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THE DEVELOPMENT OF THE PLASTICS INDUSTRY
IN INDIA^{1/}

by

Chetan D. ANAND

^{1/} The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO.

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History

The plastics industry in India is about three decades old. The production of plastics processed goods by extrusion, lamination, fabrication and coating in the early years was established from imported raw materials with imported machines and moulds. The first plastic raw material to be produced in the country was phenolic moulding material (general purpose grade) in 1948 and its production was based on imported phenol and formaldehyde. At that time, the manufacture of injection moulded goods like combs, soap cases, toys, bangles, etc., had also commenced. The production of industrial goods claimed some attention in the beginning of 1950. Then the use of PVC in the manufacture of leather cloth and for the production of insulated cables, wires and flexibles made a good start. Production of radio cabinets, telephone receiver sets, gramophone records and injection moulded articles from polystyrene and polyethylene was also established. In the 1950's the manufacture of consumer goods such as tooth brushes, spectacle frames, fountain pens and buttons was also commenced in the country. In 1952, the production of paper and textile based phenolic laminates for general industrial applications and electrical industries, polyethylene film and lay-flat tubing for packaging was established.

The first thermoplastic material to be produced in the country was polystyrene in 1957. Subsequently, the manufacture of urea formaldehyde moulding material and polyethylene (low density) was commenced in 1956 and 1959 respectively. During the same period, two calendering plants commenced operation for making PVC supported and unsupported film. The use of polyethylene for injection and extrusion blow moulding became very popular and the extrusion of polyethylene pipes was also commenced. Large size objects of polyethylene such as buckets, baskets, basins, etc., began to be moulded. Big industrial items such as steering wheels and refrigerator parts also attracted the attention of the moulder.

With the growing consumption of basic plastics in the country, it was found necessary to develop the production of these items indigenously. Indigenous production of PVC was commenced in 1961 and cellulose acetate moulding material in 1965 (from imported flakes) and high density polyethylene in 1968.

Present Status

The production of the major basic plastics was established in India with the technical know-how obtained from overseas parties of international repute; this is elaborated below:

| Item of manufacture | Collaborators |
|--|--|
| 1. Phenolic resins/moulding materials | Bakelite, U.K. and F.R.G., Phillips, the Netherlands |
| 2. Urea/melamine formaldehyde resins and moulding materials | BIP, U.K. Ciba, Switzerland Leicester Lovel, U.K. Reichold Chemicals, U.K. |
| 3. Polystyrene | Dow Chemicals, U.S.A. BX Plastics, U.K. |
| 4. Polyethylene (low density) | ICI Ltd., U.K. Union Carbide, U.S.A. |
| 5. Polyethylene (high density) | Hoechst, F.R.G. |
| 6. PVC resins and compounds | Dynamit Nobel, F.R.G. BF Goodrich, U.S.A. Royal Dutch Shell Co., the Netherlands Maru Beni Iida, Japan Pechiney St. Gobain, France Vinatex Ltd., U.K. Kureha and Chiyoda, Japan |

Some of the overseas companies mentioned above also have equity participation in the Indian companies.

Production of polystyrene and polyethylene (low density) was initially established in the country from alcohol. In recent years, this raw material has gone into short supply which had some adverse effect on production. Manufacture of PVC was based either on calcium carbide or on ethyl alcohol. In view of the uncertain availability of adequate quantities of ethyl alcohol, a switch-over to petro-ethylene became imperative. This is in line with the trend in other industrially advanced countries. One of the existing manufacturers of polyethylene (low density) namely Union Carbide has also switched over long back to petro-ethylene after setting up the first petrochemical unit in India with ethylene capacity of 20,000 tonnes per annum at Bombay.

