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PLASTICS - AN OVERVIEW

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PLASTICS - AN OVERVIEW

1.1 INTRODUCTION

The growth in plastics has been spectacular all over the world especially in the last three decades. Between 1985 and 2000 AD the size of the plastic industry is expected to multiply five times. This is due partly to the population growth and partly to improved standards of living.

Plastics are put to variety of uses especially - commodity and engineering purposes. Plastics are used in high precision and strength purposes. They play today a significant role in most of the key sectors of the economy. These include agriculture and water management, automobile and transportation, construction and telecommunication, electronics and engineering. Besides these, defence, aerospace, computers and power transmission are also expected to be the significant end users of plastics by the turn of this century. In fact, plastics are the only materials in several critical applications. They are perhaps the most versatile of all materials available from either natural resources or synthetic materials.

Thus, plastics have created a tremendous impact on human society and it would perhaps be the most appropriate to say that we are really living in a "plastics age" today. It is generally non known but it is a fact that well over 70% organic materials end up in polymeric substances, plastic being the major segment.

1.2 DEFINITION

Plastics may be generally defined as "large and varied polymeric group of materials, consisting wholly or partially combinations of carbon with oxygen, hydrogen and other elements and are capable of being readily formed into many shapes.[1]"

1.3 IMPORTANCE OF PLASTICS

The type of diversity offered by above, types of plastics as a material has no parallel in the history of materials. Plastics can be rigid like metals as well as flexible like rubber, they can be insulators as well as conductors, they have high abrasion resistance, high impact strength, and resistance to corrosion and above all they can be "tailormade" to suit any specific need. It is the only class of material which has either partially or fully replaced conventional materials like wood, glass, ceramic, metal, leather etc. The ease with which they can be converted into a variety of articles of

everyday use in all walks of life is truly remarkable. Not too ago plastics were considered a cheap substitute but they have now come to stay as the most important class of materials today.

1.4 TYPES OF PLASTICS

Most plastics are synthetic and only a few like rubber, gutta percha, and some vegetable waxes occur naturally. The synthetic plastics are derived from petrolium, coal, salt, air and water. Intially the plastics are monomeric, resinous compound composed of small single molecules but under the influence of heat, or heat and pressure or chemical catalysts, these small molecules combine to form a macro molecule and take the form of solid or semi-solid structure.

Many synthetic resins are also used as plastics materials. These resins by mixing with other ingredients and chemical treatments are converted into plastic materials. The purpose of mixing resin with other materials is to improve and enhance the properties of resins to get desirable end-use quality.

Plastics are broadly classified into following two groups.

1. THERMOPLASTICS -

These plastics become soft when heated and harden on cooling. These are remeltable the heating and hardening can be repeated many number of times. A notable feature of this type of plastic material is the ability of it's scraps or rejects to be reworked a fresh with new members of this group of plastics. Thus, the amount of wastage gets minimise. Thermoplastic include various types of polymers such as polyethlene, polystyrene, cellulose acetate, polyvinyl chloride, polyacrylates and so on.

Most of the commercial thermoplastics common in use are listed in TABLE 1.1 with the terminology, features and commercial trade names.

TABLE 1.1 TYPES OF THERMOPLASTICS

Term	Features	Trade Names
ABS	Excellent toughness	Kralastic
Acetal	Extremely rigid	Delrin
Acetates	Tough,hard,easily coloured	Lumarith Celanese Plastarde
Butyrates	Tough,good wheathrability	Tenite Buty rate Fortical
Cellulose propionate	No odor,stable bright finish	

Cellulose Nitrate	Tough,hard surface	Nixon,Herculoid
Ethyl Cellulose	Tough stands hard treatment	Hercocel,Nixon E/C
Polyethylene	Light weight & squeezable	Poly-eth,Alathon
Polypropylene	Light weight,unusual chemical resistance	Escon
Polystyrene	Rigid,colourful	Teflon
Polyvinyl Acetate	-	PVA
Polyvinyl Chloride	-	PVC

SOURCE :

Dubey, S.C. "Selected Profitable Plastic Industries", Small Industry Research Institute (Publication Division), Delhi (1991) P.12.

2. THERMOSETTINGS -

In contrary to thermoplastics thermosetting plastics take a permanent shape on heating under pressure and cooling. Hence, once they are set they cannot be remelted under the application of heat and pressure.

