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(54) TREATMENT OF *HEVEA BRASILIENSIS*

(71) We, THE RUBBER RESEARCH INSTITUTE OF MALAYA, a Body Corporate of Malaysia, of 3rd Mile Ampang Road, Kuala Lumpur, Malaya, 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 treatment of rubber-bearing *Hevea brasiliensis* for the purpose of stimulation of yield by the agency of ethylene.

In our Patent application No. 50185/68 (Serial No. 1281524) we claimed a method of treating rubber-bearing *Hevea brasiliensis* for the purpose of stimulation of yield of rubber latex therefrom by applying thereto a substance (excluding 15 substances there disclaimed) which causes ethylene to be provided in or in close proximity to the latex-bearing tissues of the tree. The substance could be, or could contain, ethylene *per se*. Alternatively the substance could be, or could contain, 2-chloroethylphosphonic acid which decomposes to give ethylene in the plant tissues.

Both these procedures have disadvantages. Ethylene is a gas, and it is difficult to provide a controlled and sustained supply to the tree without expensive apparatus. 2-Chloroethylphosphonic acid does provide a sustained supply of ethylene, but it is an expensive compound.

The present invention provides a method of treating rubber-bearing *Hevea brasiliensis* for the purpose of stimulation of yield of rubber latex therefrom by causing ethylene to be provided in or in close proximity to the latex-bearing tissues of the tree, which method comprises generating the ethylene *in situ* by chemical reaction between at least two reactants. Preferably the ethylene is generated *in situ* by chemical reaction between an ethylene-1,2-dihalide, particularly ethylene-1,2-dibromide, and metallic zinc, e.g., in granulated form, or an alkali metal iodide, e.g., sodium iodide, preferably in the presence of an alcohol, e.g., ethanol. By the use of this reaction, a controlled and sustained supply

of ethylene can be achieved over a period of weeks without the use of expensive chemicals.

The generation of ethylene by this reaction is slow and sustained. As the examples show, very substantial increases in yield may be achieved by the application to each tree of a little as 0.8 g of ethylene-1,2-dibromide and 0.25 g of zinc at two-monthly intervals. A practical upper limit to the quantity of the reactants is set by the cost of the materials and the dimensions of the hole it is convenient to drill where this method is used. Moreover, the response in extra yield is not proportionate to the quantity of the reactants used where the larger amounts are used in the preferred methods of application. There is no critical limit on the ratio of ethylenedihalide to zinc or sodium iodide; while equimolar quantities of these reactants are preferred, ethylene is generated irrespective of the proportions in which the reactants are mixed.

The reactants may be applied to the tree by making use of an applicator comprising a flexible frame, which is made to conform to the curvature of the tree trunk and is attached in a gas-tight manner thereto, and a generating reservoir, in which the reactants are placed, secured in a gas-tight manner to the frame in such a way that the atmosphere in the reservoir is in contact with the bark, the reservoir being provided with a re-sealable opening for insertion or replenishment of the reactants. These applicators are described and claimed in our British Patent Specification No. 1,192,528. The applicator may either remain in one position on the tree, or may be moved from one position to another on the tree at each or any of the subsequent re-applications.

Alternatively, the reactants may be placed in a hole (drilled) in the wood of a tree, which hole is subsequently sealed off from the atmosphere, e.g., using a mixture of latex and cellulose as a sealant or by using a short plastic lining collar and a fitting cap. The hole may either be unlined, or lined with a material, e.g. a cellulose film (e.g. that sold

[Price 25p]

under the Trade Mark Cellophane), which is impervious to the liquid reactants but is pervious to ethylene so as to permit the gas to pass into the tissues of the tree. In order to prevent the reactants from coming in direct contact with the tree, the reactants may be placed in a tube, e.g., a glass tube, which is open at one end, the tube containing the reactants being placed in the hole in the tree.

