EFFECT OF WOOD ROSIN ON THE MECHANICAL STABILITY OF NR LATEX

PROJECT REPORT SUBMITTED TO
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BY

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CERTIFICATE

This is to certify that the report ***Effect of Wood Rosin on mechanical Stability of natural rubber latex*** is a bonafide record of the work undertaken by **Kum. Divya Soman**, IVth semester student, M.Sc. Pure Chemistry, St.Dominic's college, Kanjirappally under my supervision and guidance, in partial fulfillment of the requirement for award of Masters degree in Chemistry. Also certified that the results obtained in this study have not been used for the award of any other degree or diploma.

M. Sunny Sebastian,
t Director (P &QC)

DEPARTMENT OF CHEMISTRY

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CERTIFICATE

This is to certify that the project report "**Effect of wood rosin on the mechanical stability of NR latex**" submitted by Divya Soman in partial fulfillment for the award of Degree of Master of Science in Chemistry of Mahatma Gandhi University is a record of bonafide work carried out by her at Rubber Board , Kottayam under the guidance and supervision of Mr. M. Sunny Sebastian , Joint Director, Rubber Processing and Marketing Development Division, Rubber Board, Kottayam.

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Teacher-in-charge	Head of the Dept. of Chemistry

DECLARATION

I do hereby declare that the project work entitled " **Effect of wood rosin on the mechanical stability of NR latex"** is a bonafide record of the work carried out by me under the guidance of Mr. M. Sunny Sebastian , Joint Director , Rubber Processing and Marketing Development Division, Rubber Board, Kottayam for the partial fulfillment of the requirements of the Degree of Master of Science in Chemistry of Mahatma Gandhi University, Kottayam.

Divya

Divya Soman

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I express my sincere gratitude to all those who helped me throughout the course of this project work.

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Divya

Divya Soman.

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INTRODUCTION

Introduction

Natural rubber is a high- molecular weight polymer of isoprene, in which essentially all the isoprene have the cis-1,4 configuration. The natural polymer has a number –average degree of polymerization of about 5000 and a broad distribution of molecular weights.

Source:

Natural rubber can be obtained from nearly five hundred different species of plants. The outstanding source is the tree " Hevea brasiliensis' from which comes the name ' Hevea rubber'. Rubber is obtained from a latex that exudes from the bark of the 'Hevea tree' when it is cut.

Raw rubbers are natural or synthetic polymeric materials which are elastic at and around room temperature. Their high and reversible extensibility and damping properties distinguish them from other materials. As the mechanical properties, compared with, for example, steel or polyamide, are modest, they are generally used in composite articles where extensibility in a definite direction is virtually suppressed by combination with reinforcing materials (cord, fabric, metal or plastic). At higher temperatures, with or without the influence of deforming forces, raw rubber shows viscous flow, which enables it to undergo shaping process. Usually from 5 to 20 additives are used to modify the physical properties and processability and /or reduce the compound cost of rubbers. The rubber is shaped and the composite articles built before vulcanization, a process which changes the chemical structure and improves the quality of rubber.

Apart from natural rubber whose properties have been known for many centuries, a multitude of synthetic rubbers have been developed since 1915, to meet the demands of the growing passenger and goods transportation needs of the twentieth century. From the chemistry of a rubber, that is, it's 'microstructure', or the arrangements of its monomers, it is often possible to draw rough conclusions as to its chemical behaviour. However the mechanical properties and deformation behaviour are considerably influenced by the microstructure, compounding and vulcanization. Therefore these are only determined empirically.

STRUCTURE/ PROPERTY RELATIONS IN RUBBERS.

The inherent properties of a polymer are determined by it's molecular organization and the energy of interaction between it's molecules. Such factors as the size, shape and flexibility of the chemical groups, the ease of deformation of inter-atomic bonds, bond energies, and the strength and directionality of the interchains between molecules determine the physical and mechanical behaviour of a polymer, specially properties such as tensile strength, modulus, stress relaxation and elongation at break.

Polymer molecules may be arranged predominantly at random (amorphous state) or predominantly in regions possessing a high degree of geometrical order(crystalline state) or with a balance of crystallized and amorphous domains. In general, rubbers exhibit an amorphous structure in the relaxed state, whereas fibres show a high degree of crystallinity. Dispersion forces, the weakest of all intermolecular attractions, are the only type of intermolecular force in hydrocarbon rubbers(NR, BR, SBR,IIR,EPDM etc).

Natural rubber (NR), for example, has weak forces of attraction between the chains. .The very flexible chains tend to coil in a random fashion and can slide over each other readily on stretching ,forming crystalline regions, which melt when the external stress is released .In the case of fibres , the linear polymer chain are held together by very large forces of intermolecular attraction , resulting in high tensile strength and melting point .For example Nylon 6,6 has high intermolecular forces of attraction due to many polar groupings and hydrogen bonding forces . Strong forces between the individual chain molecules or molecular shapes which fit easily in to a crystal lattice are typical of fibres .Intermediate cases lead to typical plastics .However ,many linear polymers can be made rubber –like or drawn out to a fibre or moulded as a plastic by adjusting their crystallized amorphous domains by pressure, temperature , plasticization or mechanical influences.

