YULEX® PURE
Natural Rubber Latex

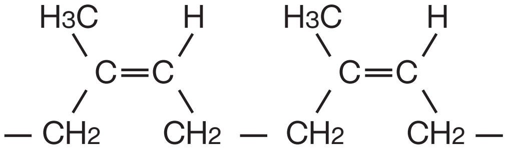
FOR DIPPED, SHEETED, FOAMED & CAST PRODUCTS

YULEX® PURE Natural Rubber Latex (YPNRL) is a stable plant-based, thermoset elastomeric polymer as a colloidal suspension of cis, 1-4 Polyisoprene used primarily in dipping, sheeting, foaming, and casting production methods. Curative or vulcanization systems are typically sulfur or peroxide in combination with activators and accelerators. White-filler systems such as calcium carbonate and clays are typically used to impart specific physical properties in finished products as well as a dilutant for cost management. YPNRL may also be used in water based adhesive systems and glues. YPNRL is a high ammonia version to ensure storage and transit protection.

TYPICAL USES:

- Dipped products such as gloves, condoms, bags, and balloons.
- Additives such as adhesives and glue.
- Foamed products such as mattresses, cushions, upholstery, carpet backings, and pillows.
- Sheeted goods such as latex sheets and bands.
- Cast or rotational molded products such as toys and models.
- Coated products such as fabrics, coir fibers

CHEMICAL STRUCTURE



Yulex Pure Natural Rubber Latex is a nonpolar elastomeric polymer.

The physical properties of the vulcanized product are totally dependent upon the compound formula, process methods and curing cycle parameters.

ITEM	TYPICAL CHARACTERISTIC
Stabilizer	Ammonia
Total Solids Content, wt.%	>60.00
Dry Rubber Content, wt.%	>60.00
Non-Rubber Content wt.%	<1%
Alkalinity - as NH3	0.4 - 0.6
Viscosity @ 60% TSC, cps.	60-120
Coagulum, wt.%	<0.02%
pH	>10.00
Mechanical stability, sec.	>750s
Density, g/cm2	0.92-0.96
CAS#	9006-04-6
Molecular Weight	68.12g/mol
MW Distribution	Multimodal
Curative System	Sulfur or Peroxide
Certified Sourcing	FSC/PEFC
RoSH	Exempt
Harmonizing Code	4001.10.00
REACH	Exempt
Chemically Modified Poly	No
California Prop 65	NA
FDA Approved Material	Yes

STORAGE OF YPNRL

It is important that the material be kept stored in airtight storage vessels where loss of volatiles and introduction of contaminants is avoided. Refrigerated storage can help prolong the shelf life, with a desired temperature range being between 5-30°C, with optimal and recommended storage being 5-15°C. The latex must never be allowed to freeze as this will produce irreversible damage and render the material unusable. Higher temperatures will promote increased instability of the colloid and should be avoided whenever possible.

SHELF LIFE

Under proper conditions is one (1) year from production date.

Always use correct and proper Personal Protection Equipment (PPE).

DISPOSAL

Since state and local guidelines vary on regulations for disposal of various materials, it is extremely important that a local waste service provider be consulted on the proper disposal of any material.

Non-Compounded material should be coagulated before disposal. This can be done by placing the material in a container in a freezer until all the latex has turned into a solid block. Alternatively, the latex may be coagulated using a weak acid.

Compounded Materials. It is the responsibility of the disposer to contact a local waste service to help determine if the materials added are considered potentially hazardous.

Working with Yulex Pure®

Proper compounding is critical to ensuring consistency of the material and achievement of optimal physical properties. Care and patience are necessary to allow for proper incorporation of all components used in the compound. Failure to take these precautions may result in inconsistencies in the compound and thus abnormalities or defects in finished parts.

ORDER OF ADDITION

Ideally, materials should have a pH as close to the latex as possible. All materials should be added slowly to avoid introducing air bubbles and reduce the risk of “shocking” the latex, which can induce local to widespread coagulation.

Many of the ingredients (sulfur, accelerators, activators, antioxidants) will be added in a dispersion form, typically between 30 and 60% solids. These dispersions will settle over time and need to be thoroughly mixed to redisperse before being added. Checking the total solids content versus the value on the dispersion Certificate of Analysis can be a good way to confirm adequate dispersion if in question.

Materials should be filtered before or as they are added to the latex, particularly the dispersions, to ensure no agglomerates are introduced into the compound.

In general, ingredient order of addition for a basic compound should follow an order such as follows:

1. Yulex Pure NR Latex
2. KOH or Ammonia (pH modifiers)
3. Surfactants/stabilizers
4. Accelerators
5. Antioxidants
6. Sulfur
7. Activator
8. Fillers, pigments
9. Additional water for viscosity/total solids adjustment

It may be found to be advantageous to add pH modifiers and stabilizers and then allow a period of time for these to equilibrate with the rubber particles in the latex. During this period the stabilizers in particular can interact fully with the surface of the rubber particles before additional compounding steps.

