Quality Assessment of Rubber Latex from Different Plane Areas in Nilambur Taluk of Kerala State

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***Abstract*— Total Solid Content (TSC), Dry Rubber Content (DRC), Non Rubber Content (NRC), Magnesium Content (MC), Total Alkalinity (TA) and Volatile Fatty acid Number (VFN) of ten rubber samples collected from different plane areas of Nilambur Taluk, Malappuram district of Kerala State have been studied. The results revealed that the samples S_3 (Kappil), S_9 (Vengaparatha) and S_8 (Chemmaram) are latexes with high quality while S7 (Pulikkalodi) is the latex with low quality.**

***Keywords*— Rubber Latex; Total Solid Content; Dry Rubber Content; Non Rubber Content; Volatile Fatty acid Number.**

I. INTRODUCTION

Hevea brasiliensis is a species of rubber wood that is native to the rain forests in the regions of South America including Brazil, Venezuela, Ecuador, Colombia, Peru and Bolivia. These trees are the most important commercial source of natural rubber and are generally found in low altitudes of moist forests, wet lands, riparian zones and forest gaps. Today, commercially produced rubber can also be found throughout Southeast Asia and Western Africa. Natural rubber is a polymer of isoprene with high molecular weight [1]. The properties of rubber can be dramatically altered by cross linking the polymer chain with sulphur by the process of vulcanization [2]. Over 20 million tonnes of rubber are produced each year. The main source of natural rubber is from the Asian countries like Thailand, Indonesia and Malaysia. Vulcanized rubber is used to make rubber hoses, shoe soles, tires, bowling balls, *etc*.

Natural rubber is an important cash crop in our country. It occupies a key position among the plantation crops in India. India is the sixth largest rubber growing country in the world and ranks fourth in natural rubber production. The plantation industry has achieved tremendous strides in the field of its expansion and productivity during the past four decades. Because of its elasticity, resistance and toughness, natural rubber is the basic constituent of many products used in the transportation, industrial, consumer, hygiene and medical sectors. The quality of rubber depends on the quality of latex from which the rubber is manufactured [3].

II. EXPERIMENTAL

Ten rubber latex samples were collected from different regions of Nilambur Taluk, Malappuram District of Kerala State as follows; Naduvath (S_1), Pullangode (S_2), Kappil (S_3), Kodassery (S_4), Pandikkad (S_5), Kanhirala (S_6), Pulikkalodi (S_7), Chemmaram (S_8), Vengaparatha (S_9) and Thelppara (S_{10}).

A. Determination of Total Solid Content (TSC)

2g of the sample is weighed and transferred in to a 100 mL beaker. Swirl the beaker gently to ensure that the latex covers the bottom of the beaker. The test portion is dried in an air oven at a temperature of 70^0C-100^0C. The contents are cooled in a desiccator and weighed as quickly as possible. The drying operation is repeated until the loss in weight is less than 1 mg during a period of 15 minutes, for temperature between 70^0C and 85^0C or during a period of 15 minutes for temperature between 85^0C to 100^0C. TSC in percent by weight can be calculated using the equation $(W_1/W_2) \times 100$ where W_1 is the weight in grams of dried film and W_2 is the weight in grams of the sample taken for the test [4].

B. Determination of Dry Rubber Content (DRC)

10g of the well mixed sample is weighed and transferred into a 250 mL beaker. Water is added until the solid content of latex is about 20%. Added up to 8 mL of acetic acid per gram of sample, gently stirred over a period of 5 minutes and kept the solution undisturbed for about 15minutes at a temperature below boiling. If the serum remains milky, added about 0.5 mL of rectified spirit per gram of the sample and gently stirred. When the serum is clear, reduce its thickness to less than 2 mm either by a hand roller or a

mechanical roller. The coagulum is dried at a temperature of approximately $70^0C \pm 20^0C$, cooled in a desiccator and weighed. Repeat drying operation until the loss in weight is less than 1mg. Duplicate determination is carried out for each sample. DRC in percent by weight can be calculated using the equation $(W_1/W_2) \times 100$ where W_1 is the weight in grams of dried coagulum and W_2 is the weight in grams of the sample taken for the test [4].