This was followed by a larger unit of National Organic Chemical Industries Limited, who put up in 1968 a petro-complex having ethylene capacity of 60,000 tonnes per annum. This unit is manufacturing PVC resins and compounds and is also providing ethylene to another unit, Polyolefins Industries, Bombay, for their manufacture of polyethylene (high density). Another naphtha based unit for the manufacture of 12,000 tonnes of PVC resins has also been established. The next petrochemical complex planned is in the public sector at Baroda with ethylene capacity of 1.30 lakh tonnes per annum of which 1.0 lakh tonnes is likely to be commissioned by 1974 as its first phase and the full capacity may be achieved in 1975-76 as its second phase. This unit will provide raw materials for the manufacture of basic plastics viz., polyethylene, PVC, polystyrene and polypropylene. Further, the existing manufacturers of PVC, polyethylene and polystyrene are also contemplating to base their expansion programme on naphtha feedstock.

The production of basic plastics in India in 1960, 1965 and 1968 to 1972 was as below:

| Item | 1960 | 1965 | 1968 | 1969 | 1970 | 1971 | 1972 |
|---|-------|-------|-------|-------|-------|--------|--------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Phenol formaldehyde moulding materials | 2100 | 3360 | 4260 | 4950 | 5330 | 6500 | 7000 |
| Urea/melamine formaldehyde moulding materials | 360 | 1300 | 1620 | 1540 | 1660 | 2000 | 2500 |
| Polystyrene | 3600 | 5650 | 6740 | 9400 | 9300 | 11000 | 12600 |
| Polyethylene (LD) | 4150 | 13500 | 15660 | 18700 | 23000 | 27500 | 22000 |
| Polyethylene (HD) | - | - | 7980 | 17350 | 18350 | 24000 | 19000 |
| PVC resins | - | 12200 | 17560 | 34400 | 38700 | 42500 | 46000 |
| Cellulose Acetate | - | 1100 | 854 | 1150 | 1050 | 1500 | 1700 |
| Total | 10210 | 37110 | 54674 | 87490 | 97390 | 115000 | 110800 |

The production of basic plastics in India recorded a phenomenal increase during the sixties, rising from about 10,000 tonnes in 1960 to about 97,000 tonnes in 1970 i.e. the production increased by 970% in the period of 10 years. PVC had the highest growth rate during the sixties.

As petrochemical complexes are being proposed in the country, plastics industry will have a tremendous growth in the next two Five-Year Plans of the Government of India. The production requirements of basic plastics for 1973-74 and 1978-79 have been estimated by the Development Council for Organic Chemical Industries constituted by the Ministry of Industrial Development as below:

| Product 1 | Estimated requirements (figures in tonnes) | |
|---|---|--------------|
| | 1973-74 2 | 1978-79 3 |
| 1. PVC resins | 80,000 | 175,000 |
| 2. Polyolefins: | | |
| a) Polyethylene (LD) | 58,000 | 150,000 |
| b) Polyethylene (HD) | 23,000 | 45,000 |
| c) Polypropylene | 7,000 | 15,000 |
| 3. Polystyrene and its co-polymers | 35,000 | 70,000 |
| 4. Acrylic resins | 5,000 | 10,000 |
| 5. Cellulosics: | | |
| a) Cellulose acetate moulding materials | 5,500 | 7,000 |
| b) Cellulose nitrate | 1,500 | 2,000 |
| 6. Phenolic resins | 13,000 | 22,000 |
| 7. Phenolic moulding materials | 6,500 | 9,000 |
| 8. Melamine formaldehyde moulding materials | 1,000 | 2,000 |
| 9. Urea formaldehyde moulding materials | 3,500 | 7,000 |
| 10. Urea formaldehyde resin adhesives | 12,000 | 24,000 |
| 11. Polyester resins | 1,400 | 3,200 |
| | 252,400 | 541,200 |

Machinery

Plastics machinery and moulds play a most important role in the development of the plastics industry. The manufacture of injection moulding machines, extruders and blow moulding machines has been established in India with technical know-how from: GKN Windsor, U.K.; Engel, Austria; Kril, U.S.A.; Buhler, F.R.G.; and Kautex, F.R.G.

