## PVC COMPOUNDS

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The most versatile thermoplastic material commercially available in a variety of compounded forms to cover a wide range of hardness and flexibility applications is PVC. It has good physical strength and excellent resistance to water and chemicals. The PVC characteristics are when the flame is withdrawn and difficult to ignite and have selfextinguishing. PVC resin is liable to degradation on heating and is a very tricky material to process, unless properly compounded. This places a great deal of responsibility on the compounding technologist. The use of compounding is to mix the resin and other additives into a homogeneous state of processing. These compounds use for the manufacture of finished products. It is impossible to process PVC resin without the addition of certain compounding ingredients such as heat stabilizers and lubricants. The problem is economy in cost and better quality. PVC compound are two type, granulated compounded.

Indian Petrochemical industry is one of the fastest growing sectors of the economy. The petrochemical sector has an average growth at a rate of 13% per annum, which is more than double the growth of GDP. The usage of polymers for injection moulding and other components used in engineering plastics is bound to increase with the increase in production of automobile vehicles, machinery and other electrical machinery and consumer durables. The Indian Plastic Industry has taken great strides in its quest for success. The last few decades have seen it rise to the position of a leading force in the country with a sizable base. The industry itself is growing at a fast pace and the per capita consumption of plastics in the country has increased manifold as compared to the earlier decade. Plastic has undoubtedly gained notable importance in every sphere of activities. It has helped substitute and save scarce natural resources. It is an inseparable part of our daily life. Constant development in polymer technology, processing machinery, know how and cost

effective production is fast replacing plastics in every segment from its conventional materials.

The per capita plastics consumption, which is currently at 3 kg, is projected to go up to 7.7 kg by the year 2007. While it is true that our consumption is below the world average of 17 kg, per capita figures should be viewed in the context of our large population; sometimes per capita figures are useful only for trend analysis and not in absolute terms

A number of PVC processes are employed according to the end application, but polymerisation is normally performed at 40-70$^{o}$C in a liquid state under pressure in a batch reactor. All routes employ free radical initiators which are either soluble in the monomer or in the aqueous solution.

Suspension polymerisation is the most common PVC process - around 89% of vinyl resin produced in North America is obtained using this route - because the resins produced are the most versatile and suitable for a wide range of applications. The vinyl chloride is introduced under pressure to the sealed reactor where it is finely dispersed in water by vigorous agitation. An initiator that is soluble in the monomer is also added. The mixture is then heated to 60-70$^{o}$C. When around 90% of the monomer is converted to the polymer, the reaction is halted by discharging the slurry into a degasser. The remaining monomer is recycled while the resin is filtered, centrifuged and dried.

Emulsion polymerisation is conducted in an aqueous solution containing water-soluble initiators and emulsifiers. The PVC latex formed has a fine particle size and is more suitable for use in paints, paper and fabric finishes and printing inks.

Mass polymerisation, in which no water is added during polymerisation, usually employs a pre-polymerisation stage containing liquid VCM in the presence of sufficient initiator to allow for 10% conversion. The solution is sent to an autoclave reactor where more initiator and the mixture is heated. The powder resin can be used to make a film with high clarity as well as in other applications.

The vinyl resin produced is inherently hard and brittle, and needs to be mixed with other additives before it can be processed into useful products. For example, the

addition of plasticisers makes PVC compounds soft and flexible while adding impact modifiers creates compounds that are tough and impact-resistant.

The initial step in producing vinyl compounds involves dry blending, which takes place in a closed vessel where dry and liquid additives are mixed using blades or paddles. Because the resin particles are porous, the liquid additives are absorbed relatively easily, yielding a dry powder compound. In a certain applications such as pipe manufacture, these powder compounds can be processed directly into the final product. In other applications, such as wire and cable, rigid profiles and injection moulded parts, additional processing may be necessary.

A process for the recycling of PVC has been developed by Solvay. A 10,000 tonnes/year demonstration plant at Ferrara, Italy, was brought on-stream in early 2002. The Vinyloop process involves using a solvent to dissolve the polymer, separating it completely from other materials in a mixture or composite structure. The PVC is then recovered by precipitation and dried to give PVC resin granules.

СПИСОК ЛІТЕРАТУРИ

1. EIRI: Technology Of Pvc Compounding And Its Applications: Engineers India Research Ins. (2015). ISBN-10: 8186732888

2. J. Leadbitter, J. A. Day & J. L. Ryan: Smithers Rapra (1994). ISBN-13: 978-8186732885