Because of this property they have limited end uses. This class includes phenolic and urea condensates. Various types of thermosetting plastics use in plastic industry with their terminology, features and commercial trade names are shown in TABLE 1.2

TABLE 1.2 TYPES OF THERMOSETTINGS

Term	Features	Trade Names
Alkyds	Good electrical properties	Plaskon
Allyls	Low electrical loss	Dapon
Coseins	Good colour range	Cascoloid-Borden
Melamines	Strong & light fast	Melmac
Phenolics	Hard,rigid,strong	Resinox-Monsanto
Polysters	Tough,hard surface	Mylar-Dupont
Silicones	Resistant to 590°F	Silastic
Urethanes	Tough,tear resistant	Mondur-Mobay Chemical
Polyvinyl Chloride	Tough, Strong	PVC
Polycarbonates	Tough, hard	-
Polyvinyl Acetate	Tough, Strong	PVA

SOURCE :

Dubey,S.C., "Selected Profitable Plastic Industries", Small Industry Research Institute (Publication Division), Delhi (1991) P. 13.

1.5 FORMS OF PLASTICS

Readily obtainable plastics are available in solid, rigid sheets, mouldings, powder, tubes, rods and many other forms. Thus, the usefulness of perticular plastic depends upon its formability. However, each type of plastic has certain advantages and limitations as well. This furnishes another basis for characterisation of plastics such as costings, resins, foams, laminating resins adhesives, films, etc. Thus a relatively few plastics are suitable for drawing into fibars or casting without the use of pressure. Some are not capable of being moulded into useful articles at all, but yet serve as necessary ingredients in plastic mixtures used for different purposes.

1.6 PLASTICS - A UNIQUE SUBSTITUTE FOR CONVENTIONAL MATERIALS

Today, plastics have become a unique substitute for several conventional non-renewable materials. The following Table 1.3 depicts the various applications of plastics and the types of polymers use in place of various conventional materials ranging from steel, glass, wood, textiles etc. This shows a remarkable prospects of plastics in coming year.

