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PROCESS FOR THE PRODUCTION OF LATEX WITH LOW PROTEIN CONTENT

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My invention relates to an improved process for the production of latex with a low protein content.

It is well known that the protein present in latex occurs therein partly in the serum and partly adsorbed on the rubber particles.

The part present in the serum is easily to be removed by repeatedly centrifuging or creaming the latex.

The other part, however, which is adsorbed by the rubber particles is so firmly united therewith that these proteins are carried along with the rubber with each centrifuging or creaming operation.

For this reason it is not possible either by repeated centrifugation or by repeated creaming to free the rubber from proteins below a certain content (see e.g. R.J.Noble I.R.I. Rubber Techn. Conf. May 1938, paper nr. 25).

The present invention makes the removal of the proteins on the rubber particles and the conveyance of this protein into the serum possible, so that the proteins may be removed from the latex by simple purification treatments e.g. by centrifugation or creaming operations. The characteristic feature of the invention is that for the removal of the proteins the principle of the adsorption displacement (exchange by adsorption) is used.

The latex which is preferably diluted before the treatment is contacted for the said purpose with a substance which is adsorbed by the rubber in a greater measure than the serum proteins. After a contact time of some hours, e.g. one night or more, the exchange equilibrium is established. A large part of the originally adsorbed proteins has then left the adsorption layer and is conveyed into the serum. Its place in the adsorption layer has now been taken by the capillary active substance mentioned above.

The dilution shows the following advantages:

1. The protein concentration is lowered and thereby the protein adsorption is weakened.

2. Better purification is possible, because of the greater difference of the rubber contents before and after the centrifugation.

As the protein displacing substance any substance can be used which is stronger adsorbed by rubber than the latex proteins.

Examples of suitable substances are soaps, such as sodium-, potassium- or ammonia salts of the higher fatty acids or naphtenic acids, sulfonated compounds, e.g. Igepon, sulfonated Lorol, Turkish Red oil etc. saponine and related substances, colloidal suspension of lipoids, fosfatids etc., and generally all those substances which can be used as wetting agents, detergents, emulgators, stabilizers etc.

In connection with the centrifugation or creaming it be mentioned that in order to obtain as intensive a purification as possible latex must be used as far diluted as possible and an attempt should be made to obtain an as concentrated cream as possible. Therefore centrifugation is in this respect better than creaming.

The addition of soaps to latex before centrifugation has long been known. The object thereof was, however, exclusively an improvement of the mechanical stability of the latex (Noble "Latex in Industry", page 130). In creaming processes soaps have also sometimes been used, as it has appeared that by the viscosity decreasing action of soap the creaming is improved (Archief voor de Rubbercultuur 23,1939,Page 14"Viscositeit en Oproomingscapaciteit van Latex", British Specification 413,185 Netherlands Patent Nr.39, 122).

In the process according to the invention the function of the soap is, however, quite different i.e. the function is that of adsorption displacer.

The fact that the process is quite different clearly appears from the fact that the displacement of the proteins from the adsorption layer requires some time. If the centrifugation is effected directly or shortly after the addition of the soap the adsorbed proteins are not removed. This only occurs when after the soap addition the latex is kept into contact with the soap for some time e.g. at least one night (vide Example 3).

By the incorporation of soap the fatty acid or naphtenic acid content of the latex and the rubber prepared therefrom is increased. In the application of the centrifugation process for separating the rubber from the serum a large part of the fatty acid or the like is removed with the serum; the final product, however, still contains an increased fatty acid content. In rubber obtained by coagulation with acid a large part of the soaps used for displacing the proteins by adsorption is converted into the free acid.

It has now appeared that the amount of fatty acid or the like, especially of the free acids, can be decreased if the rubber sheets produced from the latex with low protein content are treated with a solution of an alkaline compound. Very suitable for this purpose are ammonia and also diluted alkali solutions.

When the coagulation has taken place by other means than the addition of acid and the fatty

or naphtenic acids or sulfonated compounds are still present in the rubber in soluble condition, the can also be removed therefrom with the aid of water or other solvents for the salts.

Preferably the still wet, preferably thin sheets are extracted in the alkaline liquid e.g. in diluted 0,5%-ic ammonia. The extraction period depends on the thickness of the sheets, the amount of fatty acid to be removed, the concentration of the extraction means, the temperature, etc. After an extraction during approximately 10 hours a decrease of the fatty acid content of about 40% was obtained. In many cases it is desirable to add anti-oxydants in order to improve the aging properties of the purified rubber.

The invention is further elucidated by the following examples

Example 1

This example shows that when before the centrifugation the latex is treated with ammonium oleate, the crepe prepared from the centrifuge cream has a lower nitrogen eontent than when the ammonium oleate treatment has not taken place.

As a starting product a latex was used with a dry rubber content (DRC)=29,5% and a total solid content (T. S.) 32,6%. Nitrogen (N)—content of the crepe obtained in the usual manner after coagulation amounted to 0,52%.

A. A part of the latex was diluted with the 5-fold volume of water, to which 10 ml strong ammonia per l. was added.

B. Another part was diluted in the same manner with aqueous ammonia, in which, however, 0,5g ammonium oleate per 1 water was also added.

