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FROTHED LATEX SPONGE

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This invention relates to the manufacture of frothed latex sponge having improved physical properties.

Frothed latex sponge is made generally by compounding a rubber latex with various ingredients, such as sulfur, antioxidant, accelerator, and soaps, frothing the compounded latex, and then adding finishing ingredients including a dispersion of zinc oxide and a gellant, such as a dispersion of sodium or potassium silico-fluoride. After the froth has undergone gelation, it is vulcanized, washed, and dried. Washing the sponge with water after vulcanization increases the value of the sponge for use in mattresses and pillows because the washed sponge has an improved odor and is white in color instead of yellow or gray.

Desirable sponge is also characterized by its ability to remain in a fully expanded condition after it has been compressed many times under normal cushioning use. This property is measured in terms of permanent set retention. Another property of sponge is its ability to return quickly to its original fully expanded condition after it has been compressed. This property is a measure of its "snap." Again it is important that the sponge not become torn or ruptured through failure of the sponge structure because of poor tensile and elongation properties.

It now has been discovered that these various physical properties of the sponge are greatly improved when the vulcanized frothed latex sponge is washed with water containing an alkaline earth oxide, hydroxide, or salt.

Treatment comprises washing the sponge in water containing the alkaline earth oxide, hydroxide, or salt, separately, or in admixture with each other and hereinafter referred to as alkaline earth treating agent or treating agent, squeezing the excess treating agent out of the sponge and drying the sponge in the conventional manner. The treatment may also comprise impregnating the sponge with a dilute solution and/or slurry containing the alkaline earth treating agent, squeezing out the excess liquid, washing lightly with water, squeezing out the excess water, and then drying in the conventional manner.

In the continuous process of manufacturing frothed latex sponge, the vulcanized sponge is passed from the curing chamber through a series of squeeze rolls. Intermediate to these rolls are located spray nozzles positioned to direct a spray of water onto the surface of the sponge. The sponge absorbs the water and the water is then removed from the sponge as it passes through the squeeze rolls which press most of the water out of

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the sponge. The sponge has been washed after this cycle has been repeated a number of times. The treating agent of this invention may be added to the water used in one or more of the spray nozzles. The sponge may be treated with water containing the treating agent or the sponge may be treated with water containing the treating agent followed by treatment with water.

Another manner in which this invention may be applied in the sponge industry is to pass the vulcanized frothed latex sponge through water containing the alkaline earth treating agent in which the squeeze rolls are immersed. The sponge is then passed through suitable ringer rolls and/or given an additional water wash before the sponge is finally dried.

The alkaline earth treating agents of this invention are the alkaline earth oxides, the alkaline earth hydroxides and the alkaline earth salts. These treating agents include the oxides, hydroxides and salts of the alkaline earth metals barium, strontium, calcium, magnesium and beryllium. It has been observed that the oxides, hydroxides and salts of the alkali metals such as sodium and potassium may not be used in the same manner as the present alkaline earth treating agents and are not included in the present invention.

Specific alkaline earth treating agents which may be used in this invention are calcium hydroxide, barium hydroxide, calcium oxide, barium oxide, calcium chloride, barium chloride, strontium hydroxide, strontium oxide and strontium chloride. These alkaline earth treating agents are applied to the vulcanized sponge using water as the carrier for the agents. These treating agents may be added to the water in concentrations ranging from as low as .05% to as high as 25%. It has been observed that the actual amount of agent retained in the sponge after it has been squeezed and dried is less than .05% based on the weight of the sponge.

The physical properties of any frothed rubber latex sponge are improved when treated in accordance with the present invention. By the term "frothed rubber latex sponge" is meant sponge made from natural rubber latex and synthetic rubber latex, particularly synthetic rubber latex of the type resulting from the polymerization of a conjugated diene hydrocarbon, for example, butadiene-1,3, and particularly copolymers of conjugated diene hydrocarbons, particularly butadiene-1,3, with other copolymerizable monomers, and particularly styrene. A specific synthetic rubber latex that may be used is known as

GR-S which is a rubbery copolymer resulting from the polymerization of a mixture comprising 75 to 85% of butadiene-1,3 and 25 to 15% of styrene.