Automatic injection moulding machines upto 50 ozs capacity, blow moulding machines and extruders upto 4.50 inches are being produced at present in the country. The existing manufacturers would be producing shortly injection moulding machines upto 100 ozs. capacity and double colour injection moulding machines. The production of rotary type injection moulding machines for PVC footwear in collaboration with Foster-Finch, U.K., is also being established shortly.

There is still considerable scope for the manufacture of large sized injection moulding machines and extruders, calenders, blow moulding machines, vacuum forming machines, mono-axially/bi-axially oriented film plants, printing machinery, take-off equipments, etc., and injection moulding machines for processing thermosetting machines.

Moulds

The importance of first class mould making facilities in relation to the development of plastics processing industry is paramount. The conversion of plastics materials into usable component parts and consumer goods depends, to a greater extent, on the availability of suitable moulds.

The Central Institute of Plastics Engineering and Tools (CIPET) is a training centre set up in India at Madras under the aegis of the Ministry of P and C with assistance from the United Nations Fund and the International Labour Organization. CIPET is expected to provide the skills and technology and bridge the gap between the scientific advancement and its application in mould making and conversion industry. At present, this institution in India runs courses in mould design, mould making and mould polishing. They intend to start the course of mould setting also shortly.

Processing Industries

Basic plastics are converted into utility, industrial and electrical articles by the processing of extrusion, injection, compression, coating, calendering, lamination, blow moulding, etc. The items which are being produced by the above processes are given below:

- a) Extrusion: pipes, films, sheets and cables
- b) Injection moulding: tumblers, jugs, buckets, basins, containers, shopping baskets, fountain pens, toys, bowls, boxes, tablewares, chairs, combs, brushes, radio cabinets and industrial items.

- c) Compression: buttons, electrical accessories, crockery, closures, lamp shades and sanitary items.
- d) Coating: polyethylene-coated jute goods and leather cloth.
- e) Calendering: PVC films/sheets and leather cloth.
- f) Lamination: polyethylene laminated jute products and phenolic laminates.
- g) Blow moulding: containers.

The following are the major plastic items for which the production has been established in India:

Leather Cloth

Coating and calendering processes are being employed for its manufacture. The production of foamed leather cloth (feather touch) has also been established. Schemes have been approved for the manufacture of air-permeable leather cloth to substitute natural leather. The production of leather cloth has been more or less steady at 12000 KTs during the last five years. A unit in Ceylon has been set up for the manufacture of leather cloth in collaboration with an Indian party.

PVC Films - flexible and rigid

There are four units manufacturing PVC films (flexible and rigid) in India by the calendering process. Six calender plants have already been installed in the country and the import of a few other calender plants has been allowed. The major production at present is for flexible films.

The production of PVC films and sheets, flexible and rigid showed a considerable increase during seventies and its production was at 9000 tonnes during 1972. The production of non-toxic rigid PVC films has also commenced.

Expandable Polystyrene Beads and its products

The manufacture of expandable polystyrene beads has been established in the country in collaboration with M/s. BASF of F.R.G. The production of expandable polystyrene has been more or less steady in the country at 700 tonnes per annum. M/s. BASF (India) Limited have installed the additional machinery to manufacture 18000 tonnes per annum of expandable polystyrene beads. The manufacture of products such as pipes, slabs, moulded products, etc., has been established.

Phenolic Laminates

A laminate is manufactured by impregnation of filler materials, such as paper, cloth, asbestos, etc. with thermo-setting resins like phenol formaldehyde and melamine formaldehyde which are then pressed at high temperatures and pressures. Different types of laminates such as decorative, industrial including epoxy and copper-clad, are being produced in India. The manufacture of phenolic laminates has been established in India with the technical know-how obtained from Bakelite and Formica of U.K. and Railite International of USA. The production of phenolic laminates is showing an upward trend and its production during 1972 has been at 6500 tonnes.

