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Determination of Dry Rubber Content of Hevea Brasiliensis by Latex Film Dialysis

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Preparation of latex film followed by dialysis in clean water replaces the washing and rolling operation on a mill or by other means.

In order to obtain a coherent film and to avoid any inconsistency during coagulation of fresh ammoniated field latex, a 2% w/v formic acid solution is used as coagulant. For old ammoniated field latex and latex concentrate, however, a 20% w/v ammonium chloride solution is used.

Attention is paid to thickness and porosity of the film by avoiding application of any mechanical treatment, which will cause a denser packing of the rubber particles. A temperature of 100–105°C is applied for drying the films.

This investigation arises from the customary 'total solids' determination procedure and the principles of coagulum dialysis experiments (SCHOON, 1953 b). The main aim of this work is to replace the washing and rolling operation—on a mill or by other means—in the procedures for the determination of dry rubber content (d.r.c.) by simple dialysis. Also, it may be desirable to shorten the time needed for such determination by drying at a higher and more practical temperature; a shorter period for performing the test could also result in greater precision.

Alternating pressure and dilution of the latex before coagulation in ordinary d.r.c. methods promote the coagulum syneresis (VAN ROSSEM, 1932). No clogging of the pores occurs during coagulum syneresis without the application of an outside pressure. The pore width and thickness of the hydrogel play an important role (SCHOON, 1953a). The rate of syneresis increases with temperature and in the presence of electrolytes (JIRGENSONS AND STRAUMANIS, 1956). For rapid drying, the rubber specimens should be as thin and porous as possible; high temperatures are recommended (PIDDLESDEN, 1937). Further consideration results from the exponential curve relationship between the concentration of electrolyte and the time of dialysis, and also from the effect of regularly restoring the strength of the dialysate (VAN GILS, 1940).

Earlier records show that in consequence of diluting latex with a 20% solution of sodium chloride, the Brownian movement ceases before coagulation (VAN ROSSEM, 1932). The small difference between the flocculation powers of sodium chloride and ammonium chloride is also known; moreover, the effect of temperature and concentration of particles on coagulation rate has also been described (JIRGENSONS AND STRAUMANIS, 1956). This technique, using salt solution as coagulant, is characterised by the widening of the normal pH range in coagulation with acid, due to the lowering of the critical electro-kinetic potential of latex by ionic exchange adsorption (VAN GILS, 1940).

In previous methods (COMPAGNON AND LE CONTE, 1944; RUBBER RESEARCH INSTITUTE OF MALAYA, 1954) the coagulum was not passed between rolls, but mechanical treatment is not omitted. Besides, drying is carried out at 70°C; the coagulation technique and the handling of coagulum differ from the method proposed here.

EXPERIMENTAL

The conventional rapid d.r.c. method usually applied in the Latex Laboratory of the

B.P.P.K.* is the base for comparison of these recent d.r.c. methods. Unpublished records have shown that there might exist a good accord between the above method and the rapid d.r.c. method with application of a vacuum drying oven. The values obtained from the latter procedure in turn appear to approximate those of the customary A.S.T.M. method. There is a great possibility that the rapid methods concerned result in a higher reproducibility than the A.S.T.M. method. The precision seems to be greater when the test is applied to diluted latex.

A. Procedures of d.r.c. Methods

The main apparatus required are as follows:

The RD-A method and the RB-B method: (a) an analytical balance; (b) a measuring cylinder of 10 ml capacity, with stopper; (c) a petri dish or aluminium dish of approximately 85 mm internal diameter and 15 mm depth, with cover (to coagulate the latex specimen into a film); a microspatula made from bamboo or other material will be useful for releasing the edges of the film prior to submerging in water; (d) two burettes of 25 ml capacity, and one graduated pipette of 10 ml capacity; (e) an aluminium or enamel-lined cast-iron basin of approximately 1 litre volume capacity (for one latex film) or larger, and approximately 10 cm depth, with flat bottom (for the dialysis of latex); a device for continuously furnishing fresh clean water should be present. In the absence of such device a larger basin may be used with periodic replenishing of the dialysing water; (f) a set of triangles made from glass rods (to hold the film rigidly at the bottom of the basin); (g) a desiccator; and (h) a vented air oven (to warm up the coagulation mixture, and to dry the film).