In order to more fully explain the present invention, the following examples illustrate specific improvements. These examples are intended to be illustrative only and not as limitations on the scope of the invention. The term "parts" wherever used signifies "parts by weight" unless otherwise identified.

Example 1 (control)

The compounded rubber latex used for making the frothed latex sponge in this and the following examples had the following composition based on dry weight:

	Parts
Natural rubber latex	100
Sulfur	2.25
Zenite	1.50
Ethyl zimate	.50
Sym.-di-beta-naphthyl-para-phenylene diamine	1.00
Potassium oleate	.60
Potassium ricinoleate	.90

The rubber latex was compounded by stirring into the latex the potassium oleate and potassium ricinoleate which were made up as 20% water solutions. The sulfur, Zenite, and ethyl zimate were added as 50% water dispersions. The sym-di-beta-naphthyl-para-phenylene diamine was added as a 50% water dispersion. The sulfur is the primary vulcanization ingredient. Zenite is a zinc salt of mercaptobenzothiazole coated with paraffin and is used as a vulcanization accelerator. The ethyl zimate is an ultra-accelerator of vulcanization. The sym-di-beta-naphthyl-para-phenylene diamine is an antioxidant which inhibits oxidation of the finished sponge.

a 2-roll ringer and dried for 2¼ hours at 220° F. dry air. The dried sponge was allowed to cool at room temperature (72° F.) for 24 hours.

Example 2

The sponge as made in Example 1 was washed in a 5% barium hydroxide slurry having a pH of 13.5 and was then washed in the regular way with water. The sponge was then dried in the same manner described in Example 1.

Example 3

The sponge as described in Example 1 was washed in a 5% calcium hydroxide slurry having a pH of 12.6 and was washed with water and dried in the same manner described for Example 1.

Example 4

The sponge as described in Example 1 was washed in a 5% calcium chloride solution having a pH of 11.75 followed by washing with water and drying in the same manner as described in Example 1.

Example 5

The sponge as described in Example 1 was washed in a saturated solution of calcium hydroxide (.185 part of calcium hydroxide per 100 parts of water). The sponge was dried in the same manner as described in Example 1.

Example 6

The sponge as described in Example 1 was washed in a 5% slurry of calcium oxide followed by washing with water and drying in the same manner described in Example 1.

The improvement in the physical properties of the samples of sponge made in accordance with Examples 2 through 6 as compared to the physical properties of the sponge made in accordance with Example 1 are set forth in the following table:

Table

	Original Elongation in Percent	Percent Improvement over Control	Percent Elongation Retention after aging 22 hrs. @ 212° F.	Percent Improvement over Control	Permanent Set Retention (Percent)	Original Tensile in lbs./inch ²	Percent Tensile Retention after aging 22 hrs. @ 212° F.	Percent Improvement over Control	Snap	Odor
Example 1 (Control)	320	-----	45.3	-----	90.0	25.4	58.2	-----	Fair	Fair.
Example 2 (Ba(OH) ₂)	370	15.6	64.8	43	95.2	25.6	79.2	36	Very good.	Very good.
Example 3 (Ca(OH) ₂)	380	18.7	65.8	44	93.2	26.1	84.0	44.5	do	Do.
Example 4 (CaCl ₂)	405	26.6	56.1	24	91.2	29.5	74.2	27.6	do	Do.
Example 5 (Ca(OH) ₂)	350	9.4	62.1	37	94.0	26.2	73.0	25.5	do	Do.
Example 6 (CaO)	365	14	60.3	33	91.8	26.3	65.0	11.7	do	Do.

The potassium oleate and potassium ricinoleate are frothing agents and froth stabilizers.

