SOME POINTS IN CONNECTION WITH THE MANUFACTURE OF RUBBER.

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The purpose of this paper is to give a short account of certain points in connection with the manufacture of rubber, on which work has recently been done by the Rubber Research Scheme.

Glass Hpdrometers for Latex.

The first subject which I should like to mention is the glass hydrometer for testing the rubber content of latex. It is designed to take the place of the brass Metrolac which is at present in fairly general use in this country. The idea of using a glass instrument originated as far as I know with the R. G. A. who also designed the brass Metrolac. Some experimental instruments were sent to the Research Scheme to be tested and we have developed a type of hydrometer which appears to be more suitable for the purpose than the original design.

The question naturally arises—what are the advantages of using a glass instrument? The chief advantage is that glass does not wear away like brass and therefore the accuracy of the instrument remains unchanged after long use. Brass on the other hand gradually loses weight and therefore becomes inaccurate. The other advantage is that the glass instrument is cheaper, the relative prices being Rs. 10 and Rs. 30. The disadvantage of glass is at once apparent, viz., the liability to breakage. However, glass hydrometers of much more fragile construction than those under discussion are used in chemical industries throughout the world without undue breakage. During the factory tests carried out by the Research Scheme the number of breakages have not been excessive.

During the past year about 30 hydrometers have been distributed to estates, and a number of Superintendents have kept careful records to test their accuracy. Naturally the results from different estates varied considerably, but this is inevitable owing to differences in the size of Shanghai jars and other causes. In several cases in which estate records showed a high error, a test made by the Chemist on the same estate showed only a small error. From the results in general it is concluded that the maximum error in calculating crop would be + or — 10 per cent., and the normal error should be about 5 per cent. It is proposed to obtain a supply of the hydrometers for disposal to members of the Research Scheme.

Formic Acid as a Coagulant.

Formic acid was tested as a coagulant in the early days of the Plantation industry and was considered to be satisfactory. It was recognised to have a higher coagulating power than acetic acid; but even allowing for this, it was more expensive than acetic acid.

Owing to new processes of manufacture formic acid is now cheaper than acetic acid and the question of its adoption as a coagulant has come to the fore.

It has been established that 1 part by volume of 90 per cent. formic acid is equal in coagulating power to 2 parts by volume of strong acetic acid. The relative prices of formic acid and acetic acid are respectively about £ 48 and £ 58 per ton, but formic acid is considerably heavier bulk for bulk than acetic acid. Taking this fact into consideration the saving by adoption of formic acid as coagulant would amount to slightly more than 50 per cent.

As regards appearance there is no difference between sheet and crepe prepared with acetic acid and formic acid, and tests carried out by various Research Institutions have shown that formic acid has no appreciable influence on the vulcanising properties of rubber. The use of formic acid as a coagulant is now approved by the Rubber Research Scheme.

Sand in Rubber.

Particles of sand and grit in rubber are very harmful from the point of view of the Manufacturer, in fact they are probably one of the most harmful impurities of plantation rubber with which he has to deal.

Since rubber is sold by appearance and particles of grit are invisible to the eye, their presence does not detract from the price of the rubber, but in the interests of the industry it is important that all efforts should be taken to keep rubber free from these impurities.

In most rubber producing countries latex is collected in glass or aluminium cups which are washed daily. In Ceylon the familiar " sheraty " is in universal use and especial care is required to keep it as clean as possible. Most important is that " sheraties " should not be allowed to rest on the ground, otherwise contamination is inevitable. When not in use the " sheraty " should be supported on a stick or hung by means of a wire loop to the collecting spout, or some similar method should be adopted.

With every care it is difficult to avoid getting a certain amount of dirt into the latex and precautions should be taken to see that this is removed at the factory. In every factory the latex is strained through sieves but one frequently sees coolies rubbing the latex through the sieves to make it flow more quickly. This naturally has the effect of rubbing through particles of grit which would otherwise remain in the sieve. Two sieves should be in use, and when one tends to become clogged, it should be washed out into a separate receptacle. The washings from the sieve should be thrown away or classed as very low grade rubber. The last cupful of latex from each tapper's bucket should be kept separate and made up into low grade rubber as most of the grit sinks to the bottom of the bucket. Latex should be strained at least twice before coagulation.

Grit can also be introduced into rubber in the water used for dilution and washing. The water can be filtered in a simple way by tying a linen bag over each tap.

Incomplete Coagulation.

On many estates it is noticed that the serum remaining from coagulation is milky. Contrary to the belief of many rubbermakers, this means that rubber is being lost. This was not of great importance when rubber only fetched 50 cents per lb. but when the price rose to Rs. 2-50 it was thought to be of interest to make some tests on " milky serum." Tests on 2 estates

showed a daily loss of 3·6 and 7·3 lb. respectively which could have been avoided by the use of slightly more acetic acid in coagulation. The serum remaining from coagulation should be " water white " or at least only cloudy if loss of rubber is to be avoided.

The Effect of Smoking on the Prevention of Mould.

During the past 2 years a series of experiments has been carried out on the smoking of sheet rubber; the object being to determine to what extent variations in conditions of smoking affect the liability of sheets to become mouldy.