An ideal rubber consist of flexible cross- linked polymer chains undergoing extremely rapid molecular movement (violet – liquid motions) .

PROPERTIES OF RUBBER

Rubbers have the all round ability to be used in extension, compression, shear, torsion or combinations of these methods. Rubber elasticity may be considered as very large deformability with almost complete recoverability. Rubbers are resilient. Rubbers are characterized by a high elongation at break.

Owing to small atomic masses of atoms and insufficient chain packing, rubber densities are low, compared with metals.

Rubbers dissolve only slowly in appropriate solvents to give solutions which have high viscosities even at low concentrations. The penetration of small solvent molecules between tangled polymer chains is time and temperature dependent. The resistance to flow, offered by the coiling and tangling of chains, causes a large increase in viscosity of polymer solutions.

Rubber has both a viscous and elastic responses to deformation. Rubber displays the "Joule effect" at moderate strains. When it is stretched, then heated, it tries to contract. It's modulus of elasticity or ability to carry load, increases with rise in temperature. Rubber also absorbs heat when allowed to contract rapidly.

Rubber is a poor conductor of heat with a high coefficient of thermal expansion. This means that vulcanization temperatures are reached slowly ion the interior of a rubber product, and the articles shrink when they cool to room temperature from the temperature at which they were vulcanized in a mould.

Rubbers are generally insulators, i.e. poor conductors of electricity, since the bonding is covalent, and there are no charge carriers. A large application of rubber is in insulation application where it's flexibility is required combined with high resistance to the passage of an electric current.

Rubber when dry, has a remarkably high co-efficient of friction, but this is greatly reduced when the rubber is wetted with water.

The properties of rubber can be considerably varied by compounding with fillers and by adjusting the conditions of vulcanization. The dynamic properties of rubber are important in such diverse applications as tyres, belts, high pressure hoses, antivibration mountings and bridge bearings.

Rubbers is usually regarded as a material of high electrical resistivity.
Classification of rubber compounds according to resistivity.

Rubber compounds	Resistivity (Ωm)
Pure gum compounds	10^{12}-10^{16}
General purpose compounds	10^{9}-10^{12}
Anti-static compounds	10^{6}-10^{9}
Conductive compounds	10^{2}-10^{5}
Dry, powdered carbon black	1
Metals	10^{-2}-10^{-4}

USES OF RUBBER

The rubber goods industry is mainly divided into tyre and non-tyre sector. The tyre sector manufactures tyres for air-craft, heavy vehicles, light motor vehicles, two wheelers, and off-the road tyres also. The non-tyre sector, making use of natural, synthetic, and reclaimed rubbers, produces cycle tyres, tubes, camel back, foot wear, belts, hoses, latex foam-dipped goods, and extuded goods. Almost half of the natural and synthetic rubber output is consumed by the tyre sector. In India, the dependence on natural rubber is very high. The ratio of natural rubber to other rubber used is very high at 78:22. In some developed countries, the ratio is 30:70. The per capita consumption of rubber in India is low at 0.5 Kg/year as against over 10 kg in industrially advanced countries.

Natural Rubber latex

Latex is an aqueous dispersion of rubber, containing 25-40% rubber hydrocarbon, stabilized by a small amount of protein material and fatty acids. The latex is gathered, coagulated washed and dried.

The table given below denotes some properties of Natural Rubber.

Property	**Natural Rubber**
Tensile strength(psi)	4000
Elongation(%)	700
Dynamic properties	Excel
Tear resistance	Low
Electrical properties	Excel
Upper use temperature (^{0}C)	80
Lower use temperature (^{0}C)	50
Weather resistance	Fair
Water swelling	Excel

MECHANICAL STABILITY OF LATICES

Mechanical Stability Time (MST) is an important property of the latex. Latices can be destabilized by mechanical agitation or shear forces which occur during handling and processing, e.g. during concentration ,transportation or in compounding .In this test additional kinetic energy is imparted to particles from a disc which rotates at a high speed while immersed in the latex .The resistance to destabilization is measured by a mechanical stability test in which a latex sample is vigorously agitated by a disc of specified dimensions rotating at 14000 per minute ,additional kinetic energy is imparted to the particles by rotating disc ,the time for the first sign of flocculation to appear is noted as the Mechanical Stability Time (MST) for natural rubber latex .The coagulum which is retained on a specified size after agitation of the latex for a specified period is taken as the mechanical stability for synthetic latices .

The MST of freshly produced concentrated NR latex is always low (100sec),but this increases to reach a constant value in 3-6 weeks .

CONSTITUTION OF NR LATEX

Natural rubber latex is a colloidal dispersion of rubber hydrocarbon (polyisoprene) particles in a watery serum . The particles are mostly pear shaped and are in constant Brownian motion. In Hevea latex , to which no chemicals have been added , the average traveling speed of the particles has been determined by photography to be 12 microns per second .The size of the particles are of the order of 0.25- 5 microns .

