by them in large quantities.

2.3 UNIDO has selected these 9 drugs as priority for establishing facilities for local production. These drugs have been in existence for long and are not restricted by patents.

2.4 Several developing countries are in the process of establishing or expanding their petro-chemical industry which will make available many of the basic raw materials required for the manufacture of these drugs.

Table No. 1

List of nine Essential Drugs and related Intermediates considered in this Paper

	Drug	Intermediate
1.	Acetyl Salicylic Acid	Salicylic Acid
2.	Ampicillin Trihydrate	6-Amino Penicillinic Acid D-Alpha Phenyl Glycine (Cl2 Hol) Dimethyldichlorosilane
3.	Sulphadimidine	Sulphaguanidine
4.	Tetracycline	-
5.	Diethyl Carbamazine	N-Methyl Piperazine
6.	Dapsone	Mono-Chlorobenzene
7.	Chloroquine	4,7 E; Novaldiamine
8.	Ethambutol	d2-Aminobutanol
9.	Isoniazid	Gamma Picoline; Hydrazine Hydrate

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3.1 Methodology :

The nine bulk drug specifications [illegible] in this paper fall into two categories :

Category I : Drugs manufactured locally from imported intermediates. (ex-Intermediate stage)

Category II: Drugs manufactured from locally available raw materials (ex-Basic stage)

Cat. I	Cat. II
1. Ampicillin Tri	1. Acetyl Salicylic Acid
2. Diethyl Carbamazine	2. Sulphadiazine
3. Chloroquin Phosphate	3. Tetracycline
4. Chloramphenicol	4. Sulphadoxine
	5. Isoniazid

3.2 In cases of Category I, it is possible to compare meaningfully the cost of intermediate(s) for local manufacture with the cost of intermediate(s) that would have been incurred by the local manufacturer. In cases of Category II, a profitable comparison can be made between the cost of local raw materials and the international c.i.f. prices; reasons for advantages/disadvantages between manufacturers can be traced.

3.3 Raw materials form substantial proportions of costs of manufacture (Table 2). Therefore, in cases of Category I, the approach is to see whether the high cost of domestic manufacture arises from the high price of imported intermediates. To assess this, the c.i.f. price of the bulk drug is analysed to derive the proportionate price of the intermediate used for its manufacture. The

c.i.f. price of the bulk drug is discounted by the conversion cost incurred actually by a comparable unit to arrive at the maximum value which could be assigned to raw materials. From this residual the desirable cost of the intermediate is worked out on the basis of competitive technology - usage norms. Where more than one intermediate is involved, the residual value has been apportioned on the basis of its percentage contribution to total material cost incurred by the unit actually studied.

3.4 In cases of Category II where the approach is to compare the cost of domestic manufacture with c.i.f. prices of bulk drugs, the import prices should be comparable with, if not lower than, local costs of manufacture in developing countries.

3.5 It has been asserted from this that the desirable c.i.f. prices of bulk drugs and intermediates should be such that :

i. The cost of locally converting imported intermediates should be comparable with c.i.f. import prices of the bulk drug;

ii. The international c.i.f. prices should not be higher than the costs of local manufacture in comparable units in developing countries.

3.6 In all studies manufacturing costs have been calculated from data of units actually operating on a commercial scale in developing countries. This data consists of all raw material costs and conversion costs.

3.7 Factors underlying these cost calculations are detailed below:

Table no. 2

Weightage/Importance of raw material and variable costs in total costs of manufacture

Item	Unit Cost in $/K. Raw Materials	(a) Others	Total	Fixed Cost in $/K. (b)	Total cost $/K.	Variable cost as % of total production Cost	Raw M to cost as % Variable Cost
. Acetyl Salicyclic Acid	2.90	0.49	3.47	0.27	3.74	93.0	86.0
. Ampicillin Trihydrate	79.56	4.85	84.41	12.31	96.72	87.0	94.0
. Chloroquine Phosphate	24.74	5.69	30.43	5.98	36.41	84.0	81.0
. Diethyl Carbamazine Citrate	9.01	1.03	10.04	1.09	11.13	89.0	90.0
. Ethambutol Hydrochloride	46.99	5.10	51.63	3.32	54.95	94.0	94.0
. Isoniazid	7.30	1.99	9.19	1.41	10.60	87.0	79.0
. Dapsone	4.34	3.6	7.94	4.18	12.12	66.0	55.0
. Sulfadimidine	11.74	2.23	13.97	2.17	16.14	87.0	87.0
[illegible]	[illegible]	1.17	[illegible]	[illegible]	44.19	[illegible]	[illegible]

(a) The element "others" in variable costs included direct wages and salaries, consumable stores, repairs and maintenance.

(b) The cost elements going into "fixed costs" are depreciation, factory and administrative overheads.

(c) [illegible] in the country.

i. International CIF prices (excluding import duties) on which supplies have been made or which have actually been quoted during 1982 have been taken.

ii. To make the comparison accurate, the actually incurred prices of local raw materials have been taken after discounting for local direct taxes.

iii. All rates and amounts taken have been verified as the most recent data prevailing in developing countries.

iv. Conversion costs taken cover the following elements only:

a. Utilities
b. Salaries and Wages
c. Maintenance
(including repairs on consumable stores)
d. Depreciation and
e. Overheads
(Include administrative and factory overheads. The latter include provision for R&D and quality control)

4.1 Limitations of the Methodology :

This approach towards establishing desirable prices has certain limitations, which arise from some of the underlying assumptions.

i. Ideally, in discounting international CIF bulk drug prices to arrive at the raw material costs, the conversion costs of the actual manufacturing unit should be used. Since these are not available, the costs of the most approximate operations have to be taken into account. Thus marginal distortions can be possible although it may be noted that these can be two-way. There are instances where conversion costs of developing countries are higher than those of the developed countries due to managerial and technological inefficiencies.

[illegible]. Synthetic drugs are often manufactured in multipurpose plants. This factor has implications on the allocation of conversion costs between products common to the plant.

[illegible]. In this study, prevalent DP prices have been discounted for conversion costs only and no discounting has been provided for interest and profits. It has been argued that since exports bring about an increase in capacity utilisation efficiency by enlarging the scale of operations, their price should be based on marginal costs.

[illegible]. If conversion costs form an insignificant proportion of the cost of bulk drugs and the reliability of basic information on intermediates computed on a national level may be affected.

4.7 In view of these limitations, the selected prices have been worked out only in respect of those bulk drug operations whose technology, scale, and costs are believed to be more or less in line with those in the developed countries. (Table no.3)

5.1 Analysis of Prices and Cost: Data pertaining to the 5 drugs has been collated to analyse :

i. the structure of manufacturing costs of the bulk Drugs and some Intermediates;

ii. the viable prices of 5 drug intermediates; and

iii. the resultant effect on the manufacture of formulations.

