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PATENT SPECIFICATION

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(54) STIMULATION OF RUBBER YIELD FROM HEVEA BRASILIENSIS

(71) We, THE BOARD OF THE RUBBER RESEARCH INSTITUTE OF MALAYSIA, a Malaysian Body Corporate, of 260, Jalan Ampang, P.O. Box 150, Kuala Lumpur, Malaysia, do hereby declare the invention, for which we pray that a patent may be granted to us, to be particularly described in and by the following statement:—

This invention relates to the stimulation of the yield of rubber latex from *Hevea brasiliensis* through the application of formulations which contain ethylene or ethylene-releasing compounds. Our British Patent Specification No. 1,281,524 describes and claims the use of ethylene or ethylene-releasing materials as yield stimulants for *Hevea*. But the yield obtained with a stimulant is largely affected by the formulation chosen, and a formulation which produces excellent results

for compound A may fail completely for compound B. 20

The present invention is based on the discovery that palm kernel oil and coconut oil can be very effective carriers. Accordingly, the invention provides a composition for stimulating the yield of rubber latex from *Hevea brasiliensis* comprising a yield stimulant of the kind which releases ethylene in contact with the plant tissues in a carrier comprising palm kernel and/or coconut oil. The invention also includes a method of stimulating the yield of rubber latex by applying effective amounts of the composition to *Hevea*. 25 30

Palm oil is the oil obtained from the outer pulpy fibrous layer (mesocarp) of the oil-palm fruit. Palm-kernel oil is obtained from the hard kernel of the oil-palm fruit, and differs markedly in composition from palm oil as the following list indicates:— 35

Constituents	Palm Oil	Coconut Oil	Palm-kernel Oil
<u>Saturated Acids</u>			
Lauric	Nil	45-51%	45-52%
Myristic	1-6%	17-20%	14-19%
Palmitic	32-41%	4-10%	6-9%
Stearic	1-6%	1-5%	1-3%
<u>Unsaturated Acids</u>			
Oleic	40-52%	2-10%	10-18%
Linoleic	2-11%	0-2%	1-2%

Particular ethylene-releasing stimulants include 2-chloroethylphosphonic acid described in British Patent Specification No. 1,194,433 and sold by Amchem Products under the

Trade Mark Ethrel; and 2-substituted ethylsilanes described in British Patent Specifications 1,393,112 and 1,393,113, examples of which are:— 45

Cetrims — 2 - chloroethyltrimethoxysilane—
 $\text{Cl CH}_2\text{CH}_2\text{Si (OCH}_3)_3$
 Cetrips — 2-chloroethyltri-isopropoxysilane—
 $\text{ClCH}_2\text{CH}_2\text{Si (OC}_3\text{H}_7)_3$
 5 Cetrils — 2 - chloroethyltrilauroxysilane—
 $\text{ClCH}_2\text{CH}_2\text{Si (OC}_{12}\text{H}_{25})_3$

The carrier may consist entirely of palm-kernel oil and/or coconut oil. Alternatively, the carrier may include other ingredients. Thickeners such as lanoline or grease may be included to provide a composition of convenient application viscosity. Non-aqueous compositions, in which the stimulant is present in solution in palm kernel oil or coconut oil, generally tend to produce better results than aqueous emulsions, and we believe that there are at least two reasons:—

a) emulsion formulations are washed off the tree more quickly and easily than oil-based formulations.

b) The preferred ethylene-releasing stimulants are unstable to hydrolysis by water. Even of such stimulants are dissolved in the non-aqueous phase, emulsions containing them are liable to deteriorate on storage.

It may be advantageous to include in the composition an agent to assist assimilation of the stimulant by the tree. British Patent Application No. 59495/73 (Serial No. 1,498,004) describes how aliphatic and aromatic carboxylic acids and anhydrides, dimethyl sulphoxide, and glycerol can act as such agents. In particular, acetic anhydride has been found to be an effective bark penetrant for *Hevea*.

It is well known to incorporate surface-active agents in compositions to be applied to *Hevea*. Other ingredients may be included in accordance with knowledge in the field. For example, petrolatum, propylene glycol, lanoline, grease and rubber solution serve as

water-proofing stickers, preventing wash out or rapid hydrolysis of the formulations. Petrolatum (mineral oil with waxes), lanoline (wool fat) and grease are amorphous materials, and rubber solution forms a film on evaporation of the solvent(s). In addition, their protective coverings physically reduce oxidative degradation of oils and fats. Any added ingredient should be anhydrous and should not contain any alkaline material.

Propylene glycol is a material commonly employed to absorb moisture and delay drying. The absorption of a trace amount of water is necessary to sustain the hydrolysis reaction. In this case, it can also be used for adjusting the viscosity of the formulations. It is generally preferred, however, that palm-kernel oil and/or coconut oil constitutes at least 35%, by weight of the carrier (i.e. non-stimulant) portion of the composition.

