1. Introduction to Petrochemicals

Petrochemicals are a large group of chemicals obtained from Crude Oil/Natural Gas/Coal/Shale Gas. These are used by numerous industries like manufacturing, textiles, consumer goods, construction, packaging, healthcare and automotive among many others. Polymers form almost 50% of the total demand of Petrochemicals at 260 MMT. The demand for polymers is driven by growth in end use markets, such as packaging, automotive, infrastructure, transport rails, and telecommunication mainly from emerging economies. Polymer is continuously substituting metals, glass, paper, and other traditional materials in various applications due to its lightweight and strength and the design flexibility they offer brand owners along with low-cost.

Petrochemicals have been identified as a prime driver of future growth by IndianOil. The Corporation is envisaging an investment of Rs 30,000 crore in the petrochemicals business in the next few years. These projects will utilise product streams from the existing refineries of IndianOil, thereby achieving better exploitation of the hydrocarbon value chain.
Beginning with a low-investment, high-value projects such as Methyl Tertiary Butyl Ether (MTBE) and Butene-1 at Gujarat Refinery, Vadodara, IndianOil has set up a world-scale 120 KTA Linear Alkyl Benzene (LAB) plant at Gujarat Refinery and an integrated 553 KTA Paraxylene/Purified Terephthalic Acid (PX/PTA) plant at Panipat. A Naphtha Cracker complex with downstream polymer units of 1250 KTA and Glycol unit of 326 KTA is also in operation at Panipat. These initiatives are designed to catapult IndianOil among the top three petrochemicals players in Southeast Asia in the long term.

2. Polymers in Road Construction

With Bharatmala Initiative, 34,800 Km of roads is expected to be constructed throughout the length and breadth of the country. Polymers can also play a role in ensuring cost effective and low maintenance roads in form of three applications:-

2.1 Geosynthetics - A geosynthetic is defined by the International Geosynthetic Society as a planar, polymeric (synthetic or natural) material used in contact with soil/rock and/or any other geotechnical material. Geosynthetics are manufactured from different categories of Polymers including Polypropylene (PP), Polyester (PET) and High Density Polyethylene (HDPE) etc. Various types of Geosynthetics include:-

2.1.1 Geotextiles – It is a planar, permeable, polymeric or natural fibre textile material, used in contact with soil/rock and/or any other geotechnical material. A geotextile could be woven, non-woven or knitted. Generally, woven textiles exhibit high-tensile strength, high modulus and low elongation while Non woven geotextiles have high permeability and high elongation. Manufactured from PP and PET.

2.1.2 Geogrids – A planar, polymeric structure consisting of a regular open network of integrally connected tensile elements, which may be linked by extrusion, bonding or interlacing, whose openings are larger than constituents. They facilitate interlocking of soil/aggregate particles. Manufactured from PP, PET and HDPE.

2.1.3 Geomembrane – It is a relatively impermeable, polymeric sheet used in contact with soil/rock. Manufactured from HDPE.

2.1.4 Geocell – It is a cellular structure consisting of a regular open network of synthetic strips, linked by extrusion, adhesion or other methods. Manufactured from HDPE.

2.1.5 Geonet – It is defined as an assembled structure of geosynthetic products, in the form of manufactured sheet, consisting of atleast one layer geomembrane among the components. Manufactured from HDPE, PP etc.

2.1.6 Clay Liner – Assembled structure of geosynthetic products and low permeability earth materials such as clay, bentonite, etc. needle punched in the form of sheet, performing barrier function. Manufactured from PP, PET etc.
2.2 Various types of Functions performed by Geosynthetics:-

2.2.1 Separation
2.2.2 Filtration
2.2.3 Drainage
2.2.4 Reinforcement
2.2.5 Barrier

2.3 Applications of Geosynthetics are:

2.3.1 Basal Reinforcement
2.3.2 Soil stabilisation and reinforcement
2.3.3 Rail tracks stabilisation
2.3.4 Asphalt overlay
2.3.5 Retaining walls and soil reinforcement
2.3.6 Erosion control
2.3.7 Rockfall protection
2.3.8 Coastal and Pipeline protection
2.3.9 Landfills
2.3.10 Tunneling

2.4 Various types of failure observed in roads

2.4.1 Fatigue Cracking
2.4.2 Rutting
2.4.3 Longitudinal Cracking
2.4.4 Transverse Cracking
2.4.5 Pot Holes
2.4.6 Slippage cracking

Advantages in Using Geosynthetics in Roads
Examples include Creek Kalatalav Sanesh Road, Bhavnagar and PWD road at Nashik.

2.5 Polymer Waste as a binding agent in road construction
2.5.1 The plastic waste coated aggregate is mixed to the extent of 8-10% with hot bitumen and the resulting mix is used for road construction.

2.5.2 The quality and longevity of roads made of waste plastic-aggregate-bitumen was two times better than bitumen road.

2.5.3 Quantity of bitumen is reduced while using plastic waste in road construction. JUSCO, a subsidiary of TATA group has been able to reduce it by 7-8% of bitumen.

2.5.4 This could be an effective way to get rid of Plastic waste issue which is a major issue of solid management.

2.6 Polymer Modified Bitumen
2.6.1 Polymer modified Bitumen included different polymeric components such as Polymer Elvaloy 4170 which is 8 MFI terpolymer having density 0.94 which is normally used as binder in Polymer Modified Asphalt. It is Ethylene co-polymer resin with acrylic acid as co-monomer.
2.6.2 These components impart high bearing resistance, high tensile strength, reduced carbon footprint and cost savings due to reduced requirement of bitumen.

2.7 Conclusion

IndianOil under the brand name Propel is manufacturing world class polymeric raw materials at Panipat and have a dedicated Product Application and Development Centre for development of new applications. Geosynthetics is one of the thrust areas identified for development and IndianOil has successfully developed Polypropylene based raw material for Geotextiles (Woven and Non Woven), Geogrids, Geocells etc. and look forward to work jointly along with CRRI, NHAI, IIT's etc. to promote usage of Polymers in road construction for cost effective and durable solutions.