The RO method: (a) an analytical balance; (b) a porcelain evaporating dish or aluminium beaker of 50 ml capacity; (c) a steambath (to warm up the coagulation mixture); (d) two burettes of 25 ml capacity, and one graduated pipette of 10 ml capacity; (e) a laboratory d.r.c. crepe mill with smooth rolls 16 cm in length, 8.3 cm in diameter, and 30 rev/min in rotation speed; a device for continuously furnishing fresh clean water should also be available; (f) a desiccator; and (g) a vented air oven (for drying purpose).

Latices. Field latices from the Experiment Station of the Balai Penjelidikan Perkebunan Besar (ex-C.P.V.) in Tjiomas, Bogor, were employed for these experiments. They were ammoniated to approximately 0.3% w/v NH_3. The concentrates prepared at B.P.P.K. from these latices contained 0.7% w/v NH_3.

The different lots of field latex used in this investigation were Tjiomas field latex material tapped on different days. Such kind of latices were also utilised separately for the preparation of the different lots of concentrates. Three kinds of latex were used, *i.e.*, latex concentrate (LC), fresh ammoniated field latex (FAFL) and old ammoniated field latex (OAFL). Ammoniated field latices were considered old or fresh by their ability to coagulate into a coherent film when added to a 2% w/v formic acid solution in a petri dish. In these experiments the limit was fixed at [an age of] 2–4 days after tapping, depending on the quality of the latex and its NH_3 content.

Procedure. The procedures used were as follows:

The rapid d.r.c. method with dialysis, procedure A (RD-A method): Four millilitres of 20% w/v ammonium chloride solution were first poured into a petri dish of 8.5 cm internal diameter. In the case of fresh ammoniated field latex and fresh unammoniated field latex, 5 ml and 3 ml respectively of 2% w/v formic acid solutions were used. About 3 grams of concentrate or 5 grams of field latex—weighed to the third decimal—were slowly added, while swirling the dish constantly. The mixture was spread as uniformly as possible over the whole bottom of the dish, coagulating into a well formed film. Heating in a vented air oven at 100–105°C for about 15 minutes accelerated the coagulation, completion of which was indicated by the appearance of a clear serum. The film was further fixed between two pieces of small glass triangles, and then left submerged at the bottom of a basin (for 60 minutes, if the ammonium chloride coagulant is employed or

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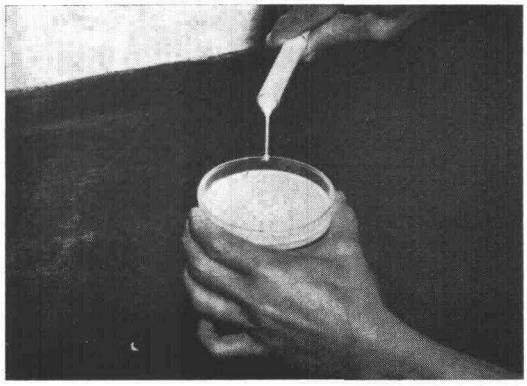

Figure 1. Adding latex to the coagulant solution in the petri dish.

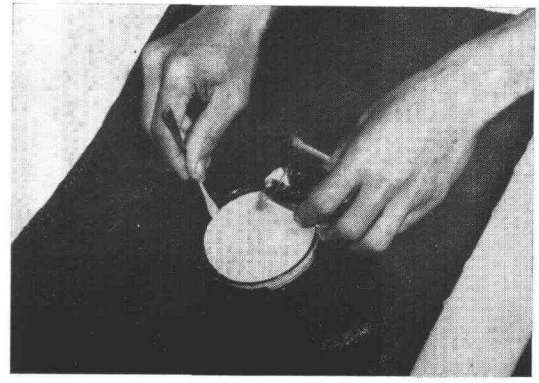

Figure 2. Releasing the coagulated film from the dish after water has been poured on it.

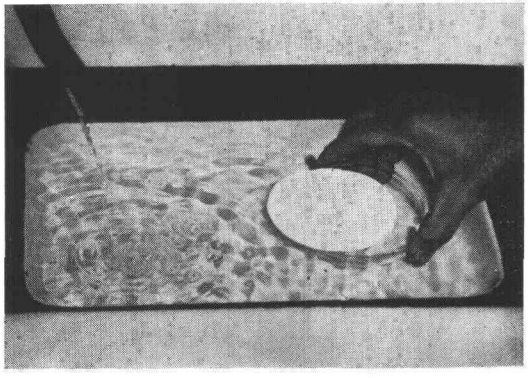

Figure 3. The floated released film obtained by carefully submerging in water.