5.2 This analysis contained in [illegible] forms the basis of all conclusions drawn in the study.

[redacted]

	[illegible] Salicylic Acid	[illegible]
2.	Ampicillin Trihydrate	Inter.
3.	Sulphadimidine	Basic
4.	Tetracycline Hcl	Basic
5.	Diethyl Carbamazine Citrate	Inter.
6.	Dapsone	[illegible]
7.	Chloroquin Phosphate	Inter.
8.	[illegible]butol Hcl	[illegible]
9.	[illegible]	[illegible]

rm/dcdi/82 [illegible]

Cost of Local Manufacture $/lb	Conversion Cost in local Manufacture $/lb	Conversion Cost as Percentage of Cost of Local Manufacture
[illegible]	[illegible]	[illegible]
96.73	17.16	18.00
13.14	4.40	27.00
44.[illegible]	19.82	45.00
11.33	2.92	26.00
[illegible]	[illegible]	[illegible]
55.41	11.07	32.00
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible] would not [illegible] intermediates or these drugs.

CONCLUSION

6. Prevailing International [illegible]s:

6.1 Intermediates:

The study [illegible] ([illegible] [illegible] 4) that the present [illegible] [illegible] of the following intermedi[illegible] [illegible] high to allow competitive manufac[illegible] corresponding bulk drug in developing [illegible]:

1. dl-Aminobutanol
2. Acetoldi[illegible]ne
3. [illegible]
4. 6-APA
5. D Alpha Phenyl Glycine Chloride Hydrochloride

6.2 Bulk Drugs:

The following [illegible] [illegible] [illegible] [illegible] [illegible] prices are too high when [illegible] [illegible] [illegible] of local manufacture in developing [illegible]:

1. Acetyl Salicylic Acid
2. Ampicillin
3. Sulphadimidine
4. Tetracycline
5. Chloroquin
6. Isoniazid

6.3 Impact on formulation price:

It [illegible] [illegible] from Table No.5 and Table No.6 that the impact of the high cost of intermediates [illegible] [illegible] of local manufacture of bulk drugs is [illegible] significantly albeit in varying measure in the formulations.

Table No. 4

COMPARISON BETWEEN ACTUAL AND DESIRABLE PRICES OF INTERMEDIATES

Sr. No.	Name of the Bulk Drug		Name of the Intermediate required therefor	Actual Price of the intermediate $/Kg	Desirable price of the intermediate $/Kg	Difference expressed as percentage of desirable %
1.	Ethambutol Hcl		d2-Aminobutanol	50.00	46.97	(+) 6.45
2.	Chloroquin Phosphate	(a)	EDME	10.33	6.83	(+) 51.00
		(b)	Novaldiamine	15.78	10.50	(+) 50.00
3.	Ampicillin Trihydrate	(a)	6-APA	74.00	67.32	(+) 10.00
		(b)	D-Alpha Phenyl Glycine Chloride Hydrochloride	18	15.92	(+) 13.00

*

Table No. 5

MANUFACTURING AND PACKING COSTS OF FORMULATIONS

Based on cost of local manufacture of bulk drug

(Percentages Items to total)

	Bulk Drug	Other Raw Materials	Packing Materials	Conversion	Packaging
1. Acetyl Salicylic Acid (Aspirin) Tab. 300 mg per tablet in pack of 1500 Bot.	69	1	15	3	12
2. Isoniazid Tablets 50 mg per tablet in a pack of 1000s tin	53	3	10	27	7
3. Tetracycline Capsules 250 mg per capsule in a box of 10 by 10s strip	57	14	17	10	2
4. Sulphadimidine Tabs 500 mg per tablet in a pack of 50 by 10s strip	70	1	22	5	2
5. Ampicillin Capsules 250 mg per capsule in a pack of 10s strip	76	7	10	5	2
6. Diethyl Carbamizine Citrate tablets 500 mg per tablet in a pack of 10s strip	20	4	33	10	33
7. Chloroquine Tablets 250 mg per tablet in box of 10 by 10 strip	84	1	7	4	4
8. Dapsone Tablets 25 mg per tablet in a pack of 1000s bottle	14	4	16	41	15
9. Ethambutol Tablets 400 mg per tablet in a pack of 10s strip	85	0.5	9	1.5	4

*

Table No. 6

MANUFACTURING AND PACKING COSTS OF FORMULATIONS
Based on CIF price of the Bulk Drug
(Percentages/Items to Total)

Sl. No.	Particulars	Bulk Drug	Other RMs	Packaging M.	Conversion	Packing	Total
1.	Acetyl Salicyclic Acid Tablets 300 mg per tablet in a pack of 1500's bottle	63	1	18	4	14	100
2.	Ampicillin Capsules 250 mg per capsule in a pack of 10's strip	74	8	10	5	3	100
3.	Sulphadimidine Tablets 500 mg per tablet in a pack size of 50x10's strip	54	1	34	8	3	100
4.	Tetracycline Capsules 250 mg per capsule in a box of 10x10" strip	46	18	21	12	3	100
5.	Diethyl Carbamazine Citrate Tablets 50 mg per tablet in a pack size of 10's strip	29	3	29	10	29	100
6.	Dapsone Tablets 25 mg per tablet in a pack size 1000's bottle	26	4	16	39	15	100
7.	Chloroquin Tablets 250 mg per tablet in a box of 10x10's strip	80	1	9	5	5	100
8.	Ethambutol Tablets 400 mg per tablet in a pack size of 10's strip	85	0.5	10	1.5	3	100
9.	Isoniazid Tablets 50 mg per tablet in a pack of 100's tin	46	3	12	31	8	100

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6.4 Among the nine formulations studied only three can be advantageously based on bulk drugs of local manufacture, unless the c.i.f. prices of intermediates and certain bulk drugs are lowered.

6.5 It will be seen from Table No.5 that barring two formulations, namely (1) Dapsone Tablets and (2) Diethyl Carbamazine Tablets, all the other formulations studied in this paper are sensitive to bulk drug pricing.

7. Price/Cost Relatives:

Comparison of 1980 relatives of c.i.f. prices of Intermediates and bulk drugs with those of 1982 (Please see Table 7) reveals that in 5 cases out of 6, the changes are unexplainable. Bulk drug prices have risen even as prices of Intermediates have fallen. Apparently there is inadequate internal correspondence between the two.

