RESIN IN RUBBER COMPOUND

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Why use Resins & Types

To impart

a) **Tackiness** (Tackifier Resin)
b) **Strength / Hardness** (Reinforcing Resin)
c) **Adhesion Promoter** (Reactive Resin)
d) **Compound modification** (Modifier Resin)
e) **Curing of saturated Rubber** (Curing Resin)

Resins are substances with a low molecular mass. They are used to aid the processing of rubber and to modify the properties of rubber vulcanizates.

i. **As processing aids**, assist in improving dispersion, extrusion and calendaring behavior of rubber compounds.

ii. **As tackifiers**, impart a degree of autohesion to components which have to be plied up.

iii. **As reinforcing agents**, increase hardness and resistance to heat, light & solvent, and can be used as vulcanizing agent.

iv. **As bonding agent**, they improve adhesion to fabrics .

Resins are used in Rubber compound to impart different properties like

- **RFL** (SBR + NR + VP Latex with Resin) – Resorcinol Formaldehyde Latex system for bonding Nylon tyre cord to rubber compound.
- **Adhesive** based on CR and also Natural Rubber latex
- **Butyl rubber curing** to get high heat resistance e.g Tire curing Bladder
- **NBR compound** for high hardness & abrasion resistance e.g Cots ,Apron, Rubber Roll
- **For high impact resistance –** moulded items

Source of Resins

The common sources of rubber resins are:

1. Pine tree products like rosins, rosin esters, pine oils and terpene-based resins.
2. Coal-tar products like oil, pitch, tar, coumarone-indene resins.
3. Petroleum resins.
4. Phenolic resins like novolaks and resols

Petroleum Resins

The olefin-derived thermoplastic hydrocarbon resins are used extensively as tackifiers for NR and SBR. Aliphatic (C_5) and aromatic (C_9), as well as the semi-aromatic resins, are used to improve the special properties of a rubber compound. By using special modified aromatic resins,, the hot-air ageing properties can be improved.

Phenolic Resins

These are used in the rubber industry both as tackifying and reinforcing resins. They are usually polycondenasates of phenols and aldehydes. Phenolic resins are generally divided into two classes, namely, novolaks and resols.

Novolaks have no reactive methylol (or substituted methylol) groups in the molecule, and thus they require a hardening agent and heat for polycondensation. Resols contain reactive methylol groups which can make the resol molecules to condense together to from larger molecules.

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Thermoseting alkyl phenol – formaldehyde act as processing aids in similar circumstance to those in which high-styrene resins are used. They give excellent flow characteristics in moulding, callendering, and extruding.

Non-reactive phenolic resins are used as tackifiers in synthetic rubbers. They give a higher level of tack than can be achieved with coumarone resins.

Tackifying Resin

Some phenol novolaks, especially those derived from p-tert-alkyl phenols, act as tackifiers for synthetic rubber. These tackifiers can be produced in two ways:

a) condensation of substituted phenols with formaldehude under acidic conditions to produce novolaks: and

b) precondensation of the monomers with formaldehyde in an alkaline medium followed by a final reaction using and acid catalyst to produce conovolaks.

Reinforcing Resins

These are also of the Novolak type. There are three varieties for reinforcing applications. These are: unmodified phenolic thermoplastics, modified phenolic thermopalstica and two-step modified phenolic resins.

Simple novolaks with a linear structure require a hardening agent, for example, hexamethylene tetramine (HMT) at a level of 6 to 15 per cent of the novolak content to effect cure. Excessive HMT is detrimental to the product. Reaction between the resin and a methylene such as hexa-methylene tetramine or etherified melamine leads to the formation of three dimensional network of the resin, which interacts with the rubber network.

Curing Resins

Resols are usually made from phenol-formaldehyde mixtures in which there is a molar excess of the aldehyde. They differ from novolaks in that they contain methylol groups, dibenzyl semiformal or dibenzyl ether groups instead of the simple methylene bridges between the benzene rings.

Dimethyl derivatives of para-substituted phenols can be used for resin cures, for example, butyl rubber diaphragms for moulding tyres.

Bondings Resins

Resorcinol formaldehyde latex dip solution is used for achieving the necessary bond strength of fabric with rubber.

High-Styrene Resins

Styrene-butadine copolymers, containing up to 85% styrene, are used as thermoplastic processing aids in addition to their reinforcing action, particularly in compounds required to have high vulcanisate hardness.

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