C. Determination of Non Rubber Content (NRC)

Non Rubber Content is the difference between DRC and TSC.

D. Determination of Magnesium Content (MC)

5-10g of the well mixed latex sample is accurately weighed into a dry weighing bottle (W_1g). Transfer 4-5g of the sample in to 100 mL standard flask and reweighed the bottle (W_2g); and made up to 100 mL. Take around 300 mL water in a 500 mL beaker; add 10 mL buffer solution and a pinch of Eriochrome black T indicator. Pipette out 20 mL of the diluted latex in to the beaker, mixed well and immediately titrated against standard EDTA solution taken in the burette. End point is the change in colour from wine red to light blue. Weight of Mg in the latex (mg/litre) can be calculated using the equation $(24.32 \times M \times V)/[(W_2\text{-}W_1) \times 10]$ where M is molarity of EDTA solution, V is the volume of EDTA solution used in mL and $(W_2\text{-}W_1)$ is the eight of latex taken [5].

E. Determination of Total Alkalinity (TA)

5-10g of the well mixed sample is weighed into a 500 mL beaker. 150 mL of water is added to it followed by 10 mL of anionic emulsion stabilizer having a pH value of 5.2 to 6.8. The solution is stirred well with a glass rod to distribute the stabilizer. The solution is titrated against standard HCl. If methyl orange is used as the indicator, the colour change will occur at a pH value of approximately 6.8. The alkalinity in milli-equivalent per 100g of water in the latex can be calculated using the equation $\{100 \div (100\text{-}TSC)\} \times (100NV \div W)$ where TSC is the total solid present in the latex solution, N is the normality of the acid, V is the volume of the acid used in mL and W is the weight of test portion in grams. If the alkali is only NH_3, the alkalinity is expressed as grams of NH_3 per 100g of water in the latex [5].

F. Determination of Volatile Fatty Acid Number (VFN)

Weigh about 50g of rubber latex in to a beaker. Add 50 mL of ammonium sulphate solution (30% w/w aqueous solution), and stirred well. Either place the beaker on a steam bath or immerse the beaker in a 70°C water bath, and continued stirring until the latex coagulates. Cover the beaker with a watch glass and leave it in the bath for a total period of 15 minutes. Decant the serum which exudes through a dry filter. The coagulum is transferred in to a mortar and press out more serum by kneading it with a pestle. Filter this serum through the same filter.

Pipette 10 mL of the filtered serum in to a dry 50 mL conical flask and acidified by adding 5 mL of dilute sulphuric acid (50% w/w aqueous solution). The contents are mixed well by swirling and a current of air is passed over the liquid into the flask. Steam is passed through the apparatus for at least 15 minutes. With steam passing through the outer jacket of the apparatus, introduce in to the inner tube 10 mL of acidified serum by using a pipette. If foaming is a difficulty, one drop of suitable anti foaming agent may be added. Place a 100 mL graduated cylinder under the tip of the condenser to receive the distillate. Partially close the steam outlet to divert steam in to the inner tube. Pass steam gently at first, then fully close the steam outlet and continue distilling at a rate of 3 to 5 mL/minute until 100 mL of the distillate has been collected. Transfer the distillate to a 250 mL conical flask and aerate the distillate by passing through it a stream of air free from carbon dioxide at a rate of 200 to 300 mL/minute for approximately 3 minutes. Titrate with 0.01N barium hydroxide solution (standardised with potassium hydrogen phthalate) using one of the indicators specified (the indicator bromothymol blue or phenolphthalein may be used; bromothymol blue shall be used as 0.5% solution of the indicator in water and phenolphthalein shall be used as 0.5% solution in a mixture of equal volumes of ethanol and water). Run a blank test by substituting 20 mL of water for 50g of the concentrated latex. The volatile fatty acid (VFA) number can be calculated using the equation $[(202 - DRC) \times 0.55 \times N \times V]/TSC$ where N is the normality of barium hydroxide solution, V is the

final volume of barium hydroxide solution required to neutralize the distillate in millilitres, DRC is the percentage dry rubber in the latex and TSC is the percentage total solids in the latex.

