TYPES OF CONCENTRATED LATEX AND TESTING PROCEDURES

BY

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Concentrated latex production started in Asian countries nearly 5 decades ago. In Sri Lanka the first centrifugation plant was set up in 1953 and indust ries based on centrifuged latex were either medium or small scale. This small concentrated latex industry in Sri Lanka was catering to the Mattress industries, small scale dipped goods industries and the two house hold gloves industries in the country. Now there are nearly 10 centrifuged latex manufacturing units in the country. In 1988 two examination glove plants were commissioned.

The few concentrated latex based rubber industries set up in the free trade zone of Sri Lanka were closed down at the very early stages of their operations due to various problems which were mainly of a managerial nature.

It is true that latex produced in countries like Thailand are selling at a discount price due to the inferior quality of them. Those problems encount ered by their producers of concentrated latex as stated clearly in the paper presented by the Technical Manager of Latex Products Ltd in Surat Thani, at the "Polytech -89" conference held in July 1989 in Bangkok, are luckily not common with Sri Lankan latex.

The draw backs alleged against Thai latex due to high VFA and low mechanical and chemical stability are as follows.

(a) Transport difficulties, which makes the arrival of field latex to the collecting centre delayed by hours or by days sometimes.
(b) Deliberate hoarding of latex when there are signs of latex price increasing.
(c) Poor quality of the collecting cups and buckets etc.

Out of these factors, though there are transport difficulties and poor road conditions we have never experienced delays of dispatch of latex to the collecting centres. The problem of hoarding of latex for 7 - 10 days some

times when the price is rising is not heard of in Sri Lanka. Condition of collecting cups used in Sri Lanka is not so bad. So far we have not had high VFA complaints to our latex as a result of contamination from dirty utensils or cups. Any way a project is already under way to replace our traditional cocount shells used for latex collection with clean resin coated coconut shells or plastic cups. There again the main aim is to minimise scrap content than improving the quality of latex. Magnesium levels of Thai latex has been reported to be going up to 800 ppm. Mg level in our latex has not recorded such high levels. During the whole of last year 1988, the highest Mg content recorded for our concentrated latex is 27 . 5 ppm which is half the Mg level allowed by the ISO for exportable latex. Tests have been carried out in the above determination using normal titremetric methods. Atomic absorption spectrometry is the most accurate method so far developed to assess Mg level in the latex. If quality of concentrated latex is in question the efficiency of preservation and the process of concentration has to be questioned rather than to the clonal characteristics, soil or husbandry practices in the field.

Our records on the testing for VFA reveal that the highest value recorded for VFA since 1977 until to date is below 0.02% with a single exception of a value of 0.045% recorded for a sample close to the wintering period. Hence I thought of starting my topic giving you the assurance that Sri Lanka latex is as good as the latex produced in Malaysia and we have so far not received a single complaint for the small quantities exported, or from the latex based gloves industries in Sri Lanka while some of them have come close to getting FDA approval from the USA for their produce out of latex collected from the small holders. In case you have any problem or querries about our latex please do not hesitate to contact us for clarification. We are the official body in Sri Lanka to do so and we have a fully equipped laboratory to carry out all the tests.

Preservation of NR latex

The stability of latex can be improved by the addition of chemicals referred to as stabilisers. These stabilisers are divided into two groups,

(a) Ionic stabilisers.

(b) Non ionic stabilisers.

Depending on the stabiliser system added and on the method used for concentration of field latex from about 30% to about 60% dry rubber content several types of concentrated latex are available in the market.

Concentration of latex is carried out to,

(a) Economise transportation.
(b) For better uniformity in quality.
(c) Preference of high % of DRC by the consuming industry.

In preservation of latex it is carried out by adding the right preservative to the latex at the right time to preserve maintain and improve quality.

An ideal preservative should have the following basic functions.

(a) It should preserve latex well and keep the VFA value at a low level for a long time.

(b) It should increase both the mechanical and chemical stability of latex.

Those preservatives should act in the following way.