MIXING AND DE-AMMONIATING

Proper care and treatment of the latex is critical to ensure material quality and processability in subsequent steps. Storage containers should remain sealed until time of use. When ready to use, it is recommended to follow these steps:

1. Open container and mix at a low speed using a paddle mixer with two or more blades at a speed that completely turns over the latex but does not create a vortex which can entrap air. Any samples should be pulled at this time.
2. If deammoniation is necessary, containers should be placed under adequate ventilation and gently and consistently agitated until desired ammonia level is achieved. Blowing a warm, moist airflow across the surface can help accelerate the process. Monitor the pH frequently during the process to ensure the latex remains stable.
3. Once deammoniation is completed, containers should be sealed and stored until compounding.

Note: Some users find it advantageous to add stabilizers before deammoniating as this can enhance the mechanical stability and reduce formation of coagulant particles during mixing.

MATURATION

After all of the chemical ingredients are added the latex compound will experience gradual changes during the maturation period. The time the compound is allowed to sit in storage as well as the storage conditions will impact this maturation and ultimately the final rubber product properties.

During this period the different materials mixed together to form the compound will have the opportunity to interact and equilibrate. During this period crosslinking will slowly but steady take place, particularly with the use of the modern ultra-accelerators. This precure can be observed in the gradual increase of the viscosity and precure as tested using the Swollen Diameter or Chloroform Number tests. If allowed to proceed to far the result will be product with poor properties.

FILTERING

All latex compounds should be filtered prior to use to remove any large particulates or coagulum that may have built up during mixing. This will help ensure a material of good consistency and help to reduce potential defects on subsequent parts. Use 2-4 layers of cheesecloth or similar compatible materials (nylon, PE, PP) of adequate mesh size is recommended. Use of basket type filtration systems work well for bulk filtration.

MATERIALS

YULEX® PURE Natural Rubber Latex, is the base material for compounding and ingredient calculations are based on the actual amount of rubber (as rubber solids) in the latex. There are many other materials used to impart or enhance specific properties, some that are critical to the system to ensure basic desired physical properties are achieved. The primary basic ingredients in a typical natural rubber latex compound are discussed below.

Stabilizers – are used to maintain colloidal stability of the latex, typically via separation of particles that have ionic charges, most commonly anionically. Fatty acid soaps are a classic, effective means to stabilize latex and produce higher mechanical stability. A proper balance must be achieved with stabilizer addition to ensure the material can be coagulated upon demand and not prematurely. The degree of stability should be tailored to the demands of the process (mechanical and chemical exposures) but not to the point of which coagulation is difficult to produce when desired.

Examples of stabilizers which can impart good processing properties include sodium lauryl sulfate, sodium dodecyl benzene sulfonate, potassium laurate, and sulfated methyl oleate with others also being potentially suitable.

Note: that it is important to deammoniate the product prior to dipping to ensure best processing. Ideally the ammonia should be reduced to ≤ 0.2%.

A key point to understand is that the high purity level of YULEX® PURE Natural Rubber Latex results in lower levels of some of the naturally occurring stabilizers found in a typical commercial natural rubber latex such as fatty acid soaps.

While this can lead to a reduced mechanical stability it allows the user excellent flexibility in tailoring a stabilizer package best suited for the application and can be very advantageous in that lower levels of chemicals may be used to destabilize the compound during part production.

Curative /Vulcanizers – the “rubbery” properties which allow for the return to original shape after stress or strain is induced are due to the network of crosslinks produced between the polyisoprene molecules during vulcanization. The crosslinkers are the chemicals responsible for linking the individual chains and greatly enhance the tensile properties of the finished/cured part. Sulfur is the primary crosslinker utilized for the compounds of discussion although peroxides can also be used for typical molding and extrusion processes.

Activators – these chemicals are what allow sulfur curing to be accomplished more efficiently. Without activators, the vulcanization would be extremely slow and inefficient. Zinc Oxide is the material used to activate the crosslinking action of sulfur in typical natural rubber formulations.

Accelerators – dithiocarbamates, thiurams, sulfonamides, thiazoles (all nitrogen bearing); xanthates, guanidines and thioureas are all materials that accelerate the crosslinking process and allow for efficient use of sulfur vulcanization in modern rubber production. These are typically used in combinations to tailor cure rate and ultimate physical characteristics towards those desired in the process and finished product.

Antioxidants – oxygen will attack and degrade rubber due to the presence of double bonds in the polymer structure. Use of antioxidants (AOs) is critical to ensure maximum life span of the cured product. The two major types of AOs are phenolics, such as Wingstay L, and amines such as the PPDs – para-phenylenediamenes. The latter may cause staining in finished parts so should only be employed in darker/pigmented parts or those where aesthetics are not important. The PPDs are also very effective antiozonants.

Antiozonants – these may or may not be employed depending on the final application. Antiozonants are typically waxes that are used in static applications as flex of the part can disrupt the protective wax barriers. The p/phenyldiamines can provide good protection as well but again, present the issue of staining the finished product.

Other additives – a variety of other materials may be added to reduce cost, impart colors/aesthetics, provide fire resistance, conductivity enhancement, aid in processing (thickeners, film surface modifiers), provide gelling/heat sensitization, enhance foaming, and modify odors.

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