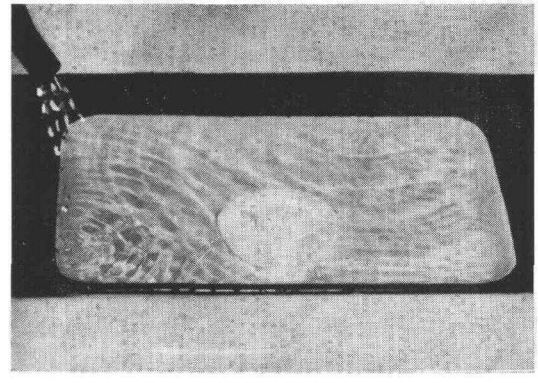

Figure 4. Dialysing the film in running water, while holding the film on the bottom of the basin by means of two triangles.

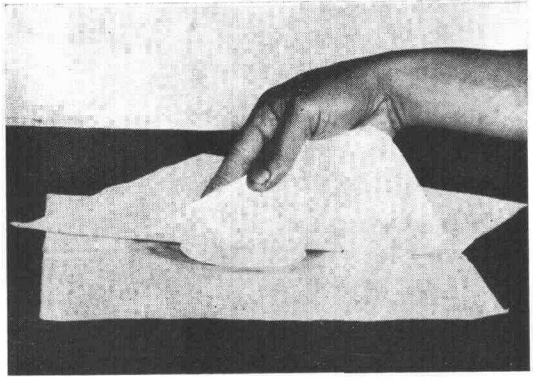

Figure 5. Removing surface-moisture by utilising filter-paper.

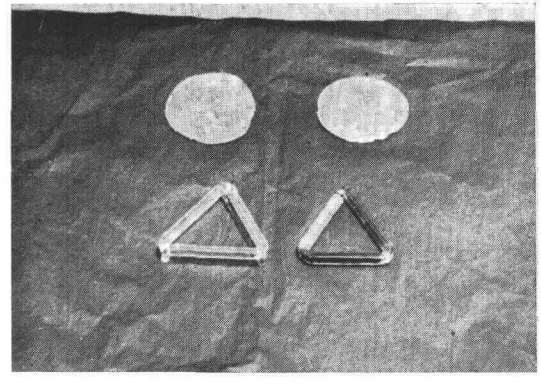

Figure 6. Dry latex films, and a set of glass triangles.

for 30 minutes, if the formic acid coagulant is applied). The basin was continuously filled with clean, running water (only in case of emergency, it could be periodically filled). Thereafter, the film was drawn out of the water, and its surface moisture was removed by blotting with a clean cloth or filter paper. Subsequently it was dried at 100–105°C for approximately 2 hours in the drying oven, cooled to room temperature in a desiccator and weighed. The drying, cooling and weighing were all repeated until the third decimal constant weight was obtained.

When 2% w/v formic acid coagulant is used, it is recommended that a preliminary coagulation trial be made to fix its dosage accurately with the appropriate test paper.

The rapid d.r.c. method with dialysis, procedure B (RD-B method): Procedure B conforms in all steps to procedure A, except that the latex concentrate was diluted prior to further treatment. Distilled water, in the proportion of 1:1 based on the weight of latex, was used for this purpose.

The ordinary rapid d.r.c. method of B.P.P.K. (RO-method): About 3 grams of concentrate or 5 grams of field latex—weighed to the third decimal—were coagulated by a 5% w/v formic acid solution at a pH of approximately 4.8 (checked with test paper). A subsequent warming-up on a steam bath for 15 minutes followed and, if a clear serum appeared, the coagulum was further rolled and washed on a laboratory d.r.c. mill. This rolling operation should be repeated 5–10 times to obtain a crepe thickness of less than 2 mm. The crepe obtained this way was dried in a vented air oven at 100–105°C for approximately 15 minutes, cooled in a desiccator to room temperature and weighed. The drying, cooling and weighing were repeated until the third decimal constant weight was obtained. Latex concentrate was diluted with distilled water, in the proportion of 1:1 based on weight of latex, prior to further treatment.