Rubber particles are surrounded by a surface layer of proteins adsorbed at the rubber -water interface .This layer determines latex stability and colloidal behaviour . Proteins are very hydrophilic and their particles are surrounded by a water envelope .For [illegible] simplicity, the protein molecules may be represented NH_2-P-COOH where P indicate the protein chain . The colloidal stability of NR latex is governed mainly by the negative charges on the surfaces of latex particles and by the dissolved substances present in the aqueous phase . Addition of base –like substances increase the stability of latex . Natural rubber latex is a whitish fluid of density between 0.975 and 0.980 g..mL^{-1},pH from 6.527 . It's viscosity is variable .Surface free energy from 40 to 45 ergs cm^{-2}.

Fresh latex upon progressive dilution with water, causes the velocity to increase at first , reach a maximum ,and then suddenly decreases .These are due to swelling and bursting of bodies know as lutoids

The composition of fresh latex are :

Total solid content	**36%**
Dry rubber content	**33%**
Protenious substance	**1to 1.5%**
Resinous substance	**1to 1.5 %**
Ash	**upto 1%**
Sugars	**1%**
Water	**ad, 100**

In latex ,the above substance are distributed between 3 principal phases . They are :

1) The rubber particles (35% of latex by weight)

2) The aqueous phase (~55% by .wt .of the whole)

3) The lutoid phase (remaining 10%)

Certain minor phases present constitute 'Frey-Wyssling particles ' .NR latex contain protenious substances ,about one half is dissolved in aqueous phase , one – quarter adsorbed on the surfaces of the rubber particles , and the remaining quarter associated with the larger particulate bodies such as lutoids.

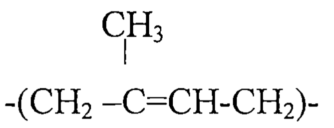
While considering the rubber-phase, the rubber particles are pear - shaped rather than spherical , and consist of a tough ,hard , elastics shell , which encloses a viscous liquid . These informations are obtained from the microscopic study of NR latex done by Hauser in 1926 . In the Hauser two phase model, solid natural rubber comprise two distinct fraction ,sol fraction and gel fraction .The size of the particles varies between 200-20000 A^0unit.

The rubber phase of Hevea latex having a typical composition ,

Rubber hydrocarbon - 86%
Water (Dispersed in rubber hydrocarbon) - 10%
Protenious substance - 1%
Lipid substance - 3%

Mg, K, and Cu are also associated with rubber particles (0.05%). Density of rubber particles is c 0.92 gmL^{-1} .

The rubber hydrocarbon in fresh hevea latex is cis –1,4 polyisoprene (which contain one C=C for each C_5H_8 unit .



$$-(CH_2-\overset{CH_3}{\overset{|}{C}}=CH-CH_2)-$$

There is some evidence that the natural rubber molecule contains minor amount of oxygen, in the form of carbonyl group.

The lipids associated with rubber particle comprise sterol and sterol ester, fats and waxes such as, eicosyl alcohol and phospholipids. The phospholipids is the effective adhesive which bonds the protein to the rubber. The phospholipids of the hevea latex of the lecithin type in which the R-groups are hydrocarbon radicals of the hepta decyl ($C_{17}H_{35}$) or hepta decenyl ($C_{17}H_{33}$) types. Other phospholipids in small quantities include metal-phosphotides and cephalin.

Aqueous-phase consist of carbohydrate, protein and aminoacids and other serum constituents. Carbohydrate which is the principal of these is 1, methyl-inositol which is also known as quebrachitol (1%)

The serum contains several proteins of widely separated isoelectric points. The principal ones are known as α-globulin and hevein-α-globulin may be obtained by precipitation from a dialysed solution of freeze-dried serum in a Na-

Citrate buffer solution of P^H 4.5 and ionic strength 0.04 . α-globulin is a surface active protein which is readily adsorbed at air-water and oil-water, interfaces. It is insoluble in distilled water. But is soluble in natural salt-solution, acid solution, and alkaline solution. It's isoelectronic point, P^H 4.8, is close to that of fresh hevea latex.

Hevein is a crystallised protein having molecular weight 10,000 and of isoelectric P^H 4.5. It contains some 5% sulphur as cystein type disulphide linkages. Hevein displays little surface activity, is soluble in water at all P^H. It is not precipitated from water by boiling. A multiplicity of polypeptides and simple amino-acids has been observed in latex serum. The free amino acids comprise in 0.1 % of the whole weight of the latex.

Other serum constituents includes free nitrogeneous bases such as choline and methyl amine, organic acids, inorganic anions and metallic ions. Fresh latex also contain some 0.25% of cyanide. A wide range of enzymes are also present in fresh rubber latex.

PRESERVATION OF NR LATEX

Latex is coagulated by addition of acetic or formic acid in suitable containers. Coagulation depends on ambient temperature and upon the stability of the latex itself, resulting in a separation into clots of rubber and a clear serum. At a latest stage 'putrefaction' sets in, with the development of bad odour. It is to prevent both of these processes, that preservation is necessary, (in order to maintain identity).