--

1.	Acetyl Salicylic Acid	2.1	2.64	+33
2.	[illegible] Salicylate	[illegible]	[illegible]	+ [illegible]
3.	Sulphadiazine	10	8.00	-20
4.	Tetracycline	38	27.60	-27
5.	Diethyl Carbamazine	21	19.65	- 6
6.	Dapsone	20	26.20	+31
7.	Chloroquine	36	28	-22
8.	Ethambutol	[illegible]	58	+[illegible]
9.	Isoniazid	6	8	+33

Table No. 7

[illegible]

[illegible]		[illegible]	International [illegible]	Percentage ±
9.74	Salicylic Acid	1.68	2.56	+52
26.72	(i) G-A.A	165.00	74	-55
	(ii) B-Alanen.Gly.	37.50	18	-52
41.14				
44.18				
11.33	1-Methyl Piperazine	27.00	12.37	-54
12.12	Mono-chloro Benzene		0.8	
35.41	(i) [illegible]	13.08	10.33	-21
	[illegible]	20.00	15.78	-24
54.23	2-Aminoethanol	54.02	50.00	- 7
10.60	Gamma picoline	5.42	2.50	-54

*

ANNEXURES

1. Acetyl Salicylic Acid
   (includes Salicylic Acid ex-Phenol)

2. Ampicillin Trihydrate
   (includes 6-APA ex-Pen G)

3. Sulphadimidine
   (includes Sulphaguanidine)

4. Tetracycline

5. Diethyl Carbamazine

6. Dapsone

7. Chloroquine Phosphate

8. Ethambutol.

9. Isoniazid
   (includes Gamma Picoline)

--

ACETYL SALICYLIC ACID (ASPIRIN) :

A. Price :

International CIF price of Bulk Drug (1982) : $ 3.00/Kg

B. Process :

Phenol is reacted with Caustic Soda to produce Sodium Phenate, which is then combined with Carbon Dioxide under pressure to form Sodium Salicylate.
Salicylic Acid is acetylated with Acetic Anhydride and the Acetyl Salicylic Acid so formed is purified by re-crystallisation from Alcohol.
Manufacturing costs in this report have been developed for Acetyl Salicylic Acid starting from :

(a) Phenol
(b) Salicylic Acid

C. Technology and Plant Capacity :

Process technology and chemical yields are competitive. Cost calculated on plant capacity of 1,200 tons per annum; both ex-Phenol and ex-Salycylic Acid.

D. Manufacturing Cost Bulk Drug :

All materials readily available. Phenol, Salicylic Acid and Acetic Anhydride are produced in some of the more advanced developing countries.

Raw Materials

	Usage Per Kg Bulk Drug	Price Per Kg	Cost per Kg Bulk Drug	Percentage Total Materials Cost
	Kg	$	$	%
Phenol	0.7105	1.63	1.16	39
Acetic Anhydride	0.7828	1.35	1.45	48
Other Materials	--	--	0.37	13
a. Total Materials			2.98	100

(Acetyl Salicylic Acid/Aspirin)

Conversion Costs

1. Utilities	.25
2. Salaries and Wages	.1[illegible]
3. Depreciation	.[illegible]5
4. Maintenance	.[illegible]
5. Overhead	.[illegible]
b. Total Conversion Cost	.[illegible]
Total Bulk Drug (a + b)	.74

E. Data Basis :

All indigenous raw materials Prices of 1981- 2.

F. Conclusion :

Comparable costs are :

International CIF price (1982) : $ [illegible]

Manufacturing Cost : $ 3.74/-

The manufacturing cost is quite competitive with the international CIF price for this bulk drug, for the technology and plant capacity used in these cost calculations.

**

Acetyl Salicylic Acid (Formulation)

Cost Break-up :

Dosage : Tablet
Strength : 300 mg. per tablet
Pack Size : 1500 tablets in a tin container

Item	Cost per pack in US$		As percentage of total cost	
	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug
1	2	3	4	5
Acetyl Salicylic Acid	1.86	1.41	69	63
Other Raw Materials	0.02	0.02	1	1
Conversion Cost*	0.31	0.31	12	14
Packing Cost*	0.08	0.08	3	4
Packaging Material Cost	0.42	0.42	15	18
Ex-factory Cost	2.69	2.24	100	100

* Includes direct wages, utilities, depreciation, maintenance and overheads.

(Acetyl Salicylic Acid [Aspirin])

A. Manufacturing Cost Bulk Drug [illegible]

Raw Materials

	Usage Per Kg Bulk Drug	Price per Kg	Cost Rs.	%
Acetic Anhydride	0.7303	2.50	1.82	36
Salicylic Acid	0.6536	2.56	2.13	34
Caustic Soda			0.41	10
Other Materials				
a. Total Materials			4.36	80

Conversion Costs

1. Utilities	0.13
2. Salaries & Wages	0.12
3. Depreciation	0.03
4. Repairs & Maintenance	0.05
5. Overhead	0.13
b. Total Conversion Cost	0.46
Total Bulk Drug Cost (a + b)	4.81

(Export Price 1976-77 - Last export)

**

../doc[illegible]

SALICYLIC ACID: ex-Phenol.

A: Price: US ¢ 3.35/kg CIF.
* ¢ 2·56/kg CIF.
(*Export Price of producer in 1976-1977.)

B. Process: Starting material Phenol is converted into Sodium Phenate which is then carbonolysed in autoclave to produce Sodium Salicylate. This is dissolved in water and cooled to yield Sodium Salicylate Hexahydrate crystals. These are then treated with acid to produce pure Salicylic Acid.

Mother liquid is treated further to recover technical grade Salicylic Acid.

C. Technology: Process technology used and chemical yields are competitive.

D. Cost of Production: Costs are based on production of 2,000 MT/pa.
Raw material prices are based on verified actuals.
Raw materials are indigeneous and their rates have been adjusted to exclude local taxes.

*Costs

Raw Materials

	Usage per kg of Salicylic A.	Price per kg.	Cost per kg/Product	Percent of Total Materials
	kg	US ¢	US ¢	%
1. Phenol	0.8323	1.40	1.17	77.5
2. Caustic Soda Lye	0.4276	0.31	0.13	8.5

(Salicylic Acid)

3. Others	---	---	0.21	14
a.Total Materials			1.51	100 %

Conversion Costs

1. Utilities	0.09
2. Salaries and Wages	0.05
3. Depreciation	0.05
4. Overheads	0.09
5. Maintenance	0.07
b. Total Conversion Cost	0.35
Total Cost of Production (a+b)	1.86

5. Conclusion: With this scale of production and process technology manufacture of Salicylic Acid is very much more advantageous than the international CIF price.