10 This method gives substantial increases in yield not only when the trees are tapped on the conventional alternate daily half spiral system (S/2.d/2.100%), but also with systems of lower intensity involving cuts of shorter

15 length or longer intervals between tapplings. Such low intensity tapping systems save labour, but are not economic owing to low yields, unless combined with effective treatments to stimulate yield such as that to which

20 the present invention relates.

The following Examples illustrate the invention.

25 The *Hevea brasiliensis* trees in all five Examples were buddings of the clone Tjir 1. The trees were 18 years old and were tapped on

the alternate daily half spiral system (C/2.d/2.100%) on the first panel of bark of first renewal, except in Example 5 where different tapping systems were used as indicated.

Example 1

In the first Example at each application 15 grams of ethylene-1,2-dibromide were mixed with 85 grams of ethanol and placed in an applicator as described in British Patent Specification No. 1,192,528, 5 grams of granulated zinc were added and the reservoir sealed. One applicator was fixed to each tree 30 cms. below the tapping cut, the applicator was moved down the tree at each successive re-application at intervals of 2 or 3 months. There were 5 trees per treatment. The mean yields in grams of dry rubber per tree per tapping (after adjustment for pretreatment differences) for the treated trees and the control trees are given in the following Table 1 with the yields of the treated trees expressed as a percentage of the yields of the control trees.

TABLE 1
Mean Yield in Grams/Tree/Tapping

Application	Month	Control	Treated*	as %
1	1	66.4	220.6	332
	2	70.2	137.0	195
2	3	66.2	115.2	174
	4	61.5	183.7	299
	5	65.8	92.9	141
3	6	68.2	98.0	144
	7	87.9	72.9	95
	8	36.5	45.3	124
4	9	18.5	31.5	170
	10	27.6	42.4	154
	11	35.6	43.6	122
5	12	46.6	74.3	159
	13	51.4	72.2	140
	14	47.3	61.4	130
6	15	51.2	78.8	154
	16	49.4	63.3	128
	17	47.7	51.4	108
7	18	43.6	72.4	155
	19	48.8	68.9	141
	20	45.4	54.1	119
Mean		51.9	84.0	162

* Treated as described in the text.

No adverse effects upon the treated trees have been observed throughout the 20 months; when an average of 62% more dry rubber has been harvested.

Example 2

In the second Example at each application the stated quantities of ethylene-1,2-dibromide, ethanol and zinc were placed in a hole (12.5 cm. long x 2.5 cm. diameter) drilled at 40°

from the horizontal near the base of the tree, lined with a cellulose tube and subsequently sealed with a plug of cellulose and latex. The applications were repeated at intervals of two months using the same holes as before. There were 5 trees per treatment. The mean yields in millilitres of latex per tree per tapping (after adjustment for pretreatment differences) for the treated trees and the control trees are given in the following Table 2.

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TABLE 2

Mean yield in ml/tree/tapping and as percentage
of control in parenthesis

Application per tree		Control	1	2	3
Ethanol, ml.		0	0.5	1.5	2.5
Ethylene-1,2-dibromide, g.		0	0.8	4.0	8.0
Zinc, g.		0	0.25	2.5	5.5
Application	Month				
1	1	75 (100)	349 (465)	396 (528)	407 (542)
	2	39 (100)	134 (344)	142 (364)	221 (516)
2	3	52 (100)	167 (321)	271 (521)	270 (518)
	4	70 (100)	123 (176)	210 (300)	204 (291)
3	5	65 (100)	182 (280)	231 (355)	217 (344)
	6	70 (100)	131 (187)	198 (282)	201 (287)
4	7	72 (100)	153 (213)	223 (310)	241 (335)
	8	69 (100)	160 (232)	212 (307)	221 (320)
5	9	65 (100)	168 (258)	233 (358)	253 (389)
	10	63 (100)	148 (235)	182 (289)	195 (310)
6	11	61 (100)	149 (244)	195 (320)	201 (330)
	12	59 (100)	122 (207)	165 (280)	175 (297)
Mean		63 (100)	166 (263)	222 (352)	234 (371)

5 No adverse effects upon the treated trees have been observed throughout the year, when the harvest of liquid latex from the treated trees was more than twice to nearly four times that of the controls.