Gramophone Records

The manufacture of gramophone records was commenced in India long ago in technical and financial collaboration with M/s. Gramophone Company of U.K. Another unit in technical collaboration with Polydor International of F.R.G. has been set up recently. Gramophone records are being manufactured by the compression and injection moulding process from PVC co-polymers which are imported at present. The manufacture of PVC co-polymers suitable for gramophone records is being established in the country shortly.

Plastic Pipes and Allied Products

The manufacture of low and high density polyethylene pipes and PVC pipes including the fittings have been established in the country long ago. The production of polyethylene pipes was commenced in collaboration with ICI of U.K., Union Carbide of U.S.A. and Hoechst of F.R.G. and PVC pipes with Wavin of the Netherlands and Goodrich of U.S.A. These pipes are mostly used for potable water supply, transportation of chemicals, drainage and for agricultural purposes. PVC pipes are also used as electrical conduits. The sizes of pipes being produced in India are given below:

| <u>Pipes</u> | <u>Size in mm</u> |
|-------------------|-------------------|
| Polyethylene (LD) | 15 to 150 |
| Polyethylene (HD) | 15 to 200 |
| PVC | 15 to 250 |

Plastic taps and valves of various sizes from polyethylene and PVC are also being produced in the country. The manufacture of PVC spiral hose pipes too of sizes 15 to 250 mm has been set up in collaboration with AG Petzetakis of Athens (Greece). These hose pipes have outstanding strength, flexibility and versatility with extra-ordinary lightness.

Containers

Certain types of PVC and polyethylene containers by blow moulding technique are being produced in the country. A good number of schemes have already been approved by the Government for the manufacture of these items. These containers would be used for packing of beverages, vegetable oil, hair oil, creams, talcum powders, pharmaceuticals and food products. PVC bottles having advantages of high impact strength, less weight compared to glass, will go a long way to replace the glass in packaging industry. In case of opaque containers, polyethylene would be preferred material because of its superior impact resistance except where low gas vapour permeability is the critical requirement. Small sizes of bottles would be manufactured from PVC.

Other Miscellaneous Items

The other items for which the production has been established in the country are nylon monofilaments, heavy duty woven sacks, flexible polyurethanes, reinforced plastics, electro-plated ABS components, fountain pens, PVC footwear, spectacle frames, asbestos vinyl tiles, briefcases, suitcases, metallised polyester film, metallic yarn (in collaboration with Rexor of France), etc.

