

PATENT SPECIFICATION

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COMPLETE SPECIFICATION

NO DRAWINGS

Preservation of Natural Rubber Latex

We, DUNLOP RUBBER COMPANY LIMITED, a British Company of 1, Albany Street, London, N.W.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the preservation of natural rubber latex, especially latex obtained from *Hevea brasiliensis*.

Natural rubber latex must be preserved to prevent bacterial degradation. If no preservative is added to the latex bacterial activity is liable to cause spontaneous coagulation of the latex within 6 to 12 hours. Ammonia is the preservative which is most widely used and latex, after concentration to a rubber content of about 60 per cent, is normally preserved with about 0.6 per cent by weight of ammonia based on the total latex but as much as 0.75 per cent ammonia is sometimes used. Ammonia, however, has only a limited preservative effect and any further increase in the ammonia content gives no improvement. In order to obtain really satisfactory results it is necessary to add strong bactericides such as pentachlorophenol in addition to ammonia and in such cases it is possible to reduce the amount of ammonia required. When concentrated latex is transported, for example from factory to railway sidings, from rail tankers to dockside storage tanks and into ships' holds, it is not always possible to move the latex by gravity flow and in such cases it must be pumped. The usual method of pumping is by blowing the latex through pipelines by means of compressed air but this also increases the degradation of the latex when preserved by the conventional methods.

It has now been found that increased

preservation of natural rubber field latex, both at normal concentration and when mechanically concentrated, can be obtained if the free ammonia content of the said latex is maintained at not less than 1.25 per cent of the weight of the serum in the latex and a compound which maintains the redox potential of the latex in an oxidative condition is added thereto.

By 'mechanically concentrated' latex there is meant in this specification natural rubber latex which has been concentrated by means of a centrifuge, by electrodecantation or by heating with agitation. For a mechanically concentrated latex containing 60 per cent by weight of rubber an ammonia content of 1.25 per cent of the weight of the serum is normally expressed at 0.5 per cent ammonia by weight of the latex.

The compounds which are added to the latex in accordance with the invention are found when examined bacteriologically to have only a feeble bactericidal effect but since they keep the latex in an oxidative condition, the preserving action of the system is greatly enhanced.

Examples of compounds which can be used are the borates, iodates, bromates, dichromates and ferricyanides of the alkali metals, or the corresponding ammonium salts such as ammonium borate, sodium borate, ammonium iodate, potassium bromate, potassium dichromate and potassium ferricyanide. Ammonium borate is conveniently added as boric acid dissolved in a slight excess of aqueous ammonia. The amount of such compounds which is required is low and is preferably not greater than 0.25 per cent of the weight of the serum in the latex; for a mechanically concentrated latex containing 60 per cent by weight of rubber this amount of compound can also be expressed as 0.1 per cent by

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weight of the latex. The amount can vary, according to the compound used, down to about 0.01 per cent based on the serum, which for a 60 per cent latex can be expressed as 0.004 per cent by weight of the latex.

Obviously no compound which has a deleterious action on the latex is suitable for use in this invention and no compound should be used in such a proportion that it has any deleterious effect on the latex. By 'deleterious effect' there is meant in this specification especially the coagulation or the discolouration of the latex.

In a preferred form of the invention the compound is added to the field latex or to the mechanically concentrated field latex in such quantity that the redox potential of the latex immediately after the addition is at least 125 mv. but is preferably not less than 150 mv. The redox potential of the latex should not, however, exceed 200 mv.

The amount of ammonia added should be not less than 1.25 per cent by weight of the serum, i.e. not less than 0.5 per cent of the latex in the case of a 60 per cent concentrate.

The preferred method of measuring the redox potential is by means of a platinum/calomel electrode assembly. The convention has been adopted that an oxidative condition is designated by a potential more positive than that of the normal hydrogen electrode. At the ammonia concentration with which this specification is concerned the pH value of the latex is substantially constant at 10.6 ± 0.2 and therefore no correction in the redox potential for variation of pH value is necessary.

A method by which the degree of preservation of a latex can be rapidly ascertained consists in measuring the volatile fatty acid content (V.F.A.) which increases as the latex deteriorates. It has been observed that increase of V.F.A. takes place only when the redox potential, measured as described above, has reached a strongly reducing condition. The volatile fatty acid content of a latex is determined by distillation of the acids and titration of the distillate against a standard caustic alkali solution. The V.F.A. number is expressed as the equivalent in grammes of KOH per 100 gm. total solids of the latex.

The invention is illustrated by the following examples in which all percentages are by weight, based on the latex:—

EXAMPLE I

A field latex containing 0.35 per cent ammonia was concentrated by centrifuging to a 60 per cent rubber content. The concentrate was then ammoniated until it contained 0.6 per cent ammonia. The V.F.A. No. of the concentrate was 0.02. The latex was divided into two equal parts, one part

being used as control. To the other part 0.05 per cent boric acid was added as a solution in ammonium hydroxide. The two portions of latex were then subjected to the conditions of bulk transport for a period of six weeks during which the V.F.A. No. and the redox potentials of both latices were measured at regular intervals.