The tests were conducted in 2 small smoke-chambers at the Laboratories. In one of these, combustion of the firewood was controlled so that it smouldered slowly. This gives a smoke with a soft tarry smell, and only slightly irritant to the eyes. This I call " uncombusted" smoke. In the other smoke-house the wood glowed brightly giving a smoke with an acrid smell and a very irritant effect on the eyes. I call this " combusted " smoke

In these smoke-chambers samples were prepared under various conditions as follows:—

(1) Sheets were smoked for varying lengths of time. (2) Comparison was made between sheets washed after rolling for 5 minutes and 2 hours respectively. (3) Comparison was made between smoke from " rubber " wood and " del " wood.

After smoking, the samples were tested for liability to mould by a test devised by Dr. De Vries. In this test samples were inoculated with mould and then kept in a damp atmosphere, the susceptibility to mould being judged by the amount which develops in a given length of time. These tests were made both on freshly smoked sheet and on sheet which had been hung up for some time after smoking, as is the practice on many estates.

The series of experiments is now completed and the following conclusions have been reached.

1. " Uncombusted " smoke is more effective than " combusted " smoke.
2. Lightly smoked sheet is more liable to mould than thoroughly smoked sheet.
3. In the case of " uncombusted " smoke, sheet which has been hung up after smoking is more liable to mould than freshly smoked sheet. This is less marked in the case of " combusted " smoke.
4. Sheet washed for 5 minutes after rolling, and smoked with " combusted " smoke is more liable to mould than sheet washed for 2 hours. This is less marked in the case of " uncombusted " smoke.
5. Sheet cannot be made completely immune to mould by smoking.

In the average estate smoke-house the smoke is probably a mixture of cumbusted and uncombusted smoke, and the conditions tending to minimise liability to mould, are:—

1. Thorough washing of the sheet after rolling.
2. Thorough smoking.
3. Packing immediately after removal from the smoke-house.

Para nitrophenol as a Mould Preventive.

One of the conclusions reached from the smoking experiments is that sheet cannot be made completely immune to mould by smoking. This can probably only be done by adding some chemical to the rubber.

Para nitrouhenol has been introduced by the Rubber Growers' Association as a suitable substance for this purpose.

Some recent tests at the Research Scheme Laboratories have shown that ·02 per cent. of p.n.p. is sufficient to prevent growth of a typical mould culture. With certain other organisms the amount required is less than this (for instance with phytophthora faberi, ·005 per cent. prevents growth). As regards cost, p.n.p. is now being sold in Colombo at Re. 1·75 per lb. and the cost of treatment would be approximately $\frac{1}{4}$ cent per lb.

The most important question which must be asked in connection with the proposal to incorporate a chemical in rubber is—will it have any harmful effect on the vulcanising properties of the rubber? This has been thoroughly investigated by the Rubbers Growers' Association and the conclusion has been reached that p.n.p. has no such harmful effect. In Malaya it is customary to mix the requisite amount of the chemical with the acid used for coagulation, but under Ceylon conditions it is considered preferable to soak the freshly rolled and washed sheets in a 0·1 per cent. solution (i.e. 1 lb. to 100 gallons) for $\frac{1}{2}$ to 1 hour before transferring to the smoke-house. During this treatment it is important that the sheets should be frequently turned over so that all parts come in contact with the solution.

Para nitrophenol can also be used in the same way for prevention of spots in crepe.

DISCUSSION.

MR. BRUCE FOOTE enquired whether Para nitrophenol might not as effectively be added to the water in which the sheet was washed.

MR. O'BRIEN replied that in order to derive the full benefit of the washing of the sheets, which of course was to remove serum, they should be washed in running water and Mr. Foote's suggestion, therefore, was impracticable.

THE CHAIRMAN asked for any information Mr. O'Brien could give of the new process of maufacture whereby the latex was precipitated in form of powder instead of coagulation.

MR. O'BRIEN said that he had heard of the process and that the largest plantation in the world prepared all their rubber in that form. He did not think the British manufacturers had anywhere given any indication that they had found that form of rubber as satisfactory as the ordinary coagulated rubber. Considering that one had to remove six pounds of water to every ten pounds of latex it must be an expensive process. He did not however remember seeing any figures of what it cost.

MR. A. W. WINTER pursuing Mr. O'Brien's advice on the method of smoking, enquired if there was any objection to the use of damp coconut husk as fuel. It created a lot of smoke which seemed a desideratum, but the sheet tended to become shiny.

MR. O'BRIEN said he had no experience in smoking rubber with coconut husk, but he was hoping to conduct an experiment with this method at a future date. He declared with emphasis that he would not recommend the use of damp fuel in any form.

MR. J. D. DUNLOP said he had observed that the finer the crepe or sheet was rolled, the longer it took to dry. He had put some sheet through a second rolling, but though it became finer it took half as long again to dry as sheet rolled in the ordinary method.

MR. O'BRIEN replied that this was generally recognised by rubber chemists.

In reply to a question by Mr. R. Senanayake, MR. O'BRIEN said that there was no appreciable difference in the length of time between rubber coagulated by formic acid and acetic acid.