C. A third part was diluted in the same manner as B; here, however, the ammonium oleate concentration amounted to 1 g/l.

After having stood one night centrifugation took place.

	Per cent
A. Cream: DRC = 54,2%; TS = 54,4%;	
N-content crepe from cream	0,15
B. Cream: DRC = 50,4%; TS = 50,5%;	
N-content crepe from cream	0,12
C. Cream: DRC = 54,2%; TS = 54,4%;	
N-content crepe from cream	0,09

Before coagulation the cream was always diluted to a DRC of about 10%.

Example 2

Qulte analogous to example 1 with this difference that instead of ammonium oleate the soap has been used traded under the trade mark "Sunlight" in the concentration of 1 g per 1 diluted latex.

Starting latex: DRC=32,6% TS=35,5%.

Mixed: 800 cc of latex + 5,5 l water + 60 cc of ammonia.

Centrifuged this gives a cream with DRC = 49,8% and from this a crepe was prepared with a N-content of 0,14%.

The same experiment, however, with addition of soap to the diluting water gave after having stood one night and centrifugation a cream with DRC = 52,2% and from this cream a crepe could be prepared with a N-content of 0,09%.

Example 3

Herein it is shown that it is essential to contact the latex for some time with soap because the adsorption displacement is a process, demanding time.

Starting latex DRC = 27,5%; TS = 28,9%.

Crepe prepared herefrom N = 0,52%; Aceton extract = 2,76%.

The following mixture was prepared:

latex	l	4
ammonia	ml	30
ammonium stearate	g	30
water	l	12

(As ammonium stearate dissolves poorly, this substance had to be mixed beforehand with a little hot water).

A. Directly after the mixing a part was separated and centrifuged. A cream was obtained with a DRC of 55,8% from which a cream could be prepared with N-content of 0,13%; i. e. consequently not particularly low.

B. The remainder of the mixture was kept till the following day and then centrifuged. The cream had a DRC of 56,1% and herefrom a crepe was prepared with a N-content of 0,10%.

Example 4

1 l of latex was mixed with 4 l of water to which 10g Igepon had been added. After 24 hours the diluted latex was centrifuged in a Laval-separator, and the cream so obtained was diluted and then coagulated. The coagulum was worked up to crepe and the nitrogen content was determined and appeared to be 0,09%.

Example 5

1 l of latex was mixed with 4 l of water to which 10g Turkish red oil had been added. After 24 hours the diluted latex was centrifuged in a Laval-separator and the cream so obtained was diluted and then coagulated. The coagulum was worked up to crepe and the nitrogen content was determined and appeared to be 0,11%.

Example 6

1 l of latex was mixed with 4 l. of water to which 10g Lecithine had been added. After 24 hours the diluted latex was centrifuged in a Laval-separator and the cream so obtained was diluted and then coagulated. The coagulum was worked up to crepe and the nitrogen content was determined and appeared to be 0,10%.

Example 7

In this example it is shown that by starting from a cream purified already by a single centrifugation (without soap treatment) diluting this cream, treating with soap and centrifuging again, from the second cream a crepe can be prepared with very low nitrogen content.

A. A cream obtained by centrifuging of ammoniated latex was diluted to a DRC = 5%, treated with "Sunllght"-soap in a concentration of 2g per 1 l mixture. After having stood and being centrifuged a cream was obtained with a DRC of 29,9% and herefrom a crepe with a N-content of 0,03%.

B. Remainders of centrifuge cream were collected, diluted to a DRC of about 7%, treated with ammonium stearate in a concentration of 1 g/l diluted latex. After centrifuging again a cream was obtained with a DRC of 64% and herefrom a crepe could be prepared with a N-content of 0,05% and an ash content of 0,06%.

Example 8

Latex obtained according to any one of the preceding examples is coagulated and sheets of a thickness of 0.2 inch obtained from the protein-poor latex, in a still wet condition extracted in an aqueous alkaline solution, e. g. in 0,5% ammonia. After an extraction of several hours, 12 hours being a suitable time, the sheets are removed from the liquid and washed with pure water to remove traces of ammonia from the rubber.

The rubber obtained according to these examples has a very low protein content of below 0,12% N and preferably lower till below 0.03% N or even lower. As is well-known by the experts, a decrease of the protein content with relatively small amounts, such as e. g. 0,01% of N means an important improvement of the rubber, particularly for special purposes.

Rubber products according to the invention are particularly suitable for the production of coatings for electric cables, the water adsorbing capacity thereof being very low.

Of some crepes prepared according to previously mentioned examples, the water adsorbing capacity was determined according to a method composed on the Proefstation West-Java at Buitenzorg. For comparison here also some data are given for a standard crepe and for a protein-poor crepe prepared from latex prepared with sodium-lye.

Sample	Ash	Nitrogen	Water adsorption (mg/100 cm²) at 80° C			
			Raw rubber		Vulcanised rubber	
			7 hours	24 hours	7 hours	24 hours
	Per cent	*Per cent*				
Standard crepe	0.19	0.45	243	537	147	320
Crepe of example 3B	0.07	0.10	63	137	62	120
Crepe of example 4B	0.06	0.05	-------	-------	40	81
Crepe of latex treated with lye	0.11	0.09	60	121	58	112

By the term latex not only the common rubber is comprised but also gutta percha, balata and the like rubberlike substances.

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