Example 3

In the third Example there were 15 treat-

ments including a control. In the control a hole (12.5 cm. long x 2.5 cm. diameter) was drilled in the base of the tree but no chemicals were applied. In the second treatment 2 ml. of 40% (wt/wt) 2-chloroethylphosphonic acid in propylene glycol was placed in the hole at each application and the mouth of the hole was sealed with cellulose and latex. In the

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third to fifth treatments a glass tube was placed in the hole and the stated quantities of ethylene-1,2-dibromide, ethanol and zinc were placed in the tube, the mouth of the hole (not of the tube) being sealed with a plastic lining collar and cap. At each re-application the cap was removed, the old tube was removed and replaced with a new tube containing the reagents and the cap was replaced. In the sixth to ninth treatments the stated quantities of the reagents were placed directly in the hole without any inserted tube, and the mouth of the hole was sealed with cellulose and latex. The same hole was used for each of the seven applications in the second to ninth treatments. At each re-application the residues of the reagents were removed by a few turns of a spiral drill or bit before the reagents were placed in the hole. In the tenth to twelfth treatments the stated quantities of the reagents were placed in an applicator as described in

Example 1, except that the applicator remained on the same location at each re-application. In the thirteenth to fifteenth treatments the stated quantities of the reagents were placed in an applicator as described in Example 1 and the site of the applicator was changed at each re-application. The mean yields of dry rubber in grams per tree per tapping (after adjustment for pre-treatment differences) for the treated trees and the control trees are given in the following Table 3.

No adverse effects upon the treated trees have been observed. The slight advantage of moving the applicator over retaining it on the same site for each re-application, the advantage of application in bored holes over the use of applicators and the advantage of the mixture of reagents at the higher rates over 2-chloro-ethylphosphonic acid cannot be established with confidence in these small scale experiments, but indicate that these are promising methods.

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TABLE 3
Mean yield in grams/tree/tapping and as percentage of control in parenthesis

Treat- ment	Method	Quantity g.			Month													
		Et. dibro*	Ethanol	Zinc	1+	2	3+	4	5+	6	7+	8	9+	10	11+	12	13+	Mean
1	Control	0	0	0	30.8 (100)	23.0 (100)	22.9 (100)	42.5 (100)	51.3 (100)	48.8 (100)	54.2 (100)	47.4 (100)	51.2 (100)	49.1 (100)	47.2 (100)	48.9 (100)	45.2 (100)	43.3 (100)
2	Hole	2ml of 2-Chloroethylphosphonic acid			98.2 (319)	52.9 (230)	44.6 (195)	57.0 (134)	67.1 (131)	62.1 (127)	70.9 (131)	61.5 (130)	73.5 (144)	65.4 (133)	68.5 (146)	63.5 (130)	65.2 (144)	65.4 (151)
3	Hole & Tube	0.8	0.5	0.3	36.1 (117)	32.3 (140)	30.3 (132)	51.1 (120)	62.4 (122)	46.6 (95)	60.4 (111)	48.1 (101)	61.5 (120)	51.0 (104)	49.5 (105)	47.3 (97)	48.3 (107)	48.1 (111)
4	Hole & Tube	1.6	1.0	0.6	82.2 (267)	41.7 (181)	33.6 (147)	49.7 (117)	58.8 (115)	57.3 (117)	64.0 (118)	58.4 (123)	65.0 (127)	64.0 (130)	65.2 (138)	62.3 (127)	49.9 (110)	57.9 (134)
5	Hole & Tube	3.2	2.0	1.2	75.0 (244)	44.8 (195)	49.2 (215)	62.9 (148)	88.6 (173)	55.2 (175)	83.8 (155)	82.5 (174)	87.2 (170)	84.1 (171)	83.2 (176)	81.4 (166)	72.5 (160)	75.4 (175)
6	Hole	0.8	0.5	0.3	42.4 (138)	27.1 (118)	26.3 (115)	50.8 (120)	64.7 (126)	62.5 (128)	69.6 (128)	60.3 (127)	70.0 (137)	69.0 (141)	70.4 (149)	68.7 (141)	65.4 (145)	57.5 (133)
7	Hole	1.6	1.0	0.6	37.9 (123)	26.5 (115)	27.8 (121)	54.7 (129)	83.1 (162)	79.2 (162)	82.8 (153)	75.0 (158)	85.0 (166)	82.1 (167)	85.4 (181)	83.2 (170)	73.8 (163)	67.4 (156)
8	Hole	3.2	2.0	1.2	48.4 (157)	29.8 (130)	31.0 (135)	48.7 (115)	72.4 (141)	64.0 (131)	85.5 (157)	61.0 (129)	84.7 (165)	59.1 (120)	60.2 (128)	57.2 (117)	51.4 (114)	58.0 (134)