Various types of applications of plastics both in

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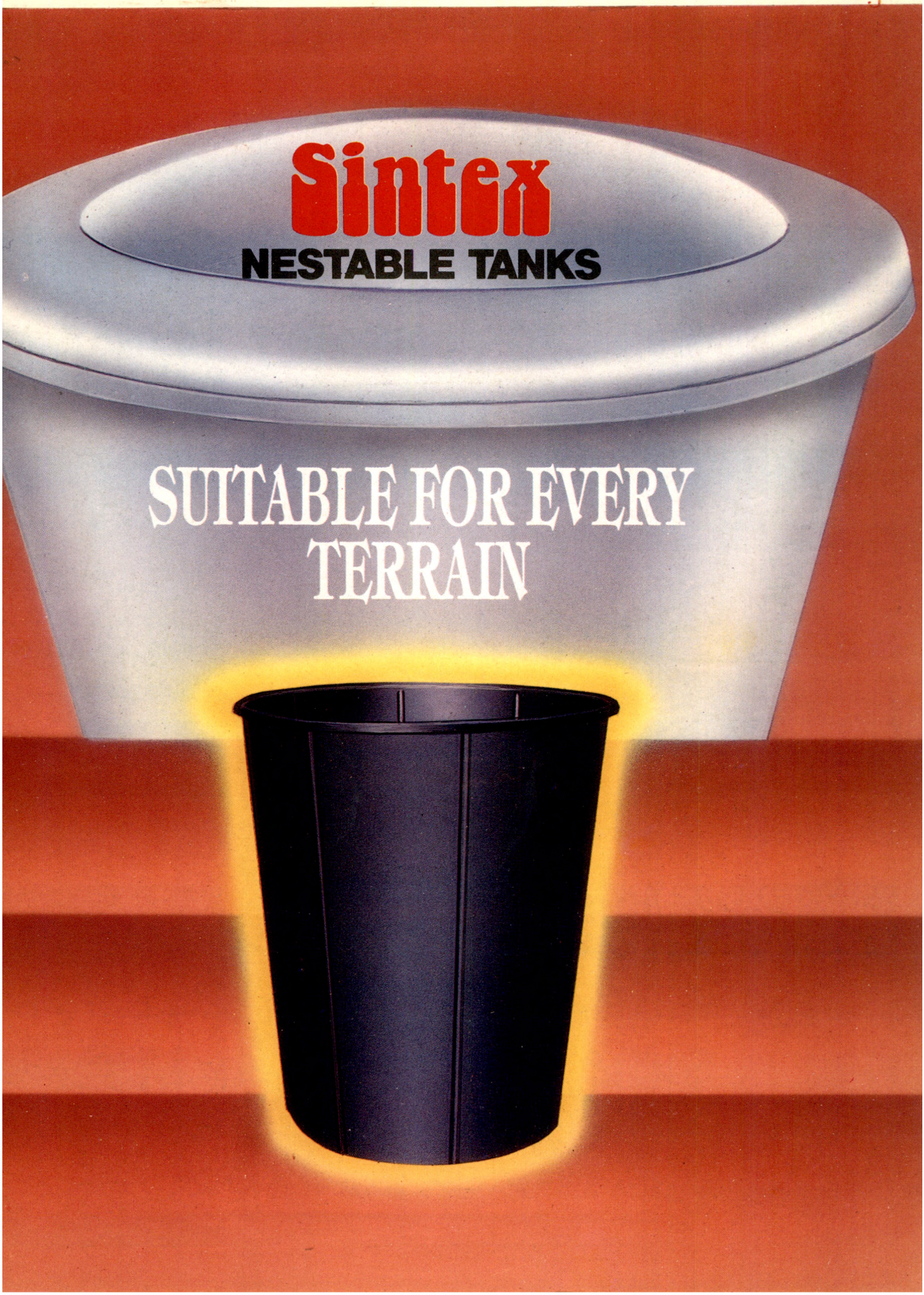
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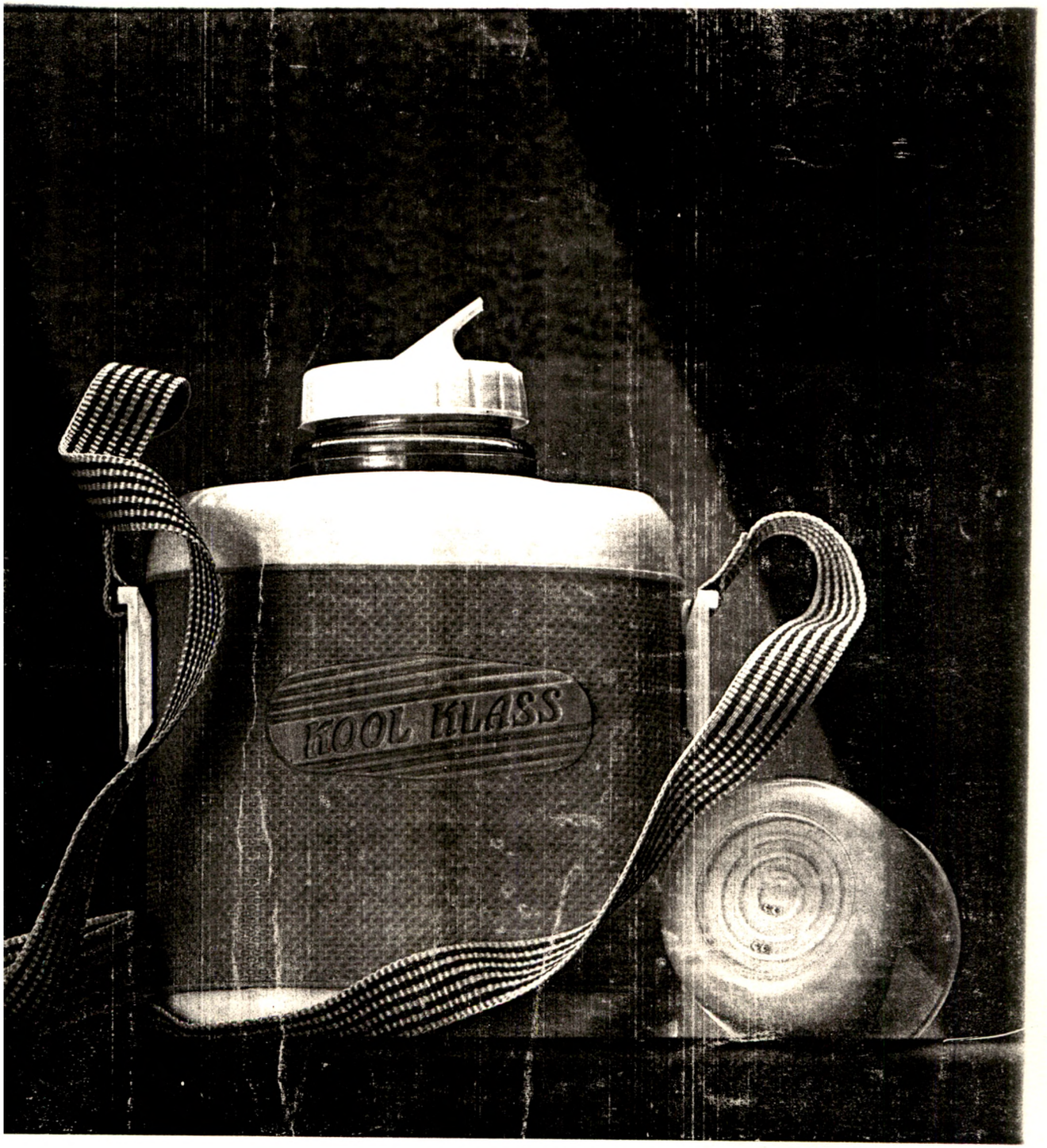