To simplify the drying, a simple water-bath oven may be used instead of the usual laboratory drying oven, although resulting in a temperature slightly lower than 100°C. To reduce eventual errors, the latex contained in the stoppered cylinder should be well shaken before pouring into the dish. Though the technique can be adopted—with solutions of certain salts as coagulants—to all kinds of latex without incoherency, the d.r.c. values obtained with solutions of different salts differ slightly from one another. The volume and concentration of salt solution is hence adjusted to suit its flocculation power. Ammonium chloride solution was used in these experiments, because it is often employed for certain processing purposes in natural latex technology. Moreover, it also gives a good coalescing effect.

The performance and initial costs of a d.r.c. method with dialysis are distinctly more advantageous than the RO method. Moreover, the method prevents the eventual loss of small coagulum parts by rough operation; also no dilution seems to be required in testing the latex concentrate. (See *Figures 1–6*).

B. Outline of Experiments

1. Non-statistically oriented experiments were first carried out to examine the effects of applying 2% w/v formic acid solution and 20% w/v ammonium chloride solution. The application of 20% w/v solutions of three different salts was similarly studied. The nitrogen and ash contents of the d.r.c. films and crepes were also checked.

2. Preliminary experiments were also conducted to examine the effects of slight variation of certain factors in the procedures of d.r.c. determination with dialysis. This programme studied the effects of three factors: the dose of latex (related to film thickness), the dose of coagulant and the dialysing period; each varied at two levels. The procedure followed was the 2^3 factorial experiment with complete confounding and three replicates (KEMPTHORNE, 1960; COCHRAN AND COX, 1957).

3. The main experiments (Experiments 1–4, see *Table 6*) studied the differences between the d.r.c. methods with dialysis and the ordinary rapid d.r.c. method of B.P.P.K. Their results were statistically analysed with the *F*-test to compare the precision of the methods (DAVIES, 1947; YOUDEN, 1951), the *t*-Test for paired differences (YOUDEN, 1951; DAVIES, 1947; UNDERWOOD *et al.*, 1954) and the sign test to check the results of the *t*-test (SCHROCK, 1957).

TABLE 1. COMPARISON BETWEEN 2% W/V FORMIC ACID SOLUTION (FA) AND 20% W/V AMMONIUM CHLORIDE SOLUTION (AC) AS COAGULANTS*

Lot of concentrate	Dose of coagulant (ml)		Warming-up period at 100–105 °C (min)		Dialysing period (min)		Drying period at 100–105 °C (min)		d.r.c. (%)		Remark
	FA	AC	FA	AC	FA	AC	FA	AC	FA	AC	
a	5	4	10	20	15	60	60	60	53.5 ; 53.5 (53.5)†	53.4 ; 53.4 (53.4)	
b	5	4	10	15	30	60	90	90	53.2 ; 53.1 (53.2)	53.1 ; 53.0 (53.1)	FA: slightly milky serum
c	5	4	10	20	30	60	90	90	56.3 ; 56.4 (56.4)	56.3 ; 56.3 (56.3)	FA: slightly clotted
d	5	4	15	15	15	120	90	90	60.2 ; 60.2 (60.2)	60.1 ; 60.2 (60.2)	FA: slightly clotted
e	5	4	15	15	30	210	120	120	60.8 ; 60.8 (60.8)	60.7 ; 60.8 (60.8)	FA: slightly clotted
f	5	4	15	20	15	22 ‡	120	120	59.1 ; 59.0 (59.1)	59.0 ; 58.9 (59.0)	FA: slightly clotted

*Each lot of latex concentrate is prepared from different day's tap of Tjiomas latex and tested in undiluted condition on different days. The d.r.c. method with dialysis is applied, using a specimen weight of 3–3.5 g

†Figures in parenthesis are averages. ‡Hours

4. Supplementary work was done on testing the quality of the wash-water used in the experiments.

RESULTS AND DISCUSSION

A. Non-Statistically Oriented Experiments

1. Paired comparison between d.r.c. determinations with formic acid and ammonium chloride coagulants. It appeared that 2% w/v formic acid solution would cause some trouble, *e.g.*, local coagulation, when applied to latex concentrate. However, there was practically no difference between the d.r.c. values obtained with both coagulants. The warming-up period for complete coagulation was about 15 minutes in both cases.

Table 1 shows that variations in the dialysing, drying and warming-up period of coagulant have not much influence on the approximately equal d.r.c. values obtained with both coagulants.