TABLE 3 (continued)
Mean yield in grams/tree/tapping and as percentage of control in parenthesis

Treat- ment	Method	Quantity g.			Month													
		Et. dibro*	Ethanol	Zinc	1+	2	3+	4	5+	6	7+	8	9+	10	11+	12	13+	Mean
9	Hole	6.4	4.0	2.4	138.6 (450)	46.3 (201)	53.8 (235)	62.6 (147)	66.1 (129)	63.5 (130)	70.8 (131)	62.5 (132)	69.7 (136)	61.0 (124)	58.4 (124)	59.1 (121)	53.5 (118)	66.6 (154)
10	Applicator (one site)	0.8	0.5	0.3	40.3 (131)	25.1 (109)	23.8 (104)	50.7 (119)	53.2 (104)	56.9 (117)	58.8 (108)	55.9 (118)	59.9 (117)	51.4 (104)	49.1 (104)	50.2 (103)	47.7 (106)	47.9 (111)
11	Applicator (one site)	1.6	1.0	0.6	35.1 (114)	26.7 (116)	25.5 (111)	45.0 (106)	56.7 (111)	51.5 (106)	60.3 (111)	50.4 (106)	59.7 (117)	49.5 (101)	48.7 (103)	48.9 (100)	46.8 (104)	46.5 (107)
12	Applicator (one site)	3.2	2.0	1.2	43.9 (143)	34.6 (150)	34.7 (152)	60.9 (143)	67.5 (132)	66.9 (137)	80.4 (148)	61.4 (130)	79.4 (155)	62.2 (127)	64.2 (136)	65.1 (133)	63.2 (140)	60.3 (139)
13	Applicator (moved)	0.8	0.5	0.3	42.4 (138)	28.2 (123)	34.2 (149)	54.0 (127)	55.7 (109)	47.4 (97)	64.5 (119)	45.7 (96)	44.4 (87)	48.1 (98)	46.6 (99)	47.7 (98)	43.2 (96)	46.3 (107)
14	Applicator (moved)	1.6	1.0	0.6	39.3 (128)	31.9 (139)	19.6 (86)	56.6 (133)	67.6 (132)	63.6 (130)	84.4 (156)	61.4 (130)	85.0 (166)	62.4 (127)	58.2 (123)	60.3 (123)	51.4 (114)	57.1 (132)
15	Applicator (moved)	3.2	2.0	1.2	46.2 (150)	36.2 (157)	36.6 (160)	65.5 (154)	69.8 (130)	60.3 (124)	88.2 (162)	60.4 (127)	89.0 (174)	62.5 (127)	80.0 (169)	71.2 (146)	62.7 (139)	63.7 (147)