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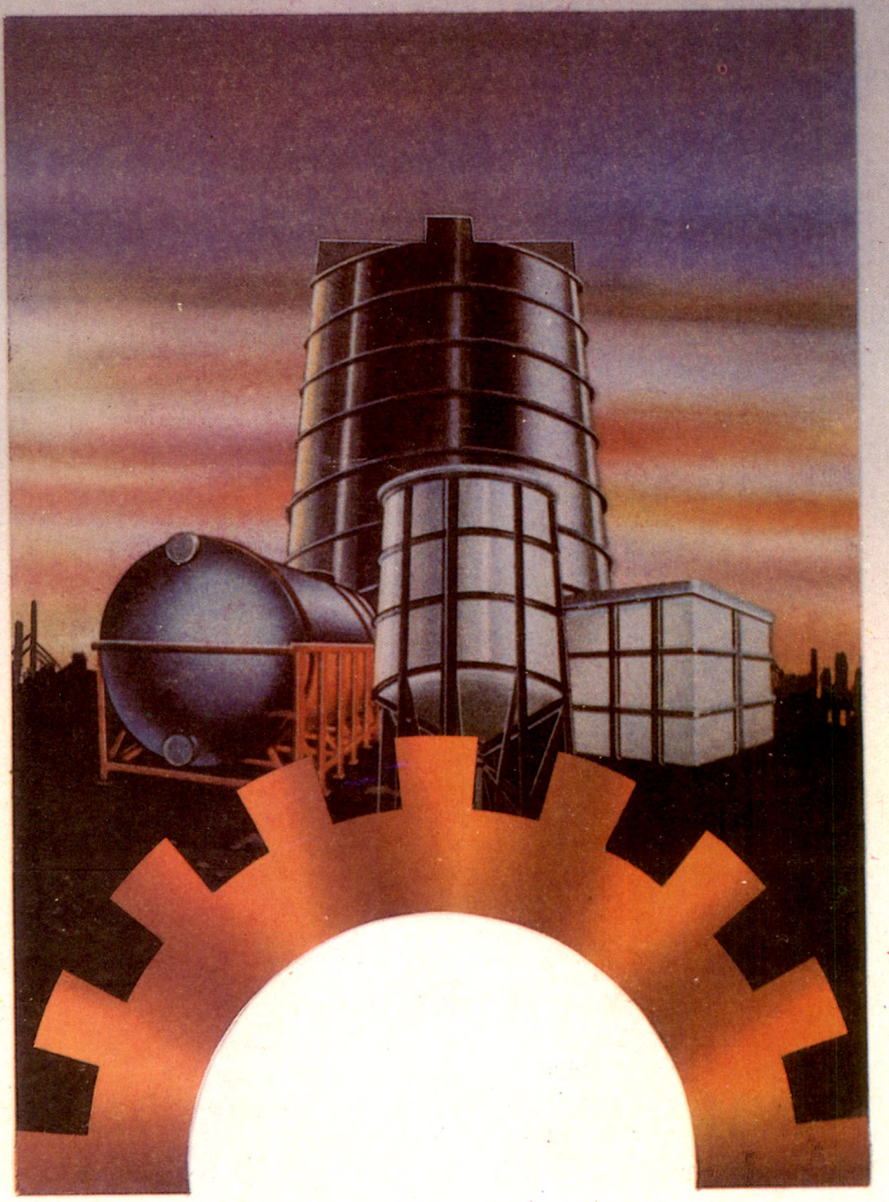

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in domestic as well as industrial sectors are depicted in pamphlets.

TABLE 1.3 REPLACEMENT OF CONVENTIONAL MATERIALS BY PLASTICS - THE INDIAN SCENARIO

APPLICATION	POLYMERS USED	CONVENTIONAL MATERIALS REPLACED
PACKING		
Milk bottling	LDPE film Pouches	Coated paper, metal, glass bottles
Beverages	PET	Glass
Beverages Creates	HDPE, PP, PPCP	Wood
Phamaceuticals	PVC, HDPE, PP	Glass, paper
Squeeze tubes (Toothpaste, ointment)	HDPE, LLDPE, PP	Metal
Consumer goods likes scaps	LLDPE, LDPE, PVC Shrink wrap	Paper
Retall carrier bag	LLDPE, HDPE, HM	Paper, jute bags
Pallet wrap	LDPE, LLDPE	Heavy duty paper
Fertilizer	HDPE/PP woven sacks	Jute
Cement	HDPE & PP woven sacks	Jute
Mineral	LDPE heavy duty sacks	Jute
Strappings	PP, HDPE	Coir, jute, steel
Ropes (Marine)	PP, Nylon	Coir, sisal, jute, steel
Cushioning material	EPS, PU, PP, PE foams	Flannelcloth, paper