(1) It should inhibit bacterial growth.
(2) It should de-activate traces of heavy metals like Mg by precipitation as insoluble salts.
(3) It should de-activate carbohydrates which act as enzymatic substrates forming fatty acid anions.
(4) It should increase the pH of latex and hence it should be an alkali.

Ammonia as a preservative

Ammonia has been used as a standard preservative for latex since 1853. Preservative systems used even today have some proportion of ammonia in it.

Ammonia keeps VFA number of latex low while increasing the stability on storage. It complexes with metal ions like Zn & Mg and inhibits bacterial growth. Ammonia is not a harmful chemical and it has no effect on rubber molecules. It has the added advantage of easy de-ammonia tion without adding chemicals.

However, it has the disadvantages of strong odour, Causing environmental pollution and also the slight tendency to discolour the rubber produced.

It can also interfere with latex processes such as reaction with ZnO in compounding and with sodium silicafluoride. Addition of ammonia in small quantities to increase the pH from 6.5–8 will favour multiplication of bacteria. Hence for long preservation, ammonia should be added at 1% for field latex and at 0.65% for concentrated latex.

Low ammonia preservative systems

In order to over come the dis-advantage of ammonia, other chemicals have been successfully used in conjunction with ammonia. These other chemicals are called secondary preservatives and such systems are called "low ammonia preservative systems". Though sodium pentachloro phenate, ZDC and boric acid are used as secondary preservatives, the latest and most widely used low ammonia system is tetramethyl thiuram disulphide (TMTD) and ZnO. Latex with low ammonia content (0. 2%) preserved with TMTD & Zno is referred to as LATZ latex.

In this system a combination of 0.25% ammonia, 0. 01% TMTD and 0.013/. ZnO are used to preserve latex. Excellent preservation obtained in this system is used in small holders collection of latex. Both these chemicals TMTD & ZnO have a very low toxicity level compared to the other secondary preservatives mentioned above while they are rubber compounding ingredients as well.

It has also been found that, ammonia promote the hydrolysis of proteins and phospholipids resulting in glycerol, fatty acid anions, phosphate anions and organic bases. Long chain fatty acid anions increase MST of latex while low molecular weight volatile fatty acids decrease stability.

Hence the relative extent of formation of volatile and non volatile fatty acid finally decide the stability of latex. It has been found that ammonia with TMTD & ZnO enhance, stability of latex. To ensure further stability an anionic soap like potassium laurate is also added at small dosages. At this stage I am glad to announce that the research carried out at the RRISL has shown that a local vegetable oil based soap, instead of the lauric acid soap, improves the MST of latex more than the lauric acid which is an imported product.

Preservative addition

Preservative addition into latex should be carried out at the earliest possible time because putrefaction of latex starts occuring from the time the latex leave the latex vessels of the tree. Once putrefaction sets in preservatives added can neither reverse the process, nor counteract the bad effects of putrefaction.

Hence the best possible point of preservative addition is in the tappers collection bucket. In other countries there is a resistance to addition of preservative in buckets as the tapper feels that this would reduce the DRC. But in Sri Lanka it is not so and hence the VFA levels recorded for Sri Lankan latex is always below 0.02%.

Preservation and storage of concentrate

Concentrated latex coming out of the centrifuging machine is to be preserved immediately. The normal practice is to add 5% ammonium laurate solution to the concentrate by drip feeding. For high ammonia (HA) systems a level of 0.02% to 0. 04% is enough while low ammonia (LA) system needs about 0.05%.

Ammonia level is to be adjusted suitably depending on HA on LA system of preservation. For high ammonia, the NH 3 level should be between 0.7% to 0.73% while for LA system should have 0.22% to 0.26% of ammonia by weight.

Preservative addition should be carried out in the storage tank or in the intermediate tank. The correct practice would be to add the preservative at a higher dosage initially and slowly bring down to the required level as the tank get filled up. The final DRC of the latex should be 60% affer the addition of all preservatives.

