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EXPERIENCE OF THE FRENCH SPEAKING INSTITUTES IN THE FIELD OF PROCESSING AND TECHNICAL GRADING OF NATURAL RUBBER

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French planters and their research institutes established in the different countries of Asia or Africa, had considered, before the last world war, that the marketing of technically specified rubber would replace the sale of traditional visually graded rubbers. This view was particularly justified with the mounting competition from synthetic rubber and different countries would be expected to reach this same conclusion.

We will consider the processes used by the companies established in Cambodia, Cameroons, Ivory Coast and Viet-Nam to make such rubbers. During the last year production of technically graded rubbers in these countries was more than 36,000 tons. Some processes had been much in operation in Viet-Nam in the years 1930 — 1940, using sheets obtained by the procedures originated by Michelin. It was observed twenty years ago that the treatment of rubber in granulated form would make the treatment both easier and more economical, giving a rubber of consistent quality as a result of the continuous or semi-continuous manipulation possible with granules.

It is not our purpose to make a review of all the granulation processes which have already been done, but to indicate the choice of the planters of the countries indicated, and the reasons for their choice.

It should not be overlooked that the processes were chosen to suit large producers since the factories in question treat the entire production of plantations, the area of which is generally between 1,500 and 8,000 hectares.

We shall analyse successively these salient points : (*a*) the treatment of latex rubber followed by that of lower grades, (*b*) the drying, and (*c*) the baling.

We shall then examine the position of the producers on the question of the technical specifications of natural rubber.

Coagulation

The coagulation and processing of granulated rubber is theoretically very simple, since the operation consists in our plantations of the introduction of the coagulum into a rotary cutter to obtain, in one pass, granules ready for drying. But the French producers and their institutes have further studied the problem in relation to extreme control of cleanliness, and also to the vulcanization characteristics and the physical properties of the rubbers obtained.

Cleanliness is achieved not only by taking the usual precautions during tapping and on the reception of the latex at the factory, but in most cases by purifying the latex in self-cleaning rotary filters, of which the mesh size is from 0·36 to 0·53 mm.

The systematic use of this equipment gives rubbers of which the mean dirt content in the Ivory Coast for example is between 0·01 and 0·02% throughout each month of the year. Systematic comparisons have shown that without the filters, the dirt content during the year lies regularly at about 0·025%.

These self-cleaning rotary filters work continuously without maintenance or particular supervision.

Coagula, which are always derived from field concentrated latex, are obtained in certain factories from partition tanks. Generally the partitions are more widely spaced than in the case of coagulation for RSS and touch the two sides of the tank thus giving slabs and not continuous sheets. Other factories use small portable circular tanks having a capacity of 250 l of latex. These tanks may be used to give coagula in the form of slabs or sheets :

—to obtain slabs, partitions are put in the tank,

—to obtain sheets, the cylindrical coagulum is cut at high speed (1 min for a coagulum of 250 l) by a horizontal saw.

Coagulum obtained from partition tanks is well adapted to small factories ; sawing of the coagulum is more advantageous for large plantations, since the investment for a coagulum saw is only economical above a daily production of 8 tons of dry rubber.

It is particularly worth noting that the use of the circular tanks with or without partitions is well adapted to smallholders who may collect and coagulate their latex therein. The tanks are then collected by lorries and processed in central factories under the best economical and technical conditions. There are already in the Ivory Coast coagulation centres of this type especially for smallholders, and this may interest planters in Ceylon.

The manufacture of rubber with good physical properties and rapid and constant vulcanization characteristics is made easy by the saw. This system allows the conservation of practically all the non-rubber constituents, natural accelerators and antioxidants, present in the latex which are partially expelled in the serum when the coagulum is sheeted on conventional batteries. The French producers have been able in this way to supply certain large French manufacturers who prefer to use the type of rubber known as ICR (initial concentration rubber).

Granulation of latex coagulum

Granulation of latex coagulum is always effected in rotary cutters using a strong current of water for rubbers of medium speed of vulcanization, and a small current of water for rubbers of rapid vulcanization. The granules obtained are loaded into baskets, allowed to drain, and passed to the semi-continuous or continuous dryers.

In some Promoci factories the rubbers of medium speed of vulcanization are allowed to fall into a tank of water and are then drawn into a vortex pump. The powerful action of this pump diminishes, by hydrolysis, the percentage of non-rubber constituents and consequently the vulcanization speed. In the course of this operation the pump transports the granules to a vibrating screen which mechanically drains the rubber granules. From the vibrating screen the granules are blown into the dryer by a pneumatic feeder.

Rapid vulcanization rubbers follow the same circuit but without passing through the vortex pump in order to conserve the non-rubber constituents.

Granulation of low grade rubbers

Granulation of lower grade rubbers, cup lumps, tree laces, *etc.*, poses other problems.

One must rid these rubbers of their impurities, as well as preparing them for drying in the form of homogeneous granules.

The Guthrie-Pullen system of treatment comprises a rotary cutter feeding a pelletizer and is used quite satisfactorily by some of our plantations. This system is best reserved for the treatment of cup lumps. Other planters prefer to use more versatile installations capable of treating all qualities of lower grade rubbers. Their versatility makes them more complex. A typical Promoci line is composed of a hammermill or a rotary cutter feeding to creping machines themselves feeding a rotary cutter.