The results are given in Table I below.

TABLE I

Storage Time Days	Redox mv.	V.F.A.	Control		80
			0.6% NH ₃	0.6% NH ₃ + 0.05% Boric Acid	
7	+ 98	0.02		+176	0.02
15	+ 17	0.025		+168	0.02
21	— 5	0.025		+142	0.02
26	— 63	0.030		+150	0.02
33	—136	0.085		+124	0.02
38	—118	0.110		+131	0.02
44	— 93	0.110		+146	0.02

It will be seen that after 44 days the latex containing the boric acid had a redox potential of +146 mv. and was still in an oxidative condition and its V.F.A. No. was still 0.02. On the other hand the 'control' latex which contained no added boric acid had a redox potential of -93 mv., was in a strongly reducing condition and had a V.F.A. No. of 0.110.

EXAMPLE II

The ammonia content of a field latex was adjusted to 0.35% NH₃ immediately on receipt and 0.02 per cent of ammonium laurate was added as an aqueous solution with stirring to give increased stability to the latex. The latex was then divided into two halves one of which was used as 'control'. To the other portion of the latex there was added 0.15 per cent of boric acid as a solution in ammonium hydroxide. The two portions of latex were then concentrated separately by centrifuging to a 60 per cent dry rubber content and the ammonia content of both concentrated latices adjusted to 0.55 per cent. The concentration of the field latex increased the rubber content from 33 per cent to 60 per cent and reduced the boric acid content of the one portion of latex to approximately 0.09 per cent. After subjecting both portions of latex to the conditions of bulk transport for 6 weeks their redox potentials and V.F.A. Nos. were measured. The redox potential of the latex containing boric acid was +138 mv. and the latex was still in an oxidative condition; its V.F.A. No. had not increased but was still 0.02. The 'control' latex had a redox potential of -117 mv., it was in a reducing condition and had a V.F.A. No. of 0.11.

EXAMPLE III

A field latex was treated and concentrated as described in Example I except that the



one half of the concentrated latex was treated with 0.05 per cent potassium dichromate in aqueous solution in place of ammonium borate. This treated latex and the 'control' were then given the 6 weeks' treatment under bulk transport conditions and the same tests were carried out. The V.F.A. No. of the 'control' sample was 0.126 and its redox potential -117 mv. while the latex containing the dichromate had a V.F.A. No. of 0.025 and a redox potential of +98 mv.

EXAMPLE IV

A field latex was treated and concentrated as described in Example I except that the ammonium borate was replaced by potassium periodate at a concentration of 0.03 per cent. After six weeks' treatment the latex containing the periodate had a V.F.A. No. of 0.024 and a redox potential of +132 mv.

WHAT WE CLAIM IS:—

1. A method of obtaining increased preservation of natural rubber field latex, both at normal concentration and when mechanically concentrated, which comprises maintaining the free ammonia content of the said latex at not less than 1.25 per cent of the weight of the serum in the latex and adding thereto a compound which maintains the redox potential of the latex in an oxidative condition but has no appreciable deleterious action thereon.

2. A method according to claim 1 wherein the rubber latex immediately after addition of the said compound has a redox potential of at least 125 mv.

3. A method according to claim 2 where-

in the redox potential is not less than 150 mv.

4. A method according to claim 2 or 3 wherein the redox potential is not greater than 200 mv.

5. A method according to any of the preceding claims wherein the said compound is a borate of an alkali metal.

6. A method according to any of claims 1 to 4 wherein the said compound is ammonium borate.

7. A method according to any of claims 1 to 4 wherein the said compound is potassium dichromate.

8. A method according to any of claims 1 to 4 wherein the said compound is potassium periodate.

9. A method according to any of the preceding claims wherein the rubber latex is mechanically concentrated to a dry rubber content of the order of 60 per cent prior to the addition of the said compound.

10. A method according to any of the preceding claims wherein the said compound is added to the latex in an amount of from 0.01 per cent to 0.25 per cent by weight based on the weight of the serum in the latex.

11. The method of preserving rubber latex substantially as herein described in the foregoing examples.

12. Rubber latex when preserved by the method according to any of claims 1 to 11.

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Agent for the Applicants.

PROVISIONAL SPECIFICATION

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is necessary to add strong bactericides such as pentachlorophenol in addition to ammonia and in such cases it is possible to reduce the amount of ammonia required. When concentrated latex is transported, for example from factory to railway sidings, from rail tankers to dockside storage tanks and into ships' holds, it is not always possible to move the latex by gravity flow and in such cases it must be pumped. The usual method of pumping is by blowing the latex through pipelines by means of compressed air but this also increases the degradation of the latex when preserved by the conventional methods.