(CIF price of US $ 3.35/kg reported in Chemical Marketing Reporter of August 1982).

****

AMPICILLIN TRIHYDRATE EX 6-APA :

A. Price :
International CIF price of Bulk Drug (July 1[illegible] : $ 90. o/Kg
The corresponding CIF price for 6-APA is $ 74 per Kg.

B. Process :
6-APA is acylised to produce Ampicillin.

C. Technology :
Process and chemical yields in these cost calculations are believed to be competitive. Plants capacity for economic viability considered to be minimum 2[illegible] per annum.

D. Manufacturing Cost Bulk Drug :
The two cost studies set out in this report are based upon importation of 6-APA and Phenyl Glycine Chloride Hydrochloride.
All other raw materials are of indigenous origin.
Imported intermediates are freely available.

Raw Materials

	Requirements Per Kg FP	Price per Kg	Cost Per Kg FP	Percentage of Total Material Cost
	Kgs	$	$	%
1. 6-APA	0.66	74	48.84	61
2. Phenyl Glycine Chloride Hcl	0.64	18	11.52	14
3. Dimethyl Dichlorosilane	0.51	8	4.08	5
4. Methyl Chloride	4.1	1.40	5.74	7
5. Isopropanol	6.7	1.2	8.04	10
6. Dimethyl Aniline	0.4	3.1	1.24	2
7. Other Materials			0.10	1
Total Materials			79.56	100

(Ampicillin Tri drate ex 6-APA)

Conversion Costs

1. Utilities	.
2. Salaries and Wages	1.
3. Depreciation	.
4. Maintenance	.
5. Overhead	.
a. Total Conversion Cost	.
Total Bulk Drug (a + b)	.

B. Data Basis :

Imported Intermediates : Average CIF price (
Actual imp tion
Indigenous materials : Average pri

F. Conclusion :

Comparative costs are :

CIF price of imported bulk drug :

Local manufacturing Cost :

Reduction in CIF price of intermediates would make local manufacture competitive.

Ampicillin Trihydrate (Formulation)

Cost Break-up :

Dosage : Capsules
Strength : 250 mg. per Capsule
Pack Size : 10 Capsules in a strip

Item	Cost per pack in US$		As percentage of total cost	
	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug
1	2	3	4	5
Ampicillin [illegible]	0.31	0.29	76	76
Other Raw [illegible]	0.03	0.03	7	8
Conversion C[illegible]	0.02	0.02	5	5
Packing Cost*	0.01	0.01	2	3
Packaging Materials Cost	0.04	0.04	10	10
Ex-factory Cost	0.41	0.39	100	100

* Includes direct wages, utilities, depreciation, maintenance and overheads.

AMPICILLIN TRIHYDRATE :

Calculation of desirable prices of 6-APA and D-Alpha Phenyl Glycine (Cl_2 Hcl)

	US $
1. International CIF Price Bulk Drug	99.00
2. Conversion Cost	17.16
3. Residual Value of Materials	72.84
4. 6-APA	
(a) Value assigned (61% of 72.84)	44.43
(b) Usage Kgs per Kg Bulk Drug	2.38
(c) Desirable CIF Price (a÷b)	67.12
(d) Actual CIF Price	74.00
5. Phenyl Glycine Chloride Hydrochloride	
(a) Value assigned (14% of $ 72.84)	10.19
(b) Usage Kgs per Kg Bulk Drug	0.64
(c) Desirable CIF Price (a÷b)	15.92
(d) Actual CIF Price	16.70

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6-APA: (6 Amino Penicillinic Acid) (Intermediate)

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A: Price :

CIF prices of 6-APA US $ 74/kg; based on imports made by major users in 1981-82.

B. Process :

Potassium Penicillin G Sod. (Ist Crystals) [illegible] ted to chemical degradation using Phosphorous [illegible] chloride under low temperature.

C. Technology and Plant Capacity :

Commercial production only recently started. Success of technology yet to be proven.

D. Manufacturing Cost of 6-APA :

This cost study assumes importation of Penicillin G. Potassium Ist Crystals which is said to be freely available.

All other materials are from indigenous sources.

Raw Materials

		Usage per kg of bulk drug	Rate per kg	Cost per kg of bulk drug	Percentage of total material cost
		kg	$	US $	%
1.	Potassium Penicillin G. (Ist Crystals)	2.40 BU	22.00	52.80	74
2.	Butyl Alcohol	2.727 kg	1.39	3.79	5.50
3.	Ammonium Hydroxide	2.226 kg	0.11	0.24	0.3
4.	Chloroform	3.208 kg	1.16	3.72	5.50
5.	Dimethylaniline	1.613 kg	2.59	4.18	5.7

(6-APA)

6.	Dimethylchlorosiline	0.802 kg	3.99	2.40	3.50
7.	Phosphorous Penta-chloride	1.235 kg	3.86	3.54	5.50
	(a) Total materials			70.67	100.00

Conversion Costs

1.	Utilities	1.05
2.	Salaries & Wages	1.98
3.	Maintenance & Repairs	1.29
4.	Overheads	4.49
5.	Depreciation	4.98
	(b) Total Conversion Cost	13.79
	Total cost of 6-APA (a + b)	84.42

E. Data Basis :

Imported raw materials: Average CIF price (duty excluded)

Indigenous raw materials: Average prices 1981-82

F. Conclusion :

Comparative costs are :-

CIF price of imported 6-APA : $ 74.00/kg

Manufacturing Cost : $ 84.42/kg

Slight reduction in Penicillin G. Sodium (Ist Crystals) CIF price and stabilisation of production would render local manufacture viable.

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6-Amino Penicillinic Acid: ex-potassium Penicillin G. Ist Crystals

Calculation of desirable price of Potassium Penicillin G. Ist Crystals

		$/kg
1.	CIF price of 6-APA	74.00
2.	Conversion cost incurred per kg of production	15.75
3.	Value assignable to raw materials (1 minus 2)	60.25
4.	Potassium Penicillin G.Ist Crystals	
	(a) Value assigned (74% of 60.25)	44.58
	(b) Usage in MUs per kg of 6-APA	2.4
	(c) Desirable C.I.F. price (a ÷ b)	18.58
	(d) Actual C.I.F. Price	22.00

SULPHADIMIDINE :

A. Price :
International CIF price Bulk Drug : $. /Kg.

B. Process :
Acetanilide is reacted with Chlorosulphonic acid to produce p-acetylsulphanilchloride which is reacted with Guanidine Nitrate to yield p-acetylsulphaguanidine. This product is refluxed with Aqueous Caustic Soda to obtain sulphanylguanidine, which is subsequently condensed with Alkali to sulphadimidine.