Fresh latex, as it exudes from the tree, is slightly alkaline or neutral. It becomes acidic rapidly due to bacterial action. The formation of organic acids neutralizes the negative charge on rubber particles and the latex get auto coagulated. Therefore, fresh latex has to be preserved usually with about 0.7 % ammonia, a variety of preservatives may also be added with a low level of ammonia concentration to sieved field latex. After sieving and addition of preservatives, the latex is fed into a bulking tank where settling and removal of the sludge takes place.

Preserved latex concentrates are of three types: Centrifuged, creamed; or evaporated lattices.

There are long term and short term preservation. Short-term preservatives are commonly known as anticoagulents.

1. The Ideal Preservative:

a) Efficiency as a preservative

It is important to distinguish at least 3 ways in which preservative should be operative.

i) It should destroy microorganism or suppress their activity and growth.

ii) It should contribute +vely to the colloid stability of the latex, by increasing the charge on the particles and the zeta potential at the rubber-water interface.

iii) It should deactivate trace metals, especially hevea metal ions, either by sequestration in solution or by precipitation as insoluble salts.

b) Ancillary requirements

The ideal preservative will be characterized by a no: of ancillary requirements. It should not impart an offensive odour.

2 Ammonia as a preservative

3 Ammoniation of Latex

0.2 % of ammonia in the whole latex is sufficient for short-term preservation about 0.7 % is required for permanent preservation. It is very effective as a bactericide of the level present exceeds 0.3 % on the whole latex.

Ammonia imparts an alkaline reaction to serum of latex, and enhances magnitude of the $^{-}$ve zeta-potential, at the rubber-serum interface. In consequence it includes the stability of the latex. The lower P^{H} of latex at any given level of ammoniation is due to the partial interaction between the added ammonia and protein which are present in the latex.

Ammonia interferes with the gelation of latex, by sodium silico fluoride and therefore has to be reduced to a low level prior to the production of latex foam rubber by this process.

c) Low ammonia preservation systems.

1) Pentachlorophenate latices:- Combination of 0.2% of ammonia plus 0.2% of Na-Pentachlorophenate on the weight of the whole latex.
2) Zinc dialkyl dithio carbamate latices: A typical combination would comprise 0.2% of ammonia plus 0.1% to 0.2%. of zinc dialkyl carbamate plus 0.2% of lauric acid. Latices which are preserved in this way give deposits which tend to discolour badly on ageing.

THE CONCENTRATION OF NR LATEX

The rubber globule is surrounded by a protective layer of proteins and phospholipids which imparts the colloidal nature to latex. Also, it contains a variety of non rubber constituents both organic and inorganic. In order to remove these non rubber constituents concentration is necessary. There are three methods mainly used for concentration, evaporation, creaming, centrifuging. Centrifuging is the practically useful method.

Fresh latex, as it exudes from the tree, is slightly alkaline or neutral. It becomes acidic rapidly due to bacterial action. Preserved latex concentrates are of three types: centrifuged, creamed; or evaporated latices; the first method predominates.

1) Latex Concentration by Centrifugation

The dry-rubber content of natural rubber latex, an average of 33%. It is therefore un-economical to transport preserved field latex over large distances. The normal procedure is to concentrate to about 60% dry rubber content, the transportation of such concentrates is clearly economically more favourable. Many important latex processes require as a raw material a high-slid latex. Concentrate of 60% minimum rubber content. Notably this is true of processes for the manufacture of latex foam rubber. Latex concentrates tend to be more uniform in quality than do field lattices. This is due to the partial removal of non rubber constituents in several of the concentration processes. Because of these considerations, there is now very little commercial interest in the bulky and shipment of preserved field latex.

The production of centrifuged latex concentrate can be shown diagrammatically. The ammoniated latex from the field collection point is taken to the centrifuging plant. After the field latex is checked for rubber content and state of preservation, it is charged into bulk storage tanks from which it flows directly on through clarifier to the centrifuges. The centrifuges are usually operated continuously and process [illegible] 350-450 litre /hr, depending on the type of machine. The centrifuges separate the field latex into two fractions; one, containing concentrated latex of approximately 60% dry rubber content, and , the other containing 3-6% skim latex. The skim fraction is generally coagulated with sulphuric acid and creped, dried and marketed as skim rubber. This is a low grade rubber which is not used in rubber products which require good dynamic properties. The concentrated latex is continuously collected through an outlet at the centre of the centrifuge and is then ammoniated and pumped to factory bulk tanks for further blending and testing. The concentrate is matured for four weeks and a series of test are done. The centrifuged concentrate accounts for over 90% of the total latex production. High ammonia centrifuged latex can be used in food applications and for medical or surgical goods.