It has now been found that increased preservation of latex can be obtained if the ammonia content is maintained at not less than 1.25 per cent of the weight of the serum in the latex and a compound which maintains the redox potential of the latex in an oxidative condition is added thereto.

The compounds which are added to the latex in accordance with the invention are



one half of the concentrated latex was treated with 0.05 per cent potassium dichromate in aqueous solution in place of ammonium borate. This treated latex and the 'control' were then given the 6 weeks' treatment under bulk transport conditions and the same tests were carried out. The V.F.A. No. of the 'control' sample was 0.126 and its redox potential -117 mv. while the latex containing the dichromate had a V.F.A. No. of 0.025 and a redox potential of +98 mv.

EXAMPLE IV

A field latex was treated and concentrated as described in Example I except that the ammonium borate was replaced by potassium periodate at a concentration of 0.03 per cent. After six weeks' treatment the latex containing the periodate had a V.F.A. No. of 0.024 and a redox potential of +132 mv.

WHAT WE CLAIM IS:—

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2. A method according to claim 1 wherein the rubber latex immediately after addition of the said compound has a redox potential of at least 125 mv.

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4. A method according to claim 2 or 3 wherein the redox potential is not greater than 200 mv.

5. A method according to any of the preceding claims wherein the said compound is a borate of an alkali metal.

6. A method according to any of claims 1 to 4 wherein the said compound is ammonium borate.

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8. A method according to any of claims 1 to 4 wherein the said compound is potassium periodate.

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10. A method according to any of the preceding claims wherein the said compound is added to the latex in an amount of from 0.01 per cent to 0.25 per cent by weight based on the weight of the serum in the latex.

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The amount of ammonia added should be not less than 1.25 per cent by weight of the serum, i.e. not less than 0.5 per cent of the latex in the case of a 60 per cent concentrate.

The preferred method of measuring the redox potential is by means of a platinum/calomel electrode assembly. The convention has been adopted that an oxidative condition is designated by a potential more positive than that of the normal hydrogen electrode. At the ammonia concentrations with which this specification is concerned the pH value of the latex is substantially constant at 10.6 ± 0.2 and therefore no correction in the redox potential for variation of pH value is necessary.

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0.05 per cent boric acid was added as a solution in ammonium hydroxide. The two portions of latex were then subjected to the conditions of bulk transport for a period of six weeks during which the V.F.A. No. and the redox potentials of both latices were measured at regular intervals.

The results are given in Table I below.

TABLE I

Storage Time Days	Redox mv.	V.F.A.	Control 0.6% NH ₃		Boric Acid 0.6% NH ₃ + 0.05% Boric Acid	V.F.A.	
			Redox mv.	V.F.A.	Redox mv.	V.F.A.	
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15	+ 17	0.025	+168	0.02			
21	— 5	0.025	+142	0.02			
26	— 63	0.030	+150	0.02			
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It will be seen that after 44 days the latex containing the boric acid had a redox potential of +146 mv. and was still in an oxidative condition and its V.F.A. No. was still 0.02. On the other hand the 'control' latex which contained no added boric acid had a redox potential of —93 mv., was in a strongly reducing condition and had a V.F.A. No. of 0.110.

EXAMPLE II

The ammonia content of a field latex was adjusted to 0.35% NH₃ immediately on receipt and 0.02 per cent of ammonium laurate was added as an aqueous solution with stirring to give increased stability to the latex. The latex was then divided into two halves one of which was used as 'control'. To the other portion of the latex there was added 0.15 per cent of boric acid as a solution in ammonium hydroxide. The two portions of latex were then concentrated separately to a 60 per cent dry rubber content and the ammonia content of both concentrated latices adjusted to 0.55 per cent. After subjecting both portions of latex to the conditions of bulk transport for 6 weeks their redox potentials and V.F.A. Nos. were measured. The redox potential of the latex containing boric acid was +138 mv. and the latex was still in an oxidative condition; its V.F.A. No. had not increased but was still 0.02. The 'control' latex had a redox potential of —117 mv., it was in a reducing condition and had a V.F.A. No. of 0.11.

EXAMPLE III

A field latex was treated and concentrated as described in Example I except that the one half was treated with 0.05 per cent potassium dichromate in aqueous solution in place of ammonium borate. This treated latex and the 'control' were then given the 6 weeks' treatment under bulk transport



conditions and the same tests were carried out. The V.F.A. No. of the 'control' sample was 0.126 and its redox potential -117 mv. while the latex containing the dichromate had a V.F.A. No. of 0.025 and a redox potential of $+98$ mv.

EXAMPLE IV

A field latex was treated and concentrated as described in Example I except that the

ammonium borate was replaced by potassium periodate at a concentration of 0.03 per cent. After the six weeks' treatment the latex containing the periodate had a V.F.A. No. of 0.024 and a redox potential of $+132$ mv.

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