Preferred carrier mixtures according to the invention for use with 2-substituted ethylsilanes are:—

Ingredient	% by weight
Palm-kernel oil	70—80
Grease	10—20
Propylene Glycol	10—20
Acetic anhydride	0— 5

Examples 1 and 2 show the use of Cetrims and Cetrips with a carrier conforming to the above formulation (code-named PY3).

EXAMPLE 1.

12 months yield results (g/tree/tapping (g/t/t)) for silanes and Ethrel in various carriers. The clone chosen was PC 86 and the tapping system used was half spiral on alternate days (s/2 d/2) on panel C; (figures in brackets as % of S/2 d/2 control)

	10% Ethrel	0.7M Cetrims	0.7M Cetrips
Carriers			
X	—	52.5 (135)	45.9 (118)
Palm Oil	63.6 (164)	54.0 (139)	57.6 (148)
Palm Oil/Petrolatum (5:3)	—	56.5 (146)	—
Palm Oil/Propylene Glycol (1:3)	—	60.7 (156)	64.2 (165)
PY3	—	61.3 (158)	66.6 (172)

Mean yield of S/2 d/2 Control — 38.8 g/tree/tapping (100%)

X is a carrier based on petrolatum, not containing palm kernel oil or coconut oil

EXAMPLE 2.

12 months yield results (g/t/t) for three concentrations of Cetrims and Cetrrips. The

clone and tapping system used for the trial are same as Example 1.

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Treatment	Concentration	g./t./t	%
Control	—	38.8	100
Ethrel in palm oil	10%	63.6	164
Cetrims in PY3	0.35 M	55.4	143
Cetrims in PY3	0.70 M	61.3	158
Cetrims in PY3	1.40 M	61.9	160
Cetrrips in PY3	0.35 M	60.8	157
Cetrrips in PY3	0.70 M	66.6	172
Cetrrips in PY3	1.40 M	53.5	138

The results show that the use of palm-kernel oil solution can enhance the improvement obtained by the use of 2-substituted ethylsilanes.

As far as Ethrel is concerned, the following carrier mixtures has been found to be particularly effective:—

Constituents	% by weight
Palm-kernel oil	35—50
Lanoline	25—35
Grease	25—35
Acetic anhydride	0—5

Examples 3 and 4 below illustrate the improved yield obtained when Ethrel was used with a carrier that has the above specified composition (code-name PY 2—3).

EXAMPLE 3.

12 and 20 months yield results for Ethrel in PY 2—3 carrier compared with Ethrel in Amchem carrier (ACP 70—90 I). The clone tested was PR 107 and the tapping system used was s/2 d/2 on panel D. ACP 70-90 I is believed to be an aqueous formulation containing 10% of active ingredient but no palm kernel oil or coconut oil.

Treatment	12 months		20 months	
	kg/ha/mth	%	kg/ha/mth	%
Control	94.0	100	92.9	100
10% Ethrel in ACP 70—90 I	169.2	180	164.3	177
10% Ethrel in PY 2—3	236.7	252	218.1	235

EXAMPLE 4.

12 and 16 months yield results for Ethrel in PY 2—3 carrier compared with Ethrel in

Amchem carrier (ACP 70—80 I). The clone tested was PB 86 and the tapping system employed was s/2 d/2 on panel C.

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Treatment	12 months		16 months	
	kg/ha/mth	%	kg/ha/mth	%
Control	157.8	100	155.1	100
10% Ethrel in ACP 70-90 I	287.1	182	278.4	179
10% Ethrel in PY 2-3	344.9	219	326.5	211

The results in Examples 3 and 4 show that the use of PY 2-3 as carrier for Ethrel can improve the yield quite significantly.

5 WHAT WE CLAIM IS:—

1. A non-aqueous composition for stimulating the yield of rubber latex from *Hevea brasiliensis* comprising a yield stimulant of the kind which releases ethylene in contact with the plant tissues in a carrier comprising palm kernel oil and/or coconut oil.

2. A composition as claimed in claim 1 wherein the yield stimulant is 2-chloroethylphosphonic acid.

3. A composition as claimed in claim 2 wherein the carrier comprises

Constituent	% by weight
Palm-kernel oil	35—50
Lanoline	25—35
Grease	25—35
Acetic anhydride	0—5

4. A composition as claimed in claim 1 wherein the yield stimulant is a 2-substituted ethylsilane.

5. A composition as claimed in claim 4, wherein the carrier:

Constituent	% by weight	
Palm-kernel oil	70—80	
Grease	10—20	
Propylene Glycol	10—20	30
Acetic anhydride	0—5	

6. A method of stimulating the yield of the rubber latex from *Hevea brasiliensis* which method comprises applying to the tree a composition as claimed in any one of claims 1 to 5.

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Propylene Glycol	10-20	30
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