Local coagulation or any other incoherency, obtained by adding the formic acid coagulant to old ammoniated field latex or latex concentrate stored for some time, may be due to the decreased activity of the stabilising protein complex compounds in such latex,caused among others by the action of micro-organisms. The formation of ammonium soaps of long chain fatty acids results in a displacement of a part of the protein molecules (VAN GILS, 1947; COOK AND SEKAR, 1955). Adding of acid to such latex will cause clot formation, especially when calcium or magnesium ions are present.

2. Comparison between d.r.c. determination using different salts as coagulants. It is shown in *Table 2* that different salts provide somewhat different results, possibly due to the ion-adsorption phenomena, in which the kind of cation and anion of the salt coagulants etc. seems to have certain effect. It appears that ammonium acetate will give the lowest d.r.c. value in comparison with calcium chloride and ammonium chloride at equal concentration of coagulant solution. Rubber particles stabilised by ammonium soaps are not stable in latex containing calcium ions (VAN GILS, 1947). The high flocculation power of calcium chloride also gives trouble. So, this salt easily effects clots in all kinds of latex. It is in contrast to the ammonium salts possessing a more suitable flocculation value for this test material and where influences on coagulation seem to be moderate.

3. Nitrogen and ash contents of dry d.r.c. crepes and films. According to SCHOON (1953), higher nitrogen and ash contents of crepes will increase the water-adsorption values. *Table 3* shows that no appreciable differences occur between the nitrogen and ash contents of d.r.c. crepes and films prepared from the same lot of field latex. In case of latex concentrate the nitrogen content differs somewhat. However, in all cases, they are still within the limits of the required nitrogen and ash contents for first grade standard rubbers (RUBBER RESEARCH INSTITUTE OF MALAYA, 1966).

B. 2^3 Factorial Experiments with Complete Confounding and Three Replicates

The experiments were carried out using the RD-A method and with application of the three variables A, B and C, each at two levels, for testing fresh ammoniated field latex and latex concentrate.

1. The effect of varying the dose of latex (A), the dose of coagulant (B), and the dialysing period (C) in testing of fresh ammoniated field latex. The following levels were employed: (i) fresh ammoniated latex—5 g (A_0) and 6 g (A_1); 2% w/v formic acid solution—5 ml (B_0) and 6 ml (B_1); and (iii) dialysing period—15 min (C_0) and 30 min (C_1). The film thickness at A_0 and A_1 was respectively 0.5–0.6 mm and 0.6–0.7 mm.

2. The effect of varying the dose of latex (A), the dose of coagulant (B), and the dialysing period (C) in testing of latex concentrate. The following levels were employed: (i) latex concentrate—3 g (A_0) and 4 g (A_1); (ii) 20% w/v NH_4Cl solution—4 ml (B_0) and 5 ml (B_1); and (iii) dialysing period—30 min (C_0) and 60 min (C_1). The film thickness at A_0 and A_1 was respectively 0.4–0.6 mm and 0.6–0.8 mm.

Data recorded in *Tables 4* and *5* show that, only in case of testing fresh ammoniated field latex with a 2% w/v formic acid solution, the treatments B and AC have had real effect on the results. In this experiment, the combined effect of variations in latex dose and dialysing period was highly significant, and much greater than

TABLE 2. COMPARISON BETWEEN DIFFERENT SALTS AS COAGULANTS

No. of specimen	Sequence of test	Coagulant, 5 cc, 20% w/v solution	d.r.c. (%)		Means of average values	Remark
			Duplicate values	Average value		
1a	1	$CaCl_2$	60.26 ; 60.37	60.32	60.24	Clotted
2a	2	$CaCl_2$	60.27 ; 60.00	60.14		
3a	3	$CaCl_2$	60.27 ; 60.24	60.26		
1b	1	NH_4Cl	60.26 ; 60.48	60.37	60.41	—
2b	2	NH_4Cl	60.42 ; 60.56	60.49		
3b	3	NH_4Cl	60.56 ; 60.76	60.66		
1c	1	$NH_4C_2H_3O_2$	60.13 ; 60.05	60.09	60.12	—
2c	2	$NH_4C_2H_3O_2$	60.09 ; 60.15	60.12		
3c	3	$NH_4C_2H_3O_2$	60.08 ; 60.20	60.14		

Latex concentrate is prepared from one day's tap of Tjiomas latex; its specimens, each of 3–3.5 g weight, are tested in undiluted condition on different days within two weeks. The d.r.c. method with dialysis is applied using solutions of different salts with a warming-up period of 10–15 min, a dialysing period of 30 min and a drying period (100–105°C) of 120 minutes.