Theory of Centrifuging

To a first approximation the motion of a centrifuging latex particle relative to it's serum is confined to the radial direction. For most practical purposes the coriolis motion ie. the lateral movement relative to the serum, may be neglected. The equilibrium radial velocity of the particle is determined by the balance between two forces, namely, the centrifugal buoyancy, which tends to accelerate the particle and viscous drag which tends to retard it. As in the case of creaming the later force is, for a spherical particle given approximately by Stoke's law for a spherical particle of diameter X and density ρ moving in a circular path of radius R with angular velocity ω in a medium of density ($\sigma > \rho$) this equality leads to the relationship.

$$4/3\ \pi(1/2X)^3\ (\sigma-\rho)\omega^2R = 6\ \pi\eta\ ½\ X\ (-\ dR/dT\ )$$

$$(-dR/dT) = \frac{X^2(\sigma-\rho)\omega^2R}{18\eta}$$

where η is the viscosity of the aqueous phase of the latex. Thus it appears that the rate of centrifuging increases with squares of the both the particle diameter and the angular velocity and increases linearly with inverse viscosity of the serum. The density difference determines both the direction of centrifuging as well as the rate; for dR/dt is $\lesseqgtr 0$ and as $\sigma \gtreqless \rho$

Furthermore the radial velocity of the particle increases linearly with the radius of it's path, so that the particle is subject to a continuel radial acceleration, even in the equilibrium condition.

The maximum radial displacement of a particle of diameter which has been subjected to centrifuging for a time 't' will be obtained by the integration of the equation.

$$dR/R = \frac{-x^2(\sigma - \rho)\omega^2\, dt}{18\eta}$$

The lower limits of the integral will be $R=R_0$&$t=t_0$ respectively where R_0 is the radius of the path in which the particle was moving initially. The upper limit are arbitrary. The result is

$$\log R/R_0 = \frac{-x^2(\sigma-\rho)\omega^2 t}{18\eta}$$

Or

$$R = R_0 e^{\frac{-x^2(\sigma-\rho)\omega^2 t}{18\eta}}$$

Hence the radial displacement is given by

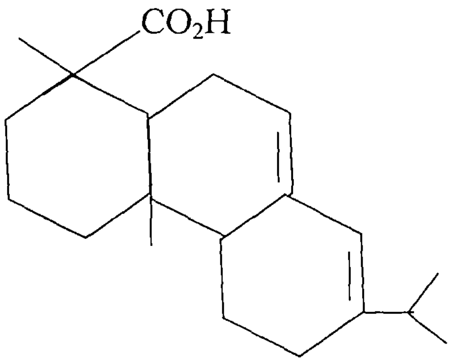
$\Delta R = R_0 - R = R_0 \left\{ 1 - e^{\frac{-x^2(\sigma-\rho)\omega^2 t}{18\eta}} \right\}$ The effect of centrifuging upon particle size distribution is evident from the above equation. Consider a particle which initially moves in a path of radius R_0, but after a time t now moves in the path of radius R. To meet this requirement, its diameter, x_R must obviously be given by

$$x_R = \sqrt{18\eta/(\sigma - \rho)\omega^2 t \,.\log R_0/R}$$

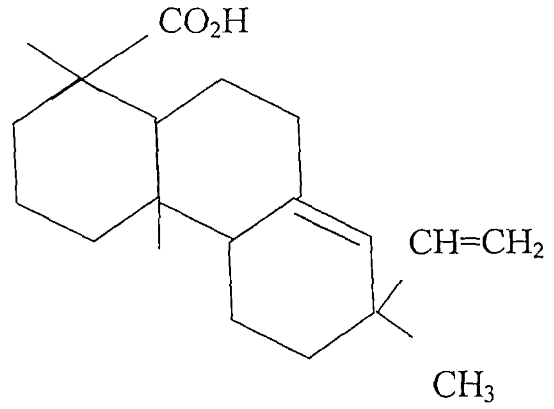
WOOD ROSIN

Rosin (also known as colophony) is a resinous substance which is obtained from certain pine trees, either by the solvent extraction of wood stumps, or by wounding (turpentining) the living tree and collecting the exudate. The product of the first process is known as wood rosin;the exudate from the second process consists of a mixture of rosin and turpentine, and its rosin fraction is known as gum rosin.

Rosin is a translucent, brittle substance at room temperature. It is graded by colour, which may vary through shades of yellow and brown. It is insoluble in water but dissolves readily in organic solvents. It also dissolves in strong alkalies to give solutions of rosin soaps or *resinates,* from which heavy metal rosin soaps are precipitated on the addition of a solution of a heavy metal salt. In chemical composition, rosin comprises some 90% of the so-called 'resin acids' and about 10% of non-acidic materials; the latter fraction includes the esters of rosin and fatty acids, together with various hydrocarbons, including terpenes. The resin acid fraction of rosin is a complex mixture of acidic materials , the main components having the molecular formula $C_{19}H_{29}.CO_2H$ and containing two carbon-carbon double bonds per molecules. These main components fall into two classes, according to whether the two double bonds are conjugated or not. Abietic acid (Structure I) and dextropimaric acid (Structure II) are typical of the two classes respectively.