C. Capacity :
Process : Technology and chemical yields are given.
Plant capacity 500 tons per annum.

D. Significance in Cost Bulk Drug :
Process involves importation of :

Acetyl Acetone
Methyl Isobutyl Ketone (para)
Guanidine Nitrate

All other raw materials are of indigenous origin and easily available.

Raw Materials

	Usage Per Kg	Price	Cost	Percentage to Total Material
	Kg	$		
	Bulk Drug	per Kg	Bulk Drug	
Imported :				
Methyl Isobutyl Ketone	1.045	1.82	1.90	16.00
Acetyl Acetone	0.327	6.07	2.02	17.00
Guanidine Nitrate	0.973	1.38	1.42	12.00
			5.34	

(Sulphadimidine)

Indigenous :				
Acetanilide	1.482	1.17	1.7	27.[illegible]
Methyl Isobutyl Ketone	0.303	1.13	0.[illegible]	6.00
Acetic Acid	1.481	0.[illegible]	0.[illegible]	1.[illegible]
Caustic Soda	3.656	0.21	0.7[illegible]	3.[illegible]
Chlorosulphonic Acid	5.676	1.15	1.[illegible]	8.00
Others	--	--	0.09	1.00
Total Material Costs :			3.[illegible]	1[illegible].[illegible]

Conversion Cost

1. Utilities	1.[illegible]
2. Salaries & Wages	0.[illegible]
3. Depreciation	0.[illegible]
4. Maintenance and Repairs	0.[illegible]
5. Overheads	0.[illegible]
	0.[illegible]
Total Bulk Drug Cost	1[illegible].[illegible]

E. Data Base :

Imported Intermediates - average CIF prices ([illegible]); actual importation [illegible].

Indigenous Materials - average 1981-82 prices

F. Conclusion :

Comparative costs are :

CIF price imported bulk drug :	$ 8.00
Local Manufacturing Cost :	$16.14

Manufacturing cost is high.

*

Sulphadimidine (Formulation)

Cost Break-up :

Dosage : Tablets
Strength : 500 mg. per tablet
Pack Size : Box of 50 strips of 10 tablets each

Item	Cost per pack in US$		As percentage of total cost	
	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug
1	2	3	4	5
Sulphadimidine	4.45	2.21	70	54
Other Raw Materials	0.04	0.04	1	1
Conversion Cost*	0.34	0.34	5	8
Packing Cost*	0.14	0.14	2	3
Packaging Material Cost	1.35	1.35	22	34
Ex-factory Cost	6.32	4.08	100	100

* Includes direct wages, utilities, depreciation, maintenance and overheads.

SULPHAGUANIDINE : (bulk drug and intermediate) ex-dicyanadianide

A. Price :

International CIF price of Bulk Drug $ 4.50/kg July, 1982.

B. Process :

Acetanilide is reacted with Chlorosulphuric Acid to obtain Acetyl Sulphachloride which, on amidation and hydrolysis gives Sulphanilamide; which is hydrolysed with Dicyanadianide to obtain Sulphaguanidine.

C. Technology :

Process technology and chemical yields fairly good. Scale of production 300 MT/per year.

D. Manufacturing Cost Bulk Drug :

Intermediate Dicyanadinide is imported. All other raw materials are of indigenous origin. All raw materials are easily available.

Raw Materials

		Requirements per kg of bulk drug	Price per kg	Cost per kg.	Percentage total material
		kg	$	$	%
	Imported				
1.	Dicyanadimide	1.12	0.80	0.90	10
	Indigenous				
2.	Acetanilide	2.04	2.45	5.00	59
3.	Others	--	--	2.54	31
	(a) Total raw materials			8.44	100

(Sulphaguanidine)

		$/kg
1.	Utilities	0.77
2.	Salaries & Wages	0.35
3.	Depreciation	0.15
4.	Maintenance & Repairs	0.31
5.	Overheads	1.14
	(b) Total conversion cost	2.72
	Total Bulk Drug Cost (a + b)	11.16

E. Data Basis:

Imported intermediate: Average CIF price (duty excluded) actual importation 1981/82

Indigenous materials : Average prices 1981-82

F. Conclusion :

Comparative costs are :-

CIF price of imported bulk drug : $ 4.50/kg.

Local manufacturing cost : $ 11.16/kg

High local cost of Acetanilide and other local raw materials makes local manufacture highly non-viable.

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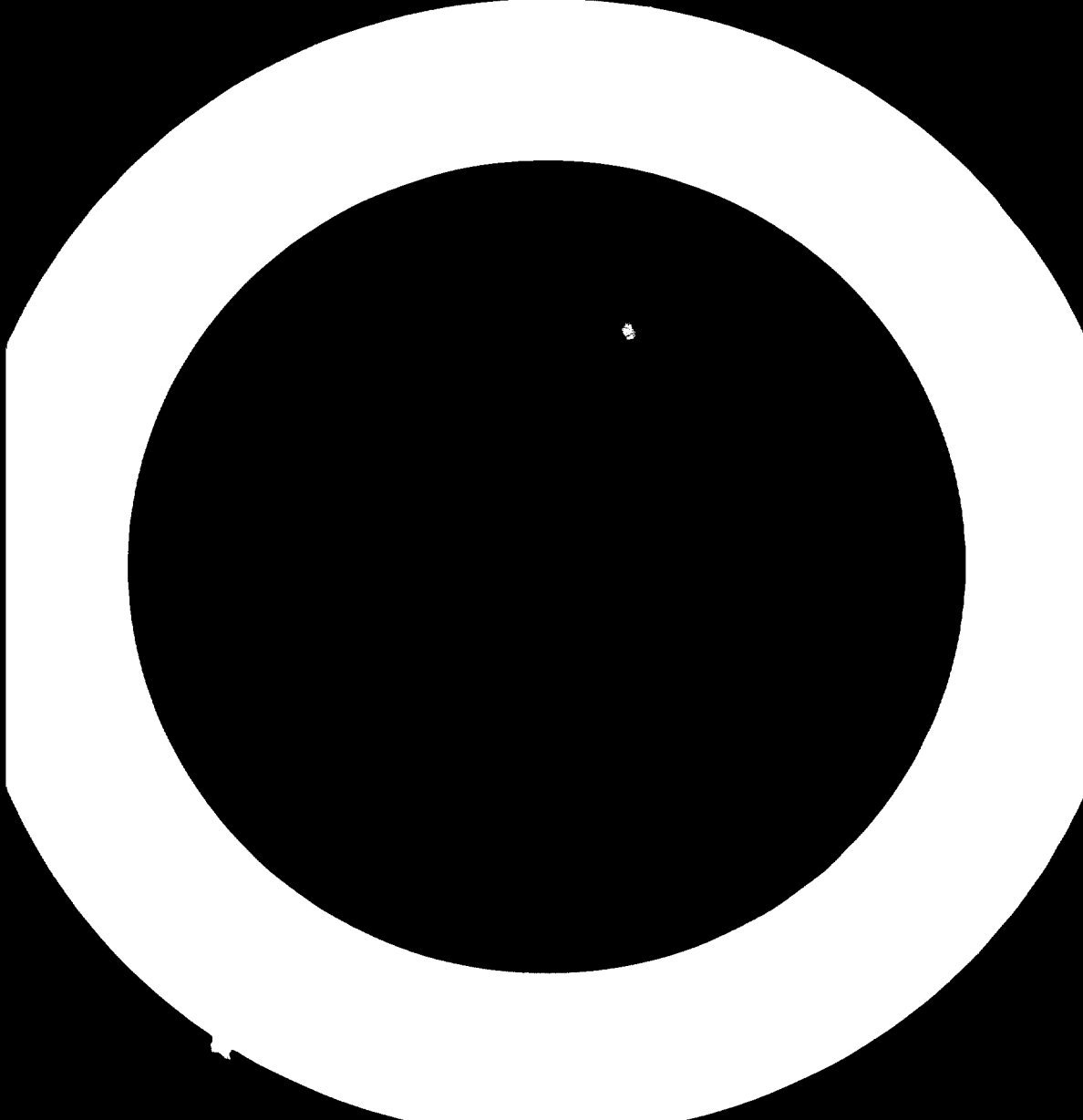