TABLE 3. NITROGEN AND ASH CONTENTS OF DRY D.R.C. CREPES AND FILMS, RESPECTIVELY PREPARED ACCORDING TO RO AND RD-A METHODS

Kind of latex	% N w/v		% Ash w/v	
	d.r.c. film	d.r.c. crepe	d.r.c. film	d.r.c. crepe
FAFL	0.49	0.45	0.14	0.22
FAFL	0.47	0.52	0.25	0.34
FAFL	0.53	0.49	0.31	0.33
FAFL	0.51	0.48	0.33	0.36
FAFL	0.47	0.50	0.36	0.42
FAFL	0.48	0.51	0.35	0.33
FAFL	0.47	0.50	0.36	0.42
Means	0.49	0.49	0.30	0.35
LC	0.27	0.21	0.09	0.09
LC	0.33	0.25	0.13	0.14
LC	0.38	0.24	0.18	0.14
LC	0.26	0.25	0.16	0.11
LC	0.27	0.24	0.15	0.13
Means	0.30	0.24	0.14	0.12

Different lots of fresh ammoniated Tjiomas field latex (FAFL) and B.P.P.K. latex concentrate (LC) were used as test materials. Each lot was tested on different days with approximately equal specimen weight for both methods.

TABLE 4. RESULTS OF STATISTICAL ANALYSIS OF 2^3 FACTORIAL EXPERIMENT WITH RD-A METHOD*

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Blocks			
Replicates	2	77.5515	38.7758
ABC	1	0.0033	0.0033
Replicates × ABC	2	0.0326	0.0163
Treatments			
A	1	0.0000	0.0000
B	1	0.0228	0.0228†
AB	1	0.0017	0.0017
C	1	0.0000	0.0000
AC	1	0.0353	0.0353‡
BC	1	0.0008	0.0008
Error	12	0.0296	0.0025
Total	23	77.6776	—

*Fresh ammoniated Tjiomas field latex used as test material

†Significant ‡Highly significant

TABLE 5. RESULTS OF STATISTICAL ANALYSIS OF 2^3 FACTORIAL EXPERIMENT WITH RD-A METHOD*

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Blocks			
Replicates	2	5.6394	2.8197
ABC	1	0.0794	0.0794
Replicates × ABC	2	0.2606	0.1303
Treatments			
A	1	0.0004	0.0004
B	1	0.0096	0.0096
AB	1	0.0043	0.0043
C	1	0.0193	0.0193
AC	1	0.0024	0.0024
BC	1	0.0048	0.0048
Error	12	0.1442	0.0120
Total	23	6.1644	—

*B.P.P.K. concentrate used as test material

the sum of the separate effects. The best results depended upon using a specific dose of a given latex material with a specific dialysing period. So, it is recommended that a fixed dose of 2% w/v formic acid solution be used for a given latex material; this dose can be determined by a simple coagulation trial. Also, to prevent a real positive effect of AC it will be necessary to avoid any variation in the dialysing period. Limited variation in the dose of latex is recommended. In the case of the 20% w/v ammonium chloride solution as coagulant for a given concentrate, no significant effect of variation of the above recorded factors was detected. The coagulation technique with this salt solution may be based more on ionic exchange adsorption than on pH value decrease.

C. Significance of Difference between Two Treatments with Paired Observations

1. Comparisons of the RD-A and RD-B methods to the RO method with fresh ammoniated field latex and latex concentrate as test materials. *Table 6* shows the following facts:

(i) With concentrate no real difference in precision of the d.r.c. values is detected between the RD-A and RD-B methods with dialysis, and the RO method with rolling operation. A highly significant small mean difference of 0.34 = 0.07% d.r.c. is found between the RD-A method and the RO method with application of the *t*-test for paired differences (direct difference method); the sign test confirms this significance. Results of Experiments 1 and 4 prove that the dilution step as applied in the RD-B method does not increase the precision. The d.r.c. values obtained by the RD-B method may differ from that of the RO method.

(ii) With old ammoniated field latex the RD-A method gives a somewhat lower precision than the RO method, although the d.r.c. values obtained appear to approximate one another.

(iii) With fresh ammoniated field latex the RD-A method seems to have a higher precision than the RO method. The RD-A method and the RO method differ slightly in their d.r.c. values obtained, with a highly significant mean difference of 0.31 ± 0.06% d.r.c.