* Et. dibro = Ethylene-1,2-dibromide.
+ = Re-application

Example 4
 In the fourth Example there were 6 treatments including the control (palm oil only applied to lightly scraped bark below the cut) and treatment 2 in which 10% (wt/wt) 2-chloroethylphosphonic acid in palm oil was applied to lightly scraped bark below the cut (which is now the preferred method of using 2-chloroethylphosphonic acid to stimulate yield in *Hevea brasiliensis*. The third and fourth treatments were the same as the third

to fifth treatments in Example 3, except that the quantities of the reagents were as stated. The fifth and sixth treatments were as the third and fourth treatments in this Example 4, except that a new hole was used at the third application at the beginning of the fifth month. The mean yields in grams per tree per tapping (after adjustment for pretreatment differences) for the treated trees and the control trees are given in the following Table 4.

TABLE 4

Mean yield in grams/tree/tapping and as percentage of control in parenthesis

Treatment	Method	Quantity g.			Month					Mean
		Et. dibro.*	Ethanol	Zinc	1+	2	3+	4	5+	
1	Control				58.7 (100)	63.4 (100)	60.2 (100)	77.1 (100)	72.4 (100)	66.4 (100)
2	Scraped bark below cut				92.7 (158)	94.5 (149)	99.8 (166)	95.3 (124)	98.4 (136)	96.1 (145)
3	Hole & Tube (one site)	3.2	2.0	1.2	137.4 (234)	92.5 (146)	105.6 (175)	113.2 (147)	107.8 (149)	111.3 (168)
4	Hole & Tube (one site)	6.4	4.0	2.4	120.2 (204)	92.4 (146)	103.3 (172)	104.8 (136)	101.7 (140)	104.5 (157)
5	Hole & Tube (moved) @	3.2	2.0	1.2	83.2 (142)	63.2 (100)	79.6 (132)	202.6 (133)	65.8 (119)	82.9 (135)
6	Hole & tube (moved) @	6.4	4.0	2.4	119.3 (203)	88.3 (139)	102.4 (170)	113.2 (147)	113.6 (157)	107/3 (162)

* Et. dibro. = Ethylene -1,2-dibromide

+ Re-application

@ (moved) = changed to different hole at the third application at beginning of Month 5.

No adverse effects upon the trees have been observed. The advantage of the treatments with a mixture of reagents over the use of 2-chloroethylphosphonic acid cannot be established with confidence in such a small scale experiment. The effect of changing holes, if any, is not clear.

Example 5

In the fifth Example there were 24 treatments arranged according to a factorial design of 6 tapping systems with 4 stimulant treatments (including the control). The four stimulant treatments were control (palm oil only applied to lightly scraped bark below the cut),

10% (wt/wt) 2-chloroethylphosphonic acid in palm oil applied to lightly scraped bark below the cut, the mixture of reagents (3.2g ethylene-1,2-dibromide, 2.0g ethanol and 1.2g zinc) applied in a tube in a bore hole as in treatment 5 of Example 3 and as in treatment 3 of Example 4, and a similar treatment except that 1.2 g sodium iodide was substituted for 1.2g zinc in the mixture of reagents. There were 50 trees per treatment, total 1200 trees. The total yield in grams per tree for the first forty days after treatment are given in the following Table 5.

TABLE 5

Mean yield in grams per tree for the first forty days after treatment with the percentage of the respective control treatment in parenthesis

Tapping System	No. of tappings	Total Yield Grams			
		Control	CEPA*	Eth(1)+	Eth(2)++
S/2.d/2.100%	20	372 (100)	957 (257)	1203 (323)	1050 (282)
S/4.d/2.50%	20	244 (100)	401 (164)	648 (266)	708 (290)
S/8.d/2.25%	20	174 (100)	306 (176)	502 (289)	528 (303)
S/2.d/4.50%	10	178 (100)	439 (246)	610 (343)	569 (320)
S/2.d/8.25%	5	77 (100)	156 (203)	275 (358)	256 (333)
S/1.d/8.50%	5	115 (100)	352 (306)	371 (322)	357 (310)

*10% 2-chloroethylphosphonic acid in palm oil applied below the cut

+Mixture of reagents in a hole as described in the text using zinc

++Mixture of reagents in a hole as described in the text using sodium iodide.