Structure - I



Structure - II

Indeed, rosin is sometimes referred to loosely as abietic acid.

TECHNIQUES

TOTAL SOLID CONTENT TEST

Total solid content of latex is defined as the percentage by weight of the whole which is non-volatile at a definite temperature in an open atmosphere .The general procedure is to weigh a known quantity of latex (2g)in to a flat bottomed dish and evaporated to constant weight at a definite temp(70°C).If $W_0$is the initial weight of latex sample and W is the weight of the dry film,then the total solid content is given by

$$\text{T.S.C} = \frac{W}{W_0} \times 100$$

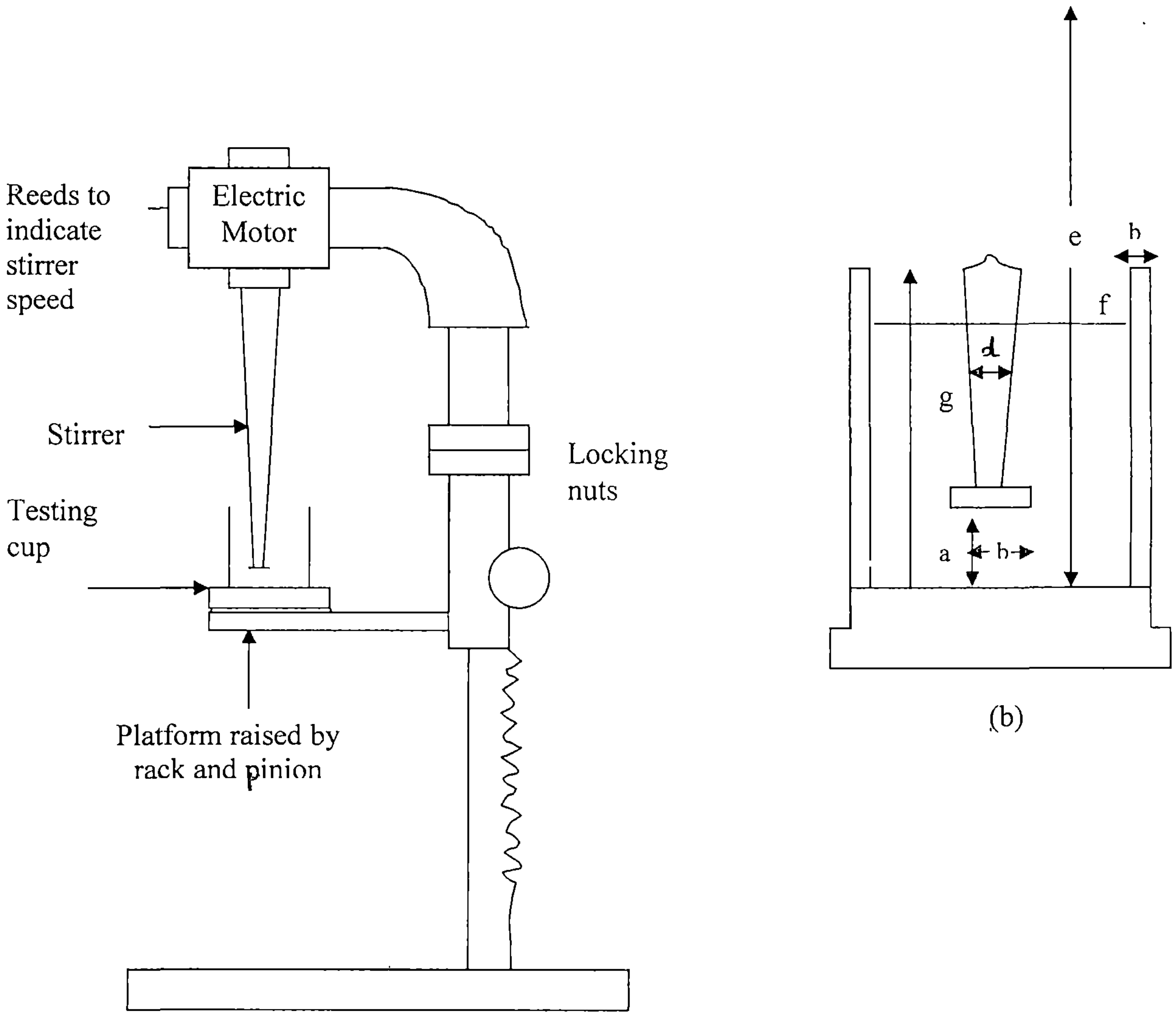
THE MECHANICAL STABILITY TEST

The mechanical stability test for natural rubber lattices is the time taken for visible aggregation of latex particles under high speed agitation with a specified rotor and container. It rises from 100s in freshly prepared concentrate to over 700s in 4-5 weeks. The coagulum content is defined as the quantity of material (expressed as percentage of TSC) remaining on a 180 micron sieve when a sample of latex is strained through it. The 'sludge content' is the quantity of material expressed as a percentage of the latex weight, which may be removed from the latex by centrifuging under specified conditions.