Dirty or very dirty rubber after soaking is fed into the hammermill. This apparatus is very robust since there is no friction between the moving and fixed parts.

Among the machines in our experience, the hammermill has shown itself to have the most efficient cleaning action. It is economical to buy and maintain although a little high in electrical energy consumption on the power peaks. Its speciality is to expel the impurities from the rubbers by percussion. It is first a cleaning machine, the best that we know of, and secondly a granulator. The granules and the dirt fall from the hammermill into a water tank. The dirt sinks to form a mud. The floating granules are drawn into the vortex pump which washes them vigorously and transports them to the two creping machines.

Clean lower grades such good cup lumps, which have no need for severe cleaning, do not pass through the hammermill but direct to a rotary cutter also installed above a water tank with vortex pump. This is sufficient to clean them thoroughly and give a dirt content of around 0·03%.

Although hammermills are not used in our countries to prepare latex and cup lump rubbers, the Rubber Research Institute in the Ivory Coast is working to see if the hammermill can be adopted to the treatment of these higher grades.

In both cases, the vortex pump washes the rubber and feeds, by pipes, the creping machines. The function of the creping machine is to homogenize the structure of the cleaned scraps in order to save time and money in the drying operation and to eliminate damp spots.

The blended sheet is then granulated with a rotary cutter. The granules flow on to a vibrating screen for mechanical draining of the water before going to the dryer.

It should be noted that in the Guthrie-Pullen process, the pelletizer combines two operations into one. The homogenization is effected by the screw and the granulation by rotating knives at the end of this screw.

The pilot plant at the Rubber Research Institute of the Ivory Coast is working with a twin screw extruding machine which is both a continuous blender and a dryer.

All the processes I have described possess the very clear advantage of increasing the quality and the selling price of rubber in comparison with traditional methods.

Drying

In our factories the rubber is dried by semi-continuous or continuous systems. The continuous dryers consist of perforated steel conveyors running in an oven. Since this oven is divided into several compartments, it is possible to regulate for each of them the temperature and the speed of the hot air.

The production capacity of these dryers amounts to between 400 and 1,500 kg per hour according to their size.

For technical and economic reasons they are particularly adapted to big factories. They need very limited labour. However, it is recommended to clean the steel conveyor once a day to remove some little granules which stick to the band and would be slowly oxidised.

The semi-continuous dryers, particularly the Uni-dryer type, constructed in Malaysia, are also satisfactorily used in some of our plantations. These dryers are made of baskets passing through a hot oven. They are simple, heavy duty and well adapted to smaller scale production. They require more labour than continuous dryers.

Packing

The collection, transport and the weighing of granules can be automatically conducted after the continuous drying.

These operations are carried out by hand in the case of semi-continuous dryers.

The power of the baling press generally lies between 50 and 120 tons in order to mould small compact bales whose weight is generally 75 lb. The pilot plant at the Institute of the Ivory Coast has adapted the weight of 33⅓ kg. This number is preferred by manufacturers because it is then possible to obtain 30 bales per metric ton.

Polythene wrapping is not always used in our factories. Some of them use an automatic dipping process to cover the bale surface with a thin coating.

This is more economical and some big French consumers do not wish to include polythene in their compounds. Some other consumers, not equipped with internal mixers, cannot obtain a good dispersion of the polythene during the roll mixing.

The French Rubber Institute has considered the use of polythene with a low melting point. The plastic industry has succeeded in obtaining a material with a melting point of 80 — 85°C making it possible to disperse at the ordinary temperature of an industrial open mill. This new polythene could be used to make the bags of polybag tapping employed in Africa.

All the bales of comminuted rubber pressed in our countries have a size of 700 × 350 × 180 mm. These dimensions are preferred by manufacturers because they are similar to those of the majority of synthetic rubber bales.

The bales are palletized or individually shipped. Experimental shipping is made from Africa using containers of different capacity. This new method will probably fast develop in the future.

Technical specifications

Measurements are made to ensure that the block rubber conforms to the required technical specifications. It is necessary to give a complete guarantee to manufacturers that they are receiving exactly the kind of rubber they have ordered.

For your information, the Institute of the Ivory Coast makes one complete analysis each day on the products from each factory. We measure : dirt, volatile matter, ash, nitrogen, PRI and Mooney viscosity on the raw rubber. The rate of cure is determined by modulus at 100% elongation with an ACS 1 compound. All figures are reported on a test certificate shipped with each lot of rubber.

It appears to be indispensable now to harmonize the various specification schemes peculiar to some producing countries and to make with them only one table of international specifications which would be submitted to the general agreement of all producers and manufacturers of the whole world. The ISO (International Standards Organization) is presently trying to do so.

QUESTIONS AND ANSWERS

Question : (*a*) In your polybag collection, there was no use of rain guards. Are these not necessary ?

(*b*) Don't you have any theft problem ? (Mr. M. Singh).

Answer : (*a*) Polystyrene rain guards have been tried rather successfully.

(*b*) Where on earth can you say there are no thefts !