EXECUTIVE SUMMARY

1.0 PRODUCT AND APPLICATIONS

1.1 Terephthalic Acid (1,4 benzene dicarboxylic acid), is one of the two raw materials for polyester. Purified Terephathalic Acid (PTA) is purified to polymerization grade terephathalic acid.

1.2 PTA is predominantly used for the production of polyester fibre, either in the form of polyester filament yarn (PFY) or polyester staple fibre (PSF).

1.3 The other uses include polyester film, polyethylene terephthalate (PET) for bottles etc. and different types of resins. In India, PTA is used to the extent of almost 96% for polyester fibre production.

1.4 Since fibre grade terephthalic acid was not available, dimethyl terephthalate (DMT) has been used, as a source of terephthalic acid, to produce polyester.

1.5 PTA was introduced on a commercial scale for the first time in the world by Amoco Corporation, USA in 1963. Since then, several plants for producing PTA have been set up all over the world.

1.6 PTA has significant advantages over DMT and hence world over it has become the preferred raw material, in comparison with DMT, for polyester production.

1.7 In India, PTA production started in 1988. Prior to that, DMT was available from domestic producers. Hence all polyester fibre plants were based on DMT as the raw material. With the availability of PTA, some of the older plants have been converted to dual feedstock and many of the new plants have provision for dual feedstock.

1.8 The major advantages of PTA over DMT are as follows:

* Weight of PTA required per ton of fibre is about 15% less than that of DMT.
* Lower PTA : glycol ratios are possible as compared to DMT : glycol ratio.
* Methanol as a by-product is not produced when PTA is used as in DMT use. Hence, no methanol recovery plant is needed.
* No catalyst is required for PTA esterification whereas it is required in DMT transesterification.

2.0 INDIAN INDUSTRY STATUS

2.1 Reliance Industries Ltd. (RIL) is, at present, the only producer of PTA in the country. It has a licensed capacity of 200,000 TPA and installed capacity of 100,000 TPA. RIL has since implemented expansion of the installed capacity to the level of licensed capacity.

2.2 Two parties are planning to put up new projects of 200,000 TPA capacity each. They are M/s. J.K. Petrochemicals Ltd. (at Saleempur, UP), and National Aromatics and Petrochemicals Corporation Ltd. (at Manali near Madras). Actual implementation has not begun in either of the cases. Approval has since been received from the Government for these projects.

2.3 The combined domestic production of DMT and PTA is not able to meet the domestic requirements for polyester fibre intermediate hence both these raw materials have been imported into the country.

2.4 The apparent consumption of PTA in India has grown from 79,500 tonne in 1987-88 to 167,850 tonne in 1990-91. The domestic production in the same period increased from 37,500 tonne to 151,500 tonne respectively.

2.5 PTA import was on Open General Licence (OGL) till 1987-88 and was subsequently transferred to restrictive list requiring advance licence to import. Now the import is completely delicensed.

2.6 The demand for PTA in India is expected to be of the order of 400,000 TPA by 1994-95 and about 800,000 TPA by the year 1999-2000. This clearly indicates the need, to set up additional manufacturing capacity in the country.

2.7 The size of the proposed new projects and the plant of RIL (after expansion) are comparable to world size plants for PTA and hence could be competitive in this regard. The export prospects for PTA, however, do not appear to be very encouraging at least in the near future due to overcapacity in several other consuming countries.

3.0 MANUFACTURING TECHNOLOGY

3.1 The basic process for manufacturing PTA, in all currently available commercial technologies, is air oxidation of para-xylene in the presence of a catalyst with bromine as a co-promoter.

3.2 The process can basically be divided into two sections viz. oxidation of para-xylene to produce terephthalic acid, the purification of the same to produce PTA. The catalyst and solvent is recovered and recycled into the system.

3.3 The oxidation takes place in presence of acetic acid as solvent and cobalt based catalyst with bromine as co-promoter. The reaction conditions are 185°C temperature and 11.2 bar pressure.

3.4 The terephthalic acid formed during the process separates out in a crystalline form. The product stream from the oxidation reactor is taken to a series of crystallizers in which the solvent is recovered.

3.5 In the purification section the major treatment is catalytic reduction of 4-carboxybenzaldehyde to para toluic acid which does not interfere in the subsequent polymerisation reaction when PTA is used.

3.6 The prominent technology licensors are Amoco Corporation, USA, I.C.I., UK, and Mitsui Petrochemicals, Japan. Amoco is by far the most prominent amongst the three in view of its technology being used for almost 80% of world PTA production. Amoco has its skills in the purification section while Mitsui has modified the crude section which is claimed to be superior to Amoco's process.

3.7 All the three licensors have started from similar basic process as developed by Scientific Design Company, USA. Each of them have however carried out process improvements. They are quite active in carrying out modification and improvement in the process.

3.8 RIL the only producer of PTA in India, has a technology tie up with I.C.I. of UK. The product quality is very well accepted by the consuming industry and is reported to be comparable to imported material.

3.9 As per RIL, the technology from I.C.I. has been fully absorbed and they have been able to operate the plant at norms comparable to those specified by the collaborator.

3.10 As regards research and development efforts regarding the process for the manufacture of PTA, these are not very significant.

3.11 Internationally, the research programmes are mainly directed towards finding out alternate raw materials (e.g. toluic acid), improving the catalyst system and modifying the operating conditions to enable saving in capital cost.

4.0 RECOMMENDATIONS

4.1 Major inputs to the growth of the chemical industry has come, and will perhaps continue to come for a long time, from high-tech process imported from Western countries or Japan. The import of the technology, appears to be necessary in order to be at par with the advancing technology and to be cost competitive in the world market.

4.2 Based on the demand projections, there is clearly a need for setting up additional capacity in PTA. The size of the projects being planned i.e. 200,000 TPA is comparable to plants being set up in other countries.

4.3 Significant research and development efforts directed to improving the technology are not presently being undertaken. Hence the level of the technology in India is likely not to keep pace with the developments taking place worldover. Thus concrete R&D efforts are needed in this direction.

4.4 It is felt that collaborative research and development efforts by the industry, utilising domestically available infrastructure, in terms of both HRD and other required facilities, need be undertaken.

4.5 In the initial stages, these efforts may be mainly directed to developing and improving the catalyst system. The objectives should be improving the selectivity (reducing by-product formation), yield, and moderating the process conditions. Contributions in these directions could help in improving process economics, making the product cheaper and competitive and ultimately making available an indigenous technology which is competitive.

4.6 The strategy to be globally competitive in the polyester fibre intermediate field should have well defined plan. In the short term plan, technology may continue to be imported.

4.7 The program of modifying the catalyst system would require substantial time and money. Hence there appears to be a need for Government's sponsorship and active participation by the manufacturers and R&D organisations.

4.8 Joint collaborative efforts between the nodal catalyst development agencies (like NCL, ACC's R&D, or IPCLs' R&D Centre) and premier air oxidation research centre (like Indian Institute of Chemical Technology, Hyderabad and UDCT, Bombay) to develop a catalyst system which would be substitute for bromine co-promoter.

4.9 Some of the plant and machinery required to produce PTA needs to be imported, especially the titanium clad equipment. Even though there are some titanium clad equipment manufacturers, yet they are not capable of fabricating equipment which could meet the harsh conditions in the oxidation section. Hence the need to upgrade the capability of the domestic capital goods industry for serving the PTA industry. This would have synergistic benefit on other chemical industry.