III. RESULTS AND DISCUSSION

For assessing the quality of the regional latex samples, different points (1 to 10) are distributed. The higher points are assigned to samples with high DRC and TSC while lower values for samples with high VFA, NRC, Mg content and NH_3 content (TABLE 1).

TABLE I
TOTAL SOLID CONTENT, DRY RUBBER CONTENT, NON RUBBER CONTENT, MAGNESIUM CONTENT, ALKALI CONTENT AND VOLATILE FATTY ACID NUMBER OF DIFFERENT RUBBER SAMPLES

Sl. No.	Sample	TSC		DRC		NRC		Magnesium Content		Alkali Content		VFA		Total Points
		TSC	Point	DRC	Point	NRC	Point	Mg Content	Point	NH_3 Content	Point	VFA	Point	
1	S_1	30.03	2	26.54	2	3.49	3	0.013	7	0.59	2	0.109	8	24
2	S_2	27.6	1	23.7	1	3.9	1	0.012	8	0.38	9	0.156	4	24
3	S_3	43.75	10	40.46	10	2.29	9	0.015	6	0.70	1	0.09	10	46
4	S_4	42.46	9	39.01	9	3.45	5	0.043	1	0.37	10	0.21	2	36
5	S_5	32.34	5	29.9	5	2.44	8	0.0156	5	0.46	6	0.13	7	36
6	S_6	31.6	4	27.93	3	3.67	2	0.007	10	0.57	3	0.14	6	28
7	S_7	30.91	3	29.24	4	1.67	10	0.019	3	0.47	5	0.25	1	26
8	S_8	40.9	8	37.54	8	3.36	6	0.0086	9	0.44	7	0.2	3	44
9	S_9	38.75	7	35.9	7	2.85	7	0.017	4	0.43	8	0.103	9	42
10	S_{10}	33.73	6	34.53	6	3.47	4	0.02	2	0.482	4	0.150	5	27

The sample S_3 has maximum points and hence it is the latex with high quality. The samples S_1 and S_2 have minimum points and therefore they are the latexes having lower quality. The above tested samples can be graded as $S_3>S_8>S_9>S_4=S_5>S_6>S_{10}>S_7>S_1=S_2$. DRC, VFA and Mg contents are the main parameters which determine the quality of latex. On the basis of these three parameters alone, tested samples can be graded as $S_3>S_8=S_9>S_6>S_1=S_5>S_2=S_{10}>S_4>S_7$. The sample S_3 is the latex with higher quality and S_7 is the latex with lower quality.

IV. CONCLUSIONS

The results revealed that among the 10 samples studied for various parameters, S_3 (Kappil), S_9 (Vengaparatha) and S_8 (Chemmaram) are latexes with high quality. The DRC and TSC of S_3 (Kappil) are very high. Vengaparath, Kappil and Chemmaram are the places in Nilambur Taluk with high rain fall and the chemical properties of the soil of these regions are very suitable for rubber growth. The VFA of the above sample is very low which also favours their quality. So it can be inferred that there is a marked dependence of latex quality with region. Rubber growth, yield and the quality of latex depend on chemical nature of soil. The climatic factors like rain fall, temperature, humidity *etc* have much influence on the latex quality. The yield of latex also depends on the time of tapping. The early morning tapping favours high yield of the latex. Thus the regional and climatic conditions in the studied places influence the yield and quality of rubber latex.

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