These initial yields suggest that the use of a mixture of the reagents in a hole drilled in the base of the tree will render low intensity, especially low frequency, tapping economic. Moreover the mixtures of reagents so applied compare favourably with 2-chloroethylphosphonic acid applied below the cut.

In all five Examples there have been substantial increases in yield due to the provision of ethylene generated by the reaction of ethylene-1,2-dibromide and zinc in the presence of ethanol. The fifth Example shows that sodium iodide may be successfully substituted for zinc.

In Example 3 treatments 5, 7 and 9 employing 1.6 to 6.4g of ethylene-1,2-dibromide and 0.6 to 2.4g of zinc have given yields in excess of treatment 2 employing 2-chloroethylphos-

phonic acid in a similar method. The cost of the largest quantities of the reagents used was about one fifth of that of the 2-chloroethylphosphonic acid at current prices.

In Example 4 treatments 3, 4 and 6 employing 3.2 to 6.4g of ethylene-1,2-dibromide and 1.2 to 28.4g of zinc in drilled holes have given yields in excess of treatment 2 employing 2-chloroethylphosphonic acid applied in palm oil below the cut, in which the amount of the latter depends on the size of the tree. The cost of the largest quantities of the reagents used was about two-thirds of that of the smallest quantity of 2-chloroethylphosphonic acid used at current prices.

In Example 5 all treatments employing 3.2g of ethylene-1,2-dibromide and 1.2g of zinc or sodium iodide have yielded more than those

comparable treatments employing 2-chloro-ethylphosphonic acid.

The drilling of the holes has been successfully mechanised by the use of lightweight power drills and the cost compares favourably with that of the manual labour of scraping bark below the tapping cut. The same hole may be used more than once and re-application may be made simply by changing the tube containing the reagents.

Thus the responses obtained by this improved method of providing ethylene to the trees are economic and competitive compared with other methods available. No adverse effects on the trees have been observed in the use of the method as described in the above Examples.

WHAT WE CLAIM IS:—

1. A method of treating rubber-bearing *Hevea brasiliensis* for the purpose of stimulation of yield of rubber latex therefrom by causing ethylene to be provided in or in close proximity to the latex-bearing tissues of the tree, which method comprises generating the ethylene *in situ* by chemical reaction between at least two reactants.

2. A method as claimed in claim 1, wherein the ethylene is generated *in situ* by chemical reaction between an ethylene-1,2-dihalide and metallic zinc.

3. A method as claimed in claim 1, wherein the ethylene is generated *in situ* by chemical reaction between an ethylene-1,2-dihalide and sodium iodide.

4. A method as claimed in claim 2 or claim 3, wherein the ethylene-1,2-dihalide is ethylene-1,2-dibromide.

5. A method as claimed in any one of claims 2 to 4, wherein the chemical reaction is performed in the presence of ethanol.

6. A method as claimed in any of claims 1 to 5, wherein the reactants are placed in a hole in the wood of the tree, which hole is subsequently sealed off from the atmosphere.

7. A method as claimed in claim 6, wherein

a mixture of cellulose and latex is used as a sealant.

8. A method as claimed in claim 6, wherein a plastic lining collar and cap is used to provide a movable and replaceable seal.

9. A method as claimed in any of claims 6 to 8, wherein the hole is not lined.

10. A method as claimed in any of claims 6 to 8, wherein the hole is lined with a film of cellulose.

11. A method as claimed in any of claims 6 to 10, wherein the reactants are placed in a tube, which is open at one end, and the tube containing the reactants is placed in the hole in such a manner to prevent the reactants from coming in direct contact with the tree.