Annexure 4

TETRACYCLINE HCL :

A. Price :

The International CIF price (import duty excluded) is $ 27.6 per kg 1981-82. This price is based on normal imports.

B. Process :

Tetracycline is manufactured by fermentation of a carefully optimised nutrient medium with a selected strain of S. Viridifacines.

Tetracycline Hydrochloride is recovered from the fermented medium by extraction and purification.

C. Technology :

Technology is concerned with optimisation of the fermented medium and selection of strains of the micro-organism, both of which can contribute to increase antibiotic yields.

Cost of the finished Bulk Drug are also sensitive to fermentor volume and total plant capacity.

D. Manufacturing Cost Bulk Drug :

Raw materials are indigenously available.

	Cost Per Kg of FP $
1. Raw Materials	24.36
2. Utilities	12.17
3. Salaries and Wages	1.50
4. Depreciation	0.80
5. Maintenance	2.50
6. Overheads	2.85
Total Conversion Cost	19.82
Total Bulk Drug	44.18

(Tetracycline Hcl)

F. Conclusion :

International CIF price imported Bulk Drug : $ 37.50/kg

Local manufacturing cost : $ 44.18/kg

The higher local cost of manufacture probably arises from a shortfall of fermentation technology and sub-optimal fermenter plant size. The high cost of locally sourced raw materials may also be a contributing factor.

For such an operation to be economically viable tariff protection may be essential.

Tetracycline Hydrochloride (Formulation)

Cost Break-up :

Dosage : Capsule
Strength : 250 mg. per Capsule
Pack Size : Box of 10 strips of 10 Capsules each

Item	Cost per pack in US$		As percentage of total cost	
	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug
1	2	3	4	5
Tetracycline Hcl.	1.22	0.76	57	46
Other Raw Materials	0.5	0.3	14	18
Conversion Cost*	0.21	0.21	10	12
Packing Cost*	0.05	0.05	2	3
Packaging Material Cost	0.35	0.35	17	21
Ex-factory Cost	2.13	1.67	100	100

* Includes direct wages, utilities, maintenance and depreciation.

DIETHYL CARBAMAZINE CITRATE :

A. Price :

International CIF price of bulk drug $ 19.55 per kg; import duty omitted. Price based on quotations.

B. Process :

Methyl Piperazine is reacted with Methyl Carbamyl Chloride in the presence of a base to form Diethyl Carbamazine base; subsequently converted into the Citrate salt.

C. Technology :

Believed to be competitive.

D. Manufacturing Cost Bulk Drug :

Raw Materials

All except N-Methyl Piperazine are local. [illegible] available.

	Requirements per Kg FP Kg	Price per Kg $	Cost per Kg FP $	Percent total materials cost %
1. N-Methyl Piperazine	0.32	12.37	3.96	44
2. Other Materials			5.05	56
a. Total Materials			9.01	100

Conversion Costs

1. Utilities	0.26
2. Salaries and Wages	0.32
3. Depreciation	0.23
4. Maintenance	0.45
5. Overhead	1.06
b. Total Conversion Cost	2.32
Total Bulk Drug	11.33

(Diethyl Carbamazine Citrate)

E. Data Basis :

For N-Methyl Piperazine average imported cost 1981-82, excluding import duty. All other materials are indigenous and are included at average 1981-82 prices.

F. Conclusion :

International CIF price Bulk Drug :	$ 19.65/kg.
Local manufacturing cost	$ 11.33/kg.

The international price of bulk drug is high.

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Diethyl Carbamazine Citrate (Formulation)

Cost Break-up :

Dosage : Tablets
Strength : 50 mg. per tablet
Pack Size : Box of 10 strips of 10 tablets each

Item	Cost per pack in US$		As percentage of total cost	
	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug
1	2	3	4	5
Diethyl Carbamazine Citrate	0.059	0.10	20	29
Other Raw Materials	0.012	0.012	4	3
Conversion Cost*	0.03	0.03	10	10
Packing Cost*	0.10	0.10	33	29
Packaging Materials Cost	0.10	0.10	33	29
Ex-factory Cost	0.30	0.34	100	100

* Includes direct wages, utilities, depreciation, maintenance and overheads.

DAPSONE :

A. Price :

International CIF price of Bulk Drug on the basis of imports in 1981-82 (import duty not included) : US $ 21.00/Kg.

B. Process :

Monochlorobenzene is converted to Dichlorodiphenyl Sulphone, which with Ammonia in the presence of a catalyst generates Di amine diphenyl Sulphone.

C. Technology :

Process and chemical yeilds used in this cost study are competitive.

D. Cost of Manufacture :

Cost study is based on production of 25 MT per year and data of 1981-82.

All raw materials are indigeneous and easily available except the catalyst which is imported.