By the mechanical stability of a latex is meant it's resistance towards those mechanical influences which tend to increase the number and violence of collisions between particles, and so tend to coacervate the latex. It is a difficult property to define and to access quantitatively.

The general procedure for mechanical stability determination is to stir a definite amount of latex under given conditions of dilution, temperature and speed of stirring, and to measure the time which elapses before signs of incipient coacervation appear. The mechanical stability is expresses in seconds.

The apparatus used is indicated diagrmmatically, and reference should be made to the table given below.



(a)

(b)

Illustration of Apparatus for mechanical stability testing of latex

Details	British Standard Procedure	ASTM Procedure
Latex concentration	55 ± 0.2% TSC	55± 0.2%TSC
Dilution fluid	1.6% ammonia solution	1.6% ammonia solution for 11 A type ,distilled water for LA type.
Sample weight	80± 1g	80± lg
Latex temp:	35± 1°C	35 ±1°C
Stirred speed	14,000 ± 200 rpm	14,000 ± 200 rpm
Dimension of cup& stirrer(figure)		
a	0.5± 0.1 in	0.5± 0.1 in
b	0.820± 0.001 in	0.820± 0.001 in
c	0.062±0.002 in	0.062± 0.002 in
d	0.25 in	c.0.25 in
e	c.6 in	any convenient length
f	2.25 ± 0.05 in	2.28±0.04 in
g	k 3.5 in	c 0.5 in
h	c 3/16 in	c 0.09 in
Material cup	Poly methyl methacrylate or Polystyrene	Glass
Material of stirrer	Stainless steel	Disc to be of stainless steel
Indicator of end point	85- mesh coagulum content of whole test sample to exceed 0.5 g when washed & dried	Dip glass rod into latex & draw once slightly over the palm; first appearance of small pieces of coagulated rubber in the film so deposited is the end point; may be verified by determining the 80- mesh coagulam, which should be c 0.1% of the total solids
Maximum allowable discrepancy between duplicate	5%	5%

in - inch
rpm - rotation per minute

Both BS & ASTM require the stirrer to rotate at 14,000 ± 200 rpm throughout the duration of the test .The speed is usually adjusted by means of a rheostatic control which is wired in series with the motor which drives the stirrer. The speed is estimated by means of the three reeds indicated in figure.These reeds are tuned to vibrate violently when the shaft speeds are respectively 13,8000, 14000 and 14200 rpm. Ideally, the center reed should vibrated violently the whole time; but so long on it is known that the first reed has already vibrated, but the third has get to do so, then the requirements for the procedure in this respect is satisfied .

The details of the BS and ASTM procedures are summarized in the table below. It should be noted that mechanical stability test procedures are as yet confined to natural rubber latex. It is a characteristic of many synthetic latices that, whilst they coagulate readily under light finger pressure, they are most reluctant to coacervate under the conditions which prevail in the standard high speed MST. A realistic test method for synthetic latices has yet to be evolved.

While doing the mechanical stability test for natural rubber latex.

1 This stirrer shaft is to be vertical

2 The test cup is to be flat – bottomed cylindrical and of smooth inner surface.

3 The cup must be concentric with the shaft

4 A convenient method for ensuring that the distance between the under side of the disc and the floor of the cup (dimension 'a' in the figure) shall be within specification limits, makes use of a cylindrical slip – gauge and the two locking rings indicated in figure.

5 The weight X of water, or the ammonia solution which is required to reduce the fractional solid content of a weight W of latex from its initial value. So to some other value S may be readily calculated form the observation that we must have

$$S= WS_0 / W+X$$

$$X= W\{ S_0/S-1\}$$

In this case it is required that S= 0.55, and hence with the sufficient accuracy may be calculated from the formula,

$$X= W(1.82S_0-1)$$

Materials used : Wood rosin, natural rubber latex, ammonia, KOH.

Requirements : Wood rosin – 5g for each
NR Latex - 150 ml for each
Ammonia, KOH – 0.01, 0.02, 0.03, 0.04, 0.05
(Concentration in %)

5g of wood rosin is accurately weighed out and dissolved in ammonia and made up to 100ml. Taken five different 250 ml beakers and filled with 150ml natural rubber latex and to this different concentrations of wood rosin dissolved in ammonia are added and kept these for 24 hours. After 24hrs. each one is subjected to the Mechanical stability Test as the above procedure. Did the same procedure using wood rosin dissolved in KOH. (Wood rosin is insoluble in water).

