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STUDIES ON USE OF RUBBER SEED OIL IN NATURAL RUBBER LATEX FOAM PRODUCTION

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Abstract: Natural rubber latex foam was prepared by using rubber seed oil soap as well as potassium oleate. Evaluation of properties indicated that the quality of the foam obtained by using rubber seed oil soap was comparable to that prepared from potassium oleate and conforms to the BIS specifications. Use of rubber seed oil soap was found to be more economical

1. Introduction

India is the fourth largest producer of Natural Rubber (...C) in the world with an annual production of 506,910 M.T. We produce about 4000 M.T. of rubber seed oil per annum using the seeds collected from the plantations. At present rubber seed oil is used mainly to produce low quality soap. About 11.5% of the total rubber produced is consumed by the latex industry. Latex foam is one of the important latex products. Potassium oleate is commonly used as the foaming agent [1]. Castor oil soap is also used as a foaming agent for latex foam [2,3]. Rubber seed oil and castor oil contain saturated and unsaturated higher fatty acids such as stearic acid, recinoleic acid, oleic acid, linoleic acid etc. Hence in this study we have attempted to use the soap prepared from rubber seed oil as a substitute for potassium oleate/castor oil soap for latex foam production.

2. Materials and Methods

Concentrated NR latex conforming to BIS: 5430-1981 and obtained from the pilot latex concentration plant of the RRII was used. Rubber seed oil having free fatty acid (...29%). Saponification value (193.93) and Iodine value (155.56) was obtained from Virudunagar, which was prepared by the expellsion process of the dried kernel.

All other chemicals used for this study were of commercial grade. A 10% solution of soap from rubber seed oil was prepared by mixing molecular proportions of rubber seed oil and potassium hydroxide at 70°C. Latex foams were prepared as per the formulation given in Table 1.

Latex foam was prepared by Dunlop Batchwise foaming Process (1). The level of expansion given was the same (1:7) in all the cases. The properties of the vulcanized latex foam were determined as per BIS: 1741-1960. The results are presented in Table 2.

3. Results and Discussion

Hardness of Foam

Hardness of latex foam as measured by the weight in kilograms required to reduce the thickness of the sample by 40% is a measure of its load bearing capacity. When potassium oleate is completely replaced with soap prepared from rubber seed oil, almost same hardness was obtained for the foam. In Industry, eithr oleic acid soap or a mixture of soaps of oleic acid and castor oil is used. Hence in this study combinations of mixtures of soaps from oleic acid, rubber seed oil and caster oil were also evaluated. The results indicated that use of a 50:50 mixture of oleic acid and rubber seed oil soaps yielded foam having higher hardness. Mixtures of soaps of castor oil and rubber seed oil or that of oleic acid and castor oil produced foams of much lower hardness compared with soaps of oleic acid, rubber seed oil or an equivalent mixture of these two. The reduction in hardness of the foam containing mixtures of soaps CORO and POCO is due to the difference in the structure of the foams obtained. Visual examination of the different samples of foam indicated that the foams

Table 1. Formulations used for foam production
(Dry weight in phr)

Ingredients		compound no. POE	RSO	POCO	PORO	CORO
NR Latex	(60%)	100	100	100	100	100
Potassium Oleate	(20%)	0.2	-	0.2	0.2	-
Castor Oil Soap	(30%)	-	-	-	-	0.2
Rubber Seed Oil Soap	(10%)	-	0.2	-	-	-
Sulpher Dispersion	(50%)	2.0	2.0	2.0	2.0	2.0
ZDC Dispersion	(50%)	1.0	1.0	1.0	1.0	1.0
ZMBT Dispersion	(50%)	1.0	1.0	1.0	1.0	1.0
SP Emulsion	(50%)	1.0	1.0	1.0	1.0	1.0
Maturation 16 hrs						
Potassium Oleate	(20%)	*1.0*	-	*0.4*	*0.4*	-
Castor Oil Soap	(30%)	-	-	06	-	04
Rubber Seed Oil Soap	(10%)	-	1.0	-	0.6	0.6
Cetyl Trimethyl Ammonium Bromide Solution	(30%)	1.0	1.0	1.0	1.0	1.0
Zinc Oxide Dispersion	(50%)	5.0	5.0	5.0	5.0	5.0
Sodium Silico Fluoride Solution	(20%)	2.0	2.0	2.0	2.0	2.0

Table 2. Physical testing of latex as per BIS 1741-1960

Compound No.	Initial hardness (Kg)	Compression set (%)	Flexing: Increase in hardness (%)	Flexing: Reduction in thickness (%)	Whole sample Compression: Change in thickness (%)	Ageing: Increase in hardness (%)	Mould Shrinkage (After 15 days): Reduction in diameter (%)
POE	38.0	6.0	5.0	3.75	4.65	9.5	10.95
RSO	37.5	5.0	15.0	3.80	4.81	14.3	11.36
POCO	31.5	5.6	4.5	2.53	3.48	8.0	8.22
PORO	39.5	5.0	1.0	2.40	1.19	11.1	10.95
CORO	33.0	4.0	3.2	2.38	4.05	6.6	8.66
Maximum values as per BIS 1741-1960	(%)	20.0	20.0	5.0	5.0	20.0	NA

obtained from compounds POE, RSO and PORO have more uniform distribution of the cells and cell size. Uniform distribution of the cells helps to have better load distribution and hence these samples have higher hardness. In the case of foam from compounds CORO and POCO the cell size as well as its distribution are non-uniform

Compression Set and Whole Sample Compression

Compression set is a measure of the capability of the product to retain its original dimensions after the application of a load under compression for a specified time. Lower the set, better the product. Latex foam made by using rubber seed oil soap showed lower set value compared with those made by using oleate soap. In the case of foams prepared by using mixtures of soaps also the same trend was noticed (Compound CORO better than Compound POCO). The change in thickness under the whole sample compression was almost the same for compounds POE and RSO. The change in thickness was least for compound PORO.

Flexing Test

In flexing test, the sample is subjected to cyclic loading for 250 kilocycles at 240 cycles per minute. Minimum change in hardness and thickness is an indication of better resistance to flexing. The reduction in thickness was almost the same for the foam samples prepared by using potassium oleate and rubber seed oil soap. The sample prepared by using rubber seed oil soap showed higher change in hardness but it is less than the maximum allowed value (20%) as per the BIS specification.

Ageing Resistance

Change in hardness after ageing at 70° C for 168 hours gives an indication about the long term performance of the product. In this case also, samples prepared by using rubber seed oil soap showed more increase in hardness compared with that made by using potassium oleate. However, the change in hardness was well within the allowed limit.

Mould Shrinkage

Knowledge on mould shrinkage of the products helps to give proper allowance in the size of the mould so that product of exact dimensions can be prepared. The mould shrinkage of the foam prepared by using potassium oleate and rubber seed oil soap was about 11% and there was not much difference between the two samples in this respect.

4. Conclusion

Natural rubber latex foam could be prepared by using rubber seed oil soap. The quality of foam was comparable to that prepared by using commercially available oleic acid soap. The properties of the foam prepared by using both the type of soaps were conforming to those specified by the Bureau of Indian Standard. As price of rubber seed oil is less by Rs. 38 per kilogram compared with that of oleic acid, use of rubber seed oil for natural rubber latex foam will be economically advantageous

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