Raw Materials

	Usage per kg/product	Price per kg.	Cost per kg/prod.	Percent of total cost/ materials
	Kg	US $	US $	%
1. Catalyst	0.0252	8.4	0.21	5
2. Monochloro benzene	1.7600	0.8	1.43	33
3. Other materials	-	-	2.70	62
4. Total materials			4.34	100

(Dapsone)

Conversion Costs

1.	Utilities	2.15
2.	Salaries and Wages	0.31
3.	Depreciation	1.68
4.	Maintenance	0.54
5.	Overheads	2.52
b.	Total Conversion Costs	7.7[illegible]
	Total Cost of Manufacture (a+b)	1[illegible]

E. Data Basis :

Apart from the imported catalyst (a minor item) all other raw materials are costed at average 1981-82 prices; local taxes excluded.

F. Conclusion :

Local manufacturing costs (₹ 12.12/kg.) are very attractive in comparison to the CIF price of imports. Major raw material Mono Chloro Benzene is manufactured locally and is available at appropriate price.

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Dapsone (Formulation)

Cost Break-up :

Dosage : Tablets
Strength : 25 mg. per tablet
Pack Size : 1000 tablets in a tin

Item	Cost per pack in US$		As percentage of total cost	
	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug
1	2	3	4	5
Dapsone	0.066	0.14	14	26
Other Raw Materials	0.02	0.02	4	4
Conversion Cost*	0.21	0.21	45	39
Packing Cost*	0.08	0.08	17	15
Packaging Material Cost	0.09	0.09	20	16
Ex-factory Cost	0.465	0.54	100	100

* Includes direct wages, utilities, depreciation, maintenance and overheads.

Annexure 7

CHLOROQUINE PHOSPHATE :

.....

A. **Price** :

CIF price of Bulk Drug based on average cost of importations 1981-82 $ 28/kg

B. **Process** :

Metachloroaniline is reacted with Diethyl Ethoxy Metlylene Malonate and further reacted with Phosphorous Oxychloride to produce 4.7 Dichloro quinoline. The latter is condensed with Novaldimine in the prescence of molten Phenol. Further reaction with Phosphoric Acid produces Chloroquine Phosphate.

C. Technology and Plant Capacity :

Technology believed to be competitive. Cost calculations based on commercial scale production.

D. Cost of Bulk Drug :

This cost study assumes importation of Diethyl Ethoxy Metlylene Malonate and Novaldiamine; both of which are freely available. All other raw materials are from indigenous sources.

Raw Materials

		Usage per kg Bulk Drug	Price per kg	Cost per kg Bulk Drug	Percentage of total materials
		kg	$	$	%
1.	Diethyl Ethoxy Metlylene Malonate	0.74	10.33	7.64	31
2.	Novaldiamine	0.42	15.78	6.63	27
3.	Other materials	--	--	10.47	42
	(a) Total Materials			24.74	100

(Chloroquine Phosphate)

Conversion Costs

1.	Utilities	3.26
2.	Salaries & Wages	1.45
3.	Depreciation	0.85
4.	Maintenance	0.98
5.	Overheads	5.13
	(b) Total Conversion Cost	11.67
	Total Bulk Drug (a+b)	36.41

E. Data Basis :

Imported Raw Materials : Average CIF price (duty excluded) actual importation 1981-82

Indigenous Materials: Average prices 1981-82

F. Conclusion :

Comparative costs are :-

CIF price imported Bulk Drug	$ 28/kg
Local manufacturing cost	$ 36.41/kg

The cost of imported intermediates which account for 58% of the total raw material is high. Suitable reduction in price of imported intermediates can make local manufacture more viable.

(Chloroquine Phosphate) ex-diethyl ethoxy Methylene Malonate and Novaldiamine

Calculation of desirable prices of EMME and Novaldiamine

		$/kg
1.	CIF price of Chlroquine Phosphate	28.00
2.	Conversion cost incurred per kg of production	11.67
3.	Residual value of materials (1 minus 2)	16.33
4.	Diethyl Ethoxy Methylene Malonate (EMME)	
	(a) Value assigned (31% of $ 16.33)	5.06
	(b) Usage kg per kg of Bulk Drug	0.74
	(c) Desirable CIF price (a ÷ b)	6.83
	(d) Actual CIF price	10.33
5.	Novaldiamine	
	(a) Value assigned (27% of $ 16.33)	4.41
	(b) Usage kg per kg of Bulk Drug	0.42
	(c) Desirable CIF price (a ÷ b)	10.50
	(d) Actual CIF price	15.78

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Chloroquin Phosphate (Formulation)

Cost Break-up :

Dosage : Tablets
Strength : 250 mg. per tablet
Pack Size : Box of 10 strips of 10 tablets each

Item	Cost per pack in US$		As percentage of total cost	
	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug
1	2	3	4	5
Chloroquin Phosphate	1.00	0.77	84	80
Other Raw Materials	0.01	0.01	1	1
Conversion Cost*	0.05	0.05	4	5
Packing Cost*	0.05	0.05	4	5
Packaging Material Cost	0.08	0.08	7	9
Ex-factory Cost	1.19	0.96	100	100

* Includes direct wages, utilities, depreciation, maintenance and overheads.

Annexure C

ETHAMBUTOL : ex-d2 Aminobutanol

A. Price :
International CIF price of bulk drug $ 55 to $ 58/kg. 1981/82; import duty excluded. Based on importation data.

B. Process :
d-2 Aminobutanol is reacted with Ethylene Dichloride in the presence of Caustic Soda, then converted to Hydrochloride salt.

C. Technology :
Process technology and chemical yields competitive. Scale of production 30 MT/per year.

D. Manufacturing Cost Bulk Drug :
Intermediate d-2 Aminobutanol is imported.
All other raw materials are of indigenous origin.
Sources of d-2 Aminobutanol are restricted.

Raw Materials

	Requirements per kg. F.P.	Price per kg.	Cost per kg.	Percent total material
	kg.	$	$	%
1. d-2 Aminobutanol	0.86	50	43.00	89
2. Isopropanol	2.4	1.56	3.75	7
3. Other materials	--	--	1.78	4
Total Materials			48.53	100

(Ethambutol)

Conversion Costs

1.	Utilities	1.66
2.	Salaries & Wages	0.66
3.	Depreciation	0.50
4.	Repairs & Maintenance	0.78
5.	Overheads	2.32
6.	Total Conversion Cost	6.42
7.	Total bulk drug	84.95

E. Data Basis :

Imported intermediate	Average c.i.f. price (duty excluded) actual importation 1981/82
Indigenous materials	Average prices, local taxes excluded.

F. Conclusion :

Comparative Costs are :

CIF price imported bulk drug	..	$ 55 to $ 58
Manufacturing cost	..	$ 84.95

Local manufacturing is competitive even when intermediate is imported. This is because current CIF prices of bulk drug are high; having risen from $ 40 to $ 55 in the last 2 to 3 years.