12. A method as claimed in any of claims 1 to 5, wherein use is made of an applicator comprising a flexible frame, which is made to conform to the curvature of the tree trunk and is attached in a gas-tight manner thereto, and a generating reservoir, in which the reactants are placed, secured in a gas-tight manner to the frame in such a way that the atmosphere in the reservoir is in contact with the bark, the reservoir being provided with a re-sealable opening for insertion or replenishment of the reactants.

13. A method as claimed in claim 12, wherein the applicator remains in one position on the tree.

14. A method as claimed in claim 12, wherein the applicator is moved from one position to another on the tree at each or any of the subsequent re-applications.

15. A method as claimed in claim 1, and substantially as hereinbefore described in any one of the Examples.

16. Rubber-bearing *Hevea brasiliensis* when treated by the method claimed in any one of claims 1 to 15.

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comparable treatments employing 2-chloro-ethylphosphonic acid.

The drilling of the holes has been successfully mechanised by the use of lightweight power drills and the cost compares favourably with that of the manual labour of scraping bark below the tapping cut. The same hole may be used more than once and re-application may be made simply by changing the tube containing the reagents.

Thus the responses obtained by this improved method of providing ethylene to the trees are economic and competitive compared with other methods available. No adverse effects on the trees have been observed in the use of the method as described in the above Examples.

WHAT WE CLAIM IS:—

1. A method of treating rubber-bearing *Hevea brasiliensis* for the purpose of stimulation of yield of rubber latex therefrom by causing ethylene to be provided in or in close proximity to the latex-bearing tissues of the tree, which method comprises generating the ethylene *in situ* by chemical reaction between at least two reactants.

2. A method as claimed in claim 1, wherein the ethylene is generated *in situ* by chemical reaction between an ethylene-1,2-dihalide and metallic zinc.

3. A method as claimed in claim 1, wherein the ethylene is generated *in situ* by chemical reaction between an ethylene-1,2-dihalide and sodium iodide.

4. A method as claimed in claim 2 or claim 3, wherein the ethylene-1,2-dihalide is ethylene-1,2-dibromide.

5. A method as claimed in any one of claims 2 to 4, wherein the chemical reaction is performed in the presence of ethanol.

6. A method as claimed in any of claims 1 to 5, wherein the reactants are placed in a hole in the wood of the tree, which hole is subsequently sealed off from the atmosphere.

7. A method as claimed in claim 6, wherein

a mixture of cellulose and latex is used as a sealant.

8. A method as claimed in claim 6, wherein a plastic lining collar and cap is used to provide a movable and replaceable seal.

9. A method as claimed any of claims 6 to 8, wherein the hole is not lined.

10. A method as claimed in any of claims 6 to 8, wherein the hole is lined with a film of cellulose.

11. A method as claimed in any of claims 6 to 10, wherein the reactants are placed in a tube, which is open at one end, and the tube containing the reactants is placed in the hole in such a manner to prevent the reactants from coming in direct contact with the tree.

12. A method as claimed in any of claims 1 to 5, wherein use is made of an applicator comprising a flexible frame, which is made to conform to the curvature of the tree trunk and is attached in a gas-tight manner thereto, and a generating reservoir, in which the reactants are placed, secured in a gas-tight manner to the frame in such a way that the atmosphere in the reservoir is in contact with the bark, the reservoir being provided with a re-sealable opening for insertion or replenishment of the reactants.

13. A method as claimed in claim 12, wherein the applicator remains in one position on the tree.

14. A method as claimed in claim 12, wherein the applicator is moved from one position to another on the tree at each or any of the subsequent re-applications.

15. A method as claimed in claim 1, and substantially as hereinbefore described in any one of the Examples.

16. Rubber-bearing *Hevea brasiliensis* when treated by the method claimed in any one of claims 1 to 15.

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