The fully compounded latex mix as described above was placed into a bowl and frothed by beating air into the latex with a wire whip until the desired froth density was obtained. The finishing ingredients were then added. Three parts of zinc oxide as a 50% water dispersion were stirred into the froth for one minute. 1.40 parts of sodium silicofluoride were then added as a 20% water dispersion and mixed into the froth for one minute. The froth was poured into an aluminum pan. The froth became gelled after 5 minutes and the gelled froth was vulcanized for 12 minutes at 15 pounds steam pressure. The sponge rubber slab was then thoroughly washed with water heated to 120° F., squeezed through

The density of the sponge is determined by obtaining the weight of a unit volume of the sponge and dividing the weight by the volume. For Examples 1 through 6, the density is expressed in pounds/inch³, and is .00417 pound/inch³ for each sample.

The property of permanent set retention is determined by placing a piece of sponge between two parallel plates, squeezing the sponge to 50% of its normal thickness, retaining the sponge in this compressed condition @ 158° F. for 22 hours, releasing the sponge, and allowing it to remain at room temperature for 30 minutes. The per cent permanent set retention is calculated as

$$100 \times \frac{\text{thickness of sponge after comp.}}{\text{thickness of sponge before comp.}}$$

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This test is described in Buyers Specification—"Latex Foam," issued by The Rubber Manufacturers Association under the heading—"Compression Set Under Constant Deflection." The higher the permanent set retention the more desirable is the sponge for commercial use.

The tensile and elongation are determined by die-cutting dumbbell-shaped samples of 2 inch break section from the sponge. The pull required to rupture the sample is calculated in pounds/square inch of original cross section. The elongation is determined in the same operation by measuring the distance the sponge is extended before rupturing. It is expressed in percent of original. For example, a sponge having 100% elongation means that a one inch piece of sponge may be stretched two inches before it breaks. The greater the tensile and elongation of the sponge, the greater is the value of the sponge. If a sponge is being used as a seat cushion, and if the tensile and elongation are not sufficiently high, tearing of the sponge may occur around the edges. This greatly decreases the life of the cushion. Also, tensile retention and elongation retention on aging are important properties of sponge. If this same sponge is being used as a seat cushion, and if after a certain period of time its tensile and elongation decrease sufficiently through normal aging, tearing of the sponge may occur and the useful life of the cushion is limited.

The accelerated aging used in the examples is that recommended by the Rubber Manufacturers Association, Inc., Buyers Specification—"Latex Foam" (as revised March 5, 1948). This consists of aging a suitable sample 22 hours at 212° F. in circulating dry air.

The "snap" of frothed latex sponge is determined by twisting a freshly cut corner of the sponge held tightly between the fingers through two complete turns, holding the sponge in this position for 20 seconds, and then allowing the sponge to snap back to its original position. The degree of speed with which the sponge returns to its original position is an indication of its snap.

The odor of the sponge is determined by cutting a section of the sponge immediately after it has been dried and having a minimum of five people compare it with the control.

The improvement in the physical properties of the sponge is very significant. The original ten-

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sile and the original elongation are improved. The snap and odor are better than the control and the physical properties on aging are improved over the control.

While certain representative embodiments and details have been shown for the purpose of illustrating the invention, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit or scope of the invention.

We claim:

1. The method of improving the physical properties of frothed rubber latex sponge made from a latex selected from at least one of the group consisting of natural rubber latex and a synthetic rubber latex resulting from the polymerization of a conjugated diene hydrocarbon, which comprises treating the sponge with water containing a composition selected from at least one of the group consisting of an alkaline earth hydroxide, an alkaline earth oxide, and an alkaline earth salt, removing excess treating agent and drying the treated sponge whereby at least one property of the group consisting of elongation, permanent set retention, tensile, snap, and odor is improved in comparison to sponge not treated with said treating agent.
2. Method according to claim 1 in which the treating agent is calcium hydroxide.
3. Method according to claim 1 in which the treating agent is barium hydroxide.
4. Method according to claim 1 in which the treating agent is calcium oxide.
5. Method according to claim 1 in which the treating agent is barium oxide.
6. Method according to claim 1 in which the treating agent is calcium chloride.
7. The frothed rubber latex sponge made in accordance with the method of claim 1.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,816,764	Cornic	July 28, 1931
1,852,447	Chapman et al.	Apr. 5, 1932
2,200,850	Miserentino	May 14, 1940
2,458,221	Svendsen et al.	Jan. 4, 1949
2,469,894	Rogers	May 10, 1949