Local manufacture can be even cheaper if costs of imported intermediate d2-Aminobutanol (89% of Raw Materials Costs) were to be lowered.

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ETHAMBUTOL ex-d2 Aminobutanol

Calculation of desirable price of D2 Aminobutanol

		Rs.
1.	CIF Price of Ethambutol	[illegible]
2.	Conversion cost incurred per kg of production	[illegible].42
3.	Value assignable to all other raw materials (1 minus 2)	[illegible]1.[illegible]
4.	Value assignable to D2-Aminobutanol (89% of $ 51.58)	[illegible]
5.	Consumption of D2-Aminobutanol in kgs. per kg of production	[illegible]
6.	Desirable price of D2-Aminobutanol	[illegible]
7.	Actual price of D2-Aminobutanol	[illegible]

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Ethambutol Hydrochloride (Formulation)

Cost Break-up :

Dosage : Tablets
Strength : 400 mg. per tablet
Pack Size : Box of 10 strips of 10 tablets each

Item	Cost per pack in US$		As percentage of total cost	
	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug
1	2	3	4	5
Ethambutol Hcl.	2.39	2.56	85	86
Other Raw Materials	0.01	0.01	0.5	0.5
Conversion Cost*	0.05	0.05	1.5	1.5
Packing Cost*	0.10	0.10	4.0	3
Packaging Material Cost	0.27	0.27	9	10
Ex-factory Cost	2.82	2.99	100	100

* Includes direct wages, utilities, depreciation, maintenance and overheads.

Annexure 9

ISONIAZID (INH): (ex-Gamma Picoline)

A. **Price** :

International CIF price of bulk drug $ 8.0 per kg 1981/82; based on quotations.

B. **Process** :

Gamma Picoline is oxidised to Nicotinic Acid, from which Isoniazid is produced by reaction with Hydrozine Hydrate.

C. **Technology** :

Technology on which these cost calculations are based is believed to be competitive.

D. **Manufacturing Cost Bulk Drug** :

Raw Materials

Gamma Picoline and Hydrazine Hydrate are freely available internationally.

	Usage per kg of FP	Price per kg	Cost per kg of FP	Percentage of materials
	Kg	$	$	%
1. Gamma Picoline	1.08	2.50	2.70	37
2. Hydrazine Hydrate	0.5448	5.01	2.73	37
3. Other Materials	-	-	1.87	26
Total Materials			7.30	100

Conversion Costs

	$/Kg
Utilities	1.14
Salaries & Wages	0.49
Maintenance	0.26
Depreciation	0.31

Overheads	1.10
Conversion Cost	3.30
Total Bulk Drug	10.60

E. Data Basis :

Gamma Picoline CIF price based on imports (duty excluded) 1981/82.

Other materials (indigenous) average prices 1981/82.

F. Conclusion :

International CIF price of bulk drug:	$ 8.00/kg
Cost of local manufacture:	$10.60/kg

The higher cost of local manufacture is in part due to the fact that the international CIF price of Gamma Picoline is higher than the desirable price and partly because the cost of locally produced major raw material (Hydrazine Hydrate) is high.

CIF price of Hydrazine Hydrate $ 3.52/kg

as reported in Chemical Marketing Reporter of 16.8.1982.

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ISONIAZID (INH): (ex-Gamma Picoline)

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Calculation of desirable price of Intermediate: Gamma Picoline

		US $/kg
1.	C.I.F. price of the drug	8.00
2.	Conversion cost incurred in domestic manufacture ex-Gamma Picolines and other raw materials (A)	3.30
3.	Residual value assignable to Gamma Picolines and other raw materials (1 minus 2)	4.70
4.	Value out of 3 which can be assigned to Gamma Picoline (37%) (B)	1.74
5.	Consumption of Gamma Picolines in kgs. per kg. of INH (4 ÷ 5)	1.08
6.	Desirable price of Gamma Picoline	1.61
7.	Actual price of Gamma Picoline	2.50
8.	Desirable price of other raw materials (63%) (B)	2.96
9.	Actual price of local raw materials	4.60

Isoniazid (Formulation)

Cost Break-up :

Dosage : Tablet
Strength : 50 mg. per tablet
Pack Size : 1000 tablets in a tin

Item	Cost per pack in US$		As percentage of total cost	
	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug	Based on local cost of manufacture of bulk drug	Based on CIF price of bulk drug
1	2	3	4	5
Isoniazid	0.58	0.44	53	46
Other Raw Materials	0.03	0.03	3	3
Conversion Cost*	0.3	0.3	27	31
Packing Cost*	0.08	0.08	7	8
Packaging Material Cost	0.11	0.11	10	12
Ex-factory Cost	1.10	0.96	100	100

* Includes direct wages, utilities, depreciation, maintenance and overheads.

GAMMAPICOLINE : (Intermediate)

A. Price :

International CIF price of the intermediate during 1981-82 $ 2.50/kg

B. Process :

Acetaldyhide and Anhydrous Ammonia are vaporised, pre-heated, and reacted in the prescence of a catalyst at an elevated temperature. Products are condensed, extracted with Benzene and stored. Gamma and Alpha Picoline are separated from this mixture by distillation and Gamma Picoline is separated by further fractional distillation.

C. Technology :

Process technology and chemical yields competitive.

Cost calculated on a plant capacity of 100 tonnes per annum; ex-acetaldyhide which is locally produced.

D. Cost of manufacture :

Raw materials

All raw materials are locally available.

	Usage per kg of Gamma Picoline	Price per kg	Cost per kg of Gamma Picoline	Percentage total material cost
	kg	$	$	%
1. Acetaldyhide	3.367	0.48	1.61	78
2. Others	-	-	0.43	22
Total materials			2.04	100

(Gamma Picoline) Conversion Costs	
Utilities	0.53
Wages and Salaries	0.07
Repairs & Maintenance	0.14
Overheads	0.34

(Commercialisation)

Overheads	0.34
Depreciation	0.04
Total Conversion Cost	1.12
Total Cost of Production	3.16

E. Data Basis :

All raw materials are indigenous except the Catalyst which is a minor material

F. Conclusion :

International CIF price	$ 2.50/kg
Manufacturing Cost	$ 3.16/kg

Local cost of manufacture is higher than c.i.f. price. It can be brought down if the price of Acetylidehide is lowered. This material is freely available internationally but at high price. c.i.f. price of Acetylidehide is $ 0.75/kg as per Chemical Marketing Reporter of 16th August 1982. Substituting this price for $ 0.48/kg (local price) taken here would raise the cost of manufacture in this operation to $ 3.80.

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