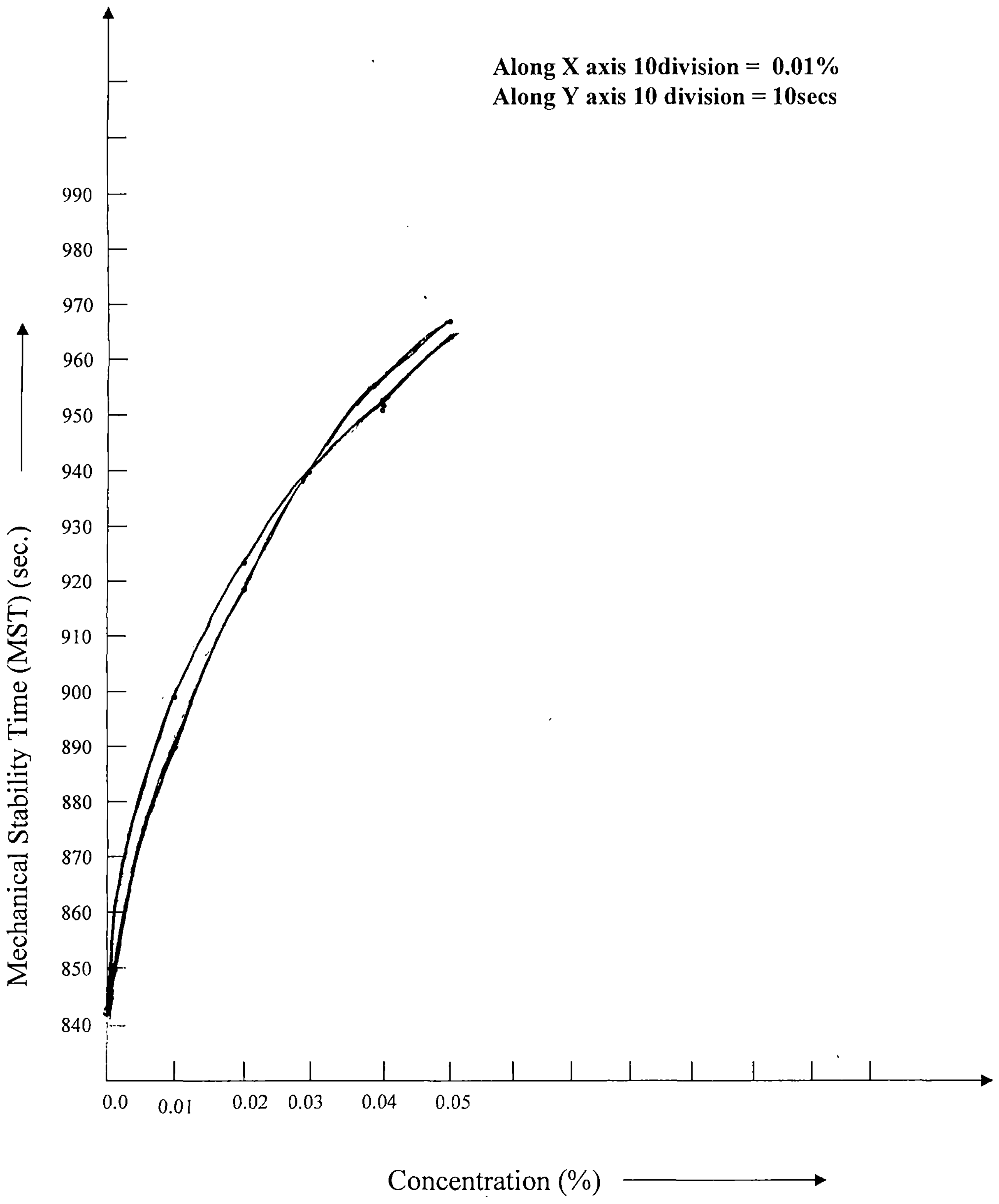
The results obtained for the two experiments discussed above are as follows:

1) Wood rosin dissolved in Ammonia

Concentration (%)	**MST (sec)**
0.0	**842**
0.01	**890**
0.02	**918**
0.03	**940**
0.04	**951**
0.05	**967**

2) Wood rosin dissolved in KOH

Concentration (%)	**MST (sec)**
0.0	**842**
0.01	**899**
0.02	**924**
0.03	**940**
0.04	**952**
0.05	**964**


Along X axis 10division = 0.01%
Along Y axis 10 division = 10secs
Mechanical Stability Time (MST) (sec.)
990
980
970
960
950
940
930
920
910
900
890
880
870
860
850
840
0.0
0.01
0.02
0.03
0.04
0.05
Concentration (%)

RESULT AND DISCUSSION

From the above experimental data it can be understood that as we increase the concentration of wood rosin, which is dissolved in different solvents such as Ammonia and Potassium Hydroxide, the mechanical stability time also increases almost similarly. The result shows that the MST remain without much variation, even though wood rosin dissolved in different solvents is used. From the graph the same result is obtained.

CONCLUSION

This work is mainly aimed at the effect of wood rosin on the MST of NR Latex. From the Mechanical Stability Test of, natural latex, it is clear that, as the concentration of wood rosin, which is dissolved in two different solvents ammonia and KOH, increases, the MST also increases. Using this mechanical stability test, we can compare the increase of rate in different solvent environments. Also from the above experimental data it can be understood that, while we are using both NH_3 & KOH, there is not much difference in the increase in M.S.T. Therefore both of them have almost similar effect on the MST of the NR latex.

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