Almost all results of the *t*-test for paired differences in the above experiments are confirmed by the sign test. The results of these two tests only differ slightly in Experiment 4.

D. Some Technical Properties of the Applied Wash-Water

Total hardness = 2.4°D; pH = 6.3; ash content = 92 mg/l; ignition residue = 86 mg/l.

CONCLUSIONS

Orientation experiments indicate that: (i) the use of ammonium acetate solution may result in a slightly higher precision than ammonium chloride solution; (ii) either the 20% w/v ammonium chloride or the 2% w/v formic acid solutions gives nearly equal d.r.c. values in testing of latex concentrate; (iii) coagulation with ammonium chloride in the RD-A method appears not to increase the hygroscopic

TABLE 6. RESULTS OF STATISTICAL ANALYSES OF PAIRED COMPARISONS BETWEEN D.R.C. METHODS WITH DIALYSIS AND RO METHOD

Experiment	1	2	3	4
d.r.c. method	RD-A *vs* RO	RD-A *vs* RO	RD-A *vs* RO	RD-B *vs* RO
Kind of latex	FAFL	LC	OAFL	LC
Number of pairs	32	27	10	13
Number of sub-samples per member of pair	2	2	2	2
Mean d.r.c. (%)	37.84 : 38.15	59.45 : 59.79	30.29 : 30.21	59.12 : 58.78
S.D. of the test	0.0872 : 0.2081	0.1545 : 0.1555	0.0407 : 0.0223	0.1161 : 0.1155
F for precision	5.70‡	1.01	3.40‡	1.19
Mean difference (M.D.)	−0.31	−0.34	+0.08	+0.34
S.E. of M.D.	0.06	0.07	0.07	0.13
t for paired differences	−5.22‡	−4.68‡	+1.08	+2.62†
Lowest rank total of same sign	+46‡	+30.5‡	−15.5	−17††*

Fresh ammoniated Tjiomas field latex and B.P.P.K. concentrate are used as test materials. Each pair is performed under different conditions such as time (other days), lot of latex, etc.

FAFL — Fresh ammoniated field latex
OAFL — Old ammoniated field latex
LC — Latex concentrate

*Possibly significant ($0.05 < P < 0.10$)
†Significant ($0.01 < P < 0.05$)
‡Highly significant ($P < 0.01$)
††Between significant and possibly significant

properties of the d.r.c. specimens, as compared to the ordinary RO method *(Tables 1–3)*.

In the RD-A method, the effects of varying the dosage of latex, the dosage of coagulant and dialysing period on the d.r.c. determination of latex concentrate are not so appreciable as that of fresh ammoniated field latex *(Tables 4* and *5)*. However, *Table 6* shows that, in normal labora-

tory practice, this variability can be neglected when compared to that of the values obtained by the RO method. This fact is possibly caused by some factors not yet included in the factorial experiments.

It can be concluded that the RD-A method is suitable for fresh or old ammoniated field latex as well as latex concentrate. A 20% w/v ammonium chloride solution should always be employed in all cases, where a 2% w/v formic acid solution fails. Dilution of latex concentrate as prescribed in the RD-B method is unnecessary. The small variability in the d.r.c. values obtained can be further reduced.

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DISCUSSION

Chairman: Prof. D. S. MacLusky

(Paper presented by Drs. K. Walujono)

Drs. Walujono agreed with the Chairman that the method described in the paper did not save time, since the unpressed coagulum took two hours to dry as compared to the fifteen minutes required for the pressed coagulum of the conventional method; however, its advantages lay in its simplicity and greater accuracy.

Mr. A.D.T. Gorton observed that neither the conventional nor the dialysis methods strictly measured the content of dry rubber only, because proteins and other substances were also precipitated; also, calcium chloride might precipitate soaps of fatty acids. He enquired why ammonium and calcium chlorides were used to coagulate the latex instead of acid. Drs. Walujono said that ammonium chloride gave a smooth coagulum in the preliminary trials; calcium chloride gave a bubbly coagulum and was not used further because of the risk of precipitating soaps of fatty acids.

Dr. Resing thought that the need for a large amount of clean water for washing was a disadvantage, though the use of a very thin film of latex was elegant. The comparison described was with ASD crepe, but a comparison with ASD rolled film might show an advantage in drying time of the new method. Drs. Walujono said this comparison had not yet been made.