STORAGE TANKS		
Water	LLDPE (rotomolded), HDPE	Cement,mild steel
Septic tanks	LLDPE,HDPE	Cement
Agrochemicals	HDPE	Steel
Automotive fuel	HDPE,PP	Steel
Textile apparels	PP,PET,nylon	Cotton,rayon,silk
Upholstery fabrics	PP,PVC rexene	Cotton,rayon,jute
Carpets	PP, nylon,acrylic	Coir, Jute
Furniture	PP, PPCP	Wood,Cane,bamboo
Toys	PP,ASS,HIPS	Wood,sheet metal
Luggage	PP(Impact modified) ABS,FRP,PPCP	Wood,Steel
Pipes tubings	PVC,HDPE,LDPE, PP, FRP	Cement,steel
Window panes, cabinet panes	Polycarbonate, acrylic	Glass
Shoe sole	PVC,PP,structural, loam, PU	Leather,rubber
Buckets,tumblers	HDPE,LLDPE,PP	Sheet metal,brass
Window and door frames	PVC, FRP	Wood,Steel, aluminium
Sign boards	FRP,Acrylic,LD	Wood,metal
Appliance housings	ABS,FRP,PP,PPCP Structural foam	Metal
Plumbing fixtures	Polyacetals,ABS,PP, HDPE	Stainless steel brass
Textile cones & bobbins	PP, FRP	Cardboard

Despite the baove mentioned facts, of late plastics have been critised by many environmentalists mainly for their indestructibility. The massage conveyed

is that the plastics are hardful for use and are polluting the environments. This concern has mainly been devided from the reports in the advanced countries like USA. In a period of less than 2 years, the attitude of consumers towards the plastic industry shifted from being favourable in early 1990 to unfavourable in late 1991. these are attitudes are being influenced by perceptions often based on misleading or non-accurate information that plastics are not environment friendly. This belief has to be corrected by appropriate programmes at appropriate foums by developing the realistic data and instituting quality control measures and standards. This may be done by following under mentioned strategies.

1. Consumer education about personal and environmental benefits from plastics.

2. Balance waste management and plastic recycling infrastructure, and

3. Working with Government and related agencies to achieve favourable laws and regulations that will increase the benefits of plastic to the society and a mechanism to implement the standards and ensure right quality material being produced.

1.7 USE OF PLASTICS

Today, the plastic industry not only produces the household articles but complex products which are increasingly used in agriculture and water management, transportation, power transmission and communication, packaging, building and construction and textile industry. The uses of plastics in different sectors are enumerated were under -

* The key sectors like agriculture, health care and personal hygiene, public health, water supply, medical, packaging, sports, etc. are extensively using plastics and it would be unthinkable to imagine convenience and modern day life without the use of plastics. They have unquestionably become an integral and unseparable part of our life.

* Plastics have been successfully used in replacing wood, paper, etc. in packaging, construction, furniture and various other applications.

* Plastics conserve energy in manufacture, conversion and end-uses. Conservation of energy implies reducing power generation requirements

and as we know our major power plants are based on thermal or nuclear energy both are high polluting and eco-hazardous industries. Will not this mean greater the use of polymer cleaner the environment?

* automotives are considered to be major sources of air pollution. Plastics have helped development of lighter and fuel efficient vehicles with reduced emissions.

* Non conventional and renewable sources of energy like biomas energy, solar energy, wind energy, etc. use plastics in one form or the other.

* Plastics are extensively used in threating the effluent from industry and reducing or eliminating the pollution hazards.

* Plastics are used as plastic towers and plastic packing for scrubbing nasty and corosive gases. Plastic pipes can easily handle variety of effluent streams, reducing the pollution.

1.8 ADVANTAGES OF PLASTICS

The advantages of plastics are -

1. A great variety of plastics are available with highly specific properties to suit every need.

2. Compared to conventional materials, the unique design freedom offered by plastics, make it possible to eliminate additional operations such as trimmings, assembly and painting. Their light weight enables easier handling with savings in transit and energy costs.

3. The technology, particularly of thermoplastics production and processing has developed to such a stage that consistency in quality can be easily maintained. This enables high-volume production.

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