Creaming of latex

Creaming is a slow process of making concentrated latex. Creaming is done by means of chemicals such as ammonium or sodium alginate, methyl cellulose and even tammarind seed powder which is obtainable locally. Ammonium alginate obtained form sea weeds is preferred over the other creaming agents. Only problem with the creamed latex is that slight discolouration and a slight foul smell of the final product formed due to putrefaction of latex during the 10 to 12 days creaming cycle.

Concentration by evaporation

Evaporation is another method by which the latex is concentrated. This is done by surface evaporation under reduced pressure of latex stabilised with alkali and soap. The latex concentrated by this method differ from that prepared by centrifuging and creaming processes in that it contains all the serum solids originally present in the latex. This technique is obsolete, as it is technically and economically not feasible.

Removal of Mg ions from field latex

Mg ions naturally present in latex enhance bacterial growth. Hence in order to remove them diammonium hydrogen phosphate is added to ammonia stabilised latex and then left overnight. The Mg ions sediment at the bottom as a sludge, which is removed before feeding Mg free latex into the concentration plant. Based on the above preservative system, the following concentrated latex grades are produced in this country, nearly 95% of which is low ammonia centrifuged latex (LATZ).

		HA latex centrifuged	LA latex centrifuged	HA latex creamed	LA latex creamed
(1)	Total solid content % by mass	61.5	61.5	66.0	64.0
(2)	Dry rubber content (% DRC by mass)	60.0	60.0	64.0	64.0
(3)	Non rubber solids % by mass	2.0	2.0	2.0	2.0
(4)	Alkalinity as ammonia % by mass	0.6 (min)	0.29 (max)	0.55 (min)	0.35 (max)
(5)	Mechanical stability (MST-sec)	650	650	650	650
(6)	Coagulum content % by mass on solids	0.05	0.05	0.05	0.05
(7)	Copper & Manganese content Mg/kg of total solids (max)	8	8	8	8
(8)	Sludge content	0.10	0.10	0.10	0.10
(9)	Volatile fatty acid no (max)	0.2	0.2	0.2	0.2
(10)	KoH number	1.0	1.0	1.0	1.0
(11)	Colour on visual inspection	No	Pronounced blue or grey.		
(12)	Odour after neutralisation	No	Pronounced odour or Putrefaction.		

Classification of latex

In latex classification what is most important is the total solid content and dry rubber content determination. Dry rubber content determination

indicates percentage of rubber in the latex by mass. In total solids, the total percentage of rubber and other solid serum substances are indicated. I am pleased to inform the audience that RRI, has been able to develop a test method to determine DRC & TS of latex in 10 min to 45 min respectively using a microwave oven. This test method will soon be adopetd in the ISO standards too.

VFA number

VFA number indicate the extent of preservation of latex right from the field till it is consumed in the factory. VFA number is an estimation of the anions of acetic, formic and propionic acids formed by the action of micro organisms, upon certain carbohydrates in the latex, because NR latex serum is an ideal medium for the growth of bacteria having a pH of close to 7 under tropical conditions. Hence if the preservation is done as early as possible, putrefaction occur there by increasing VFA unmber. For good export quality latex VFA number should not exceed 0.1 even though the standard is 0. 2.

Mechanical stability

Mechanical stability is the capacity of latex to with stand mechanical agitation or strain in handling, transportation, pumping and processing.

Mechanical stability is measured as the time in seconds required to produce obvious signs of clotting when the latex is stirred at high speed. MST of good latex should be above 650 secs.

Then the alkalinity and ammonia concentration is carried out to check whether sufficient stabilizer has been added for storage of the latex, while coagulum content determines the amount of clot found due to mechanical action and contamination of latex.

However, Sri lanka has a good reputation in the world market for producing quality raw rubber. She has the reputation for producing the worlds best latex sole crepe rubber which are labour intensive and very high skill is needed to produce them. In Sri Lanka nearly 80% of the plantation is still covered with PB 86 clone which is giving very pure white high molecular weight latex with least tendency to enzymatic discolouration. Other parameters of our latex are comparable to the quality of latex produced in Malaysia or in Indonesia.