New Items

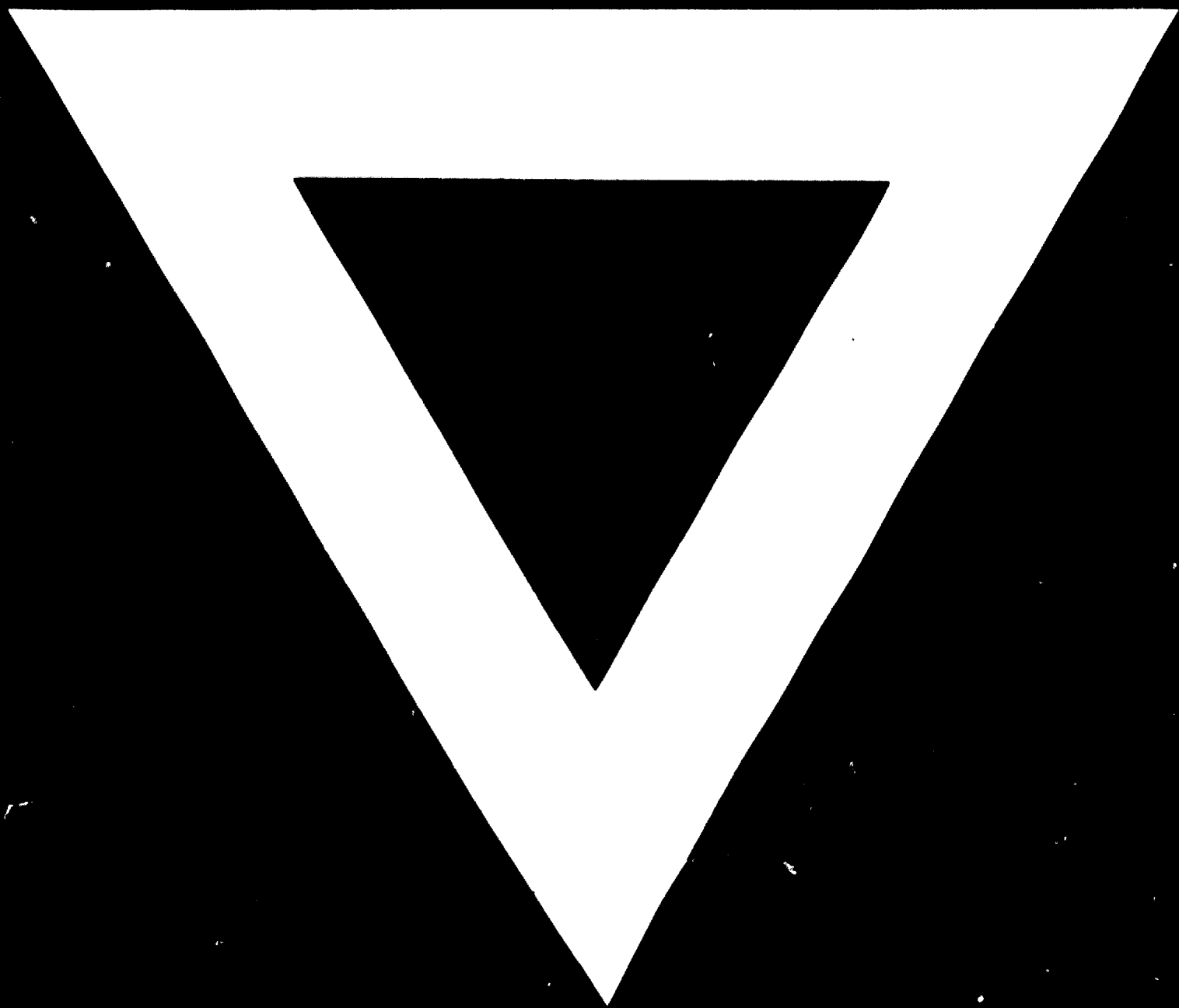
Schemes have been approved for the manufacture of nylon, cellulose acetate flakes, polypropylene, acrylics, PTFE resins, ABS/SAN copolymers, polyvinyl-butyril foil for safety glass, PVC laminated steel/wooden products, PVC profiles, heavy duty ropes, twines from high density polyethylene and polypropylene, polystyrene foam paper and boards, collapsible containers, cellulose acetate sheets suitable for optical industries, nitro-cellulose sheets, polypropylene strappings, large injection moulded products,

mono-axially/bi-axially oriented polyester, PVC, polystyrene films, etc. The items which are yet to be developed in the country are sandwich mouldings, structural foams and rigid foams, flooring materials, fibrillated products, profiles with metal inserts, furniture and various buildings, industrial components, etc. There is still lot of work required to be done even to catch up with the progress that has already taken place in Europe, Japan, United States of America, etc., in the plastics field.

Exports

India is a new entrant in the field of exports of plastics. She has however achieved a high growth rate in a short period. The total plastics exports increased to Rs. 84.4 million in 1972-73 from Rs. 27.2 million in 1967-68. The major items being exported out of India are fountain pens, ball point pens, phenolic laminates, plastic bangles, plastic electrical accessories, plastic imitation jewellery, PVC products such as hand-bags, fabricated goods, plastic moulded and extruded goods, rigid PVC pipes and fittings, polyethylene films, sheets and bags including woven sacks, spectacle frames, gramophone records, PVC leather cloth, PVC films/sheets, polylined jute goods etc.

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