Summary of Groundwood Studies.

In general, groundwood pulps from insignis pine are equal to spruce in strength, but inferior from the standpoint of colour and dirt. Elimination of the pith or core rot in the growing tree by appropriate mycological and silvicultural control would reduce the dirt count materially. The power requirements of grinding insignis pine are relatively greater than those of spruce. While these power figures are on the basis of the experimental semi-commercial equipment, the same relation would undoubtedly hold for standard commercial-sized equipment.

Tawa, being a hardwood, produces a pulp much inferior to spruce in strength, but of excellent colour, and comparatively free from dirt. The power requirements per ton indicated were not excessive, and the possibilities of the fibre as a filler are good. In seems desirable, in grinding tawa, to use a comparatively sharp stone in order to minimize the loss of fine material in the white water. The matter of size of grit of the pulp-stone should also be given consideration. The pulp made at the Madison Laboratory was, in general, more finely divided than that made at Ladysmith, but a closed white-water system is essential in any proposed installation.

SULPHITE PULPING STUDIES.*

Objectives and Scope of the Work.

In line with the major objective of this study, the principal effort in the sulphite pulping experiments was directed toward the production of a grade of pulp suitable for newsprint. Incidentally some attention was given to the bleaching of certain of the pulps produced, and applying to the minor objective of producing a bleached sulphite stock.

The experimental work was limited to the three major species—rimu, tawa, and insignis pine—with the exception of one scout cook made upon European larch. The minor species, Austrian and Corsican pine, and the European larch, were eliminated from consideration on the basis of previous laboratory tests on various pines, which have shown that the high resin or pitch content of such species render them unsuited to the sulphite process.

The Sulphite Process.

Briefly, the sulphite process consists in delignification of wood by the action of a solution of sulphurous acid and bisulphite of lime. The wood, in chip form, is subjected to the action of these reagents in an acid-proof vessel, called a digester, at relatively high temperatures and under pressure. Presumably the principal reactions are hydrolysis and sulphonation. The sulphurous acid effects an hydrolysis of the ligno-cellulose, separating cellulose and lignin, at the same time sulphonating the latter. The lime present (often termed the " base ") acts to neutralize the lignin-sulphonic derivatives, forming soluble calcium salts, which are removed in the waste liquors. Cellulose fibre, or pulp, is left in a reasonably pure state.

The sulphite cooking-liquor is commonly termed the " acid," and its two components, the dissolved sulphur dioxide or sulphurous acid and calcium bisulphite, are known as the " free " and the " combined " sulphur dioxide respectively. The sum of the two is often referred to as the " total." As noted above, the lime is frequently referred to as the " base."† Its principal function is the formation of soluble lime salts of the lignin-sulphonic acids resulting from the cooking action. If the amount of " base " present is inadequate, these lignin compounds tend to resinify and darken the pulp, a phenomenon known as " burning." The maintenance of calcium bisulphite in solution depends upon the presence of an excess of sulphur dioxide, these components being in equilibrium. If for any reason excessive amounts of sulphur dioxide are removed from the system, the bisulphite will revert to the normal calcium sulphite, an insoluble salt. Such an action results in so-called " liming " (depositing of a lime-like precipitate), and the base is said to have " dropped out." A number of the above terms will be used in the following discussion.

The most important factor in cooking sulphite pulp is the control of temperature. The factor of second importance is acid strength and composition. The latter is so chosen as to ensure a thorough penetration of the wood prior to actual cooking, which has been found to start around 110° C. when the digester has reached so-called " pressure " (about 75 lb. per square inch). Thereafter the manner in which the steam is applied and the temperature controlled governs the rate of cooking and the quality of the product produced. Usually a definite schedule is followed, often termed a " cooking curve." The curve used depends upon the kind and quality of wood and the type of pulp desired. In normal operation it covers the temperature-range between 110° C. and 148–150° C. Various typical schedules or curves have been found to produce pulps of different properties and in varying yields, as will be brought out later in the report.

Unbleached sulphite pulp constitutes from 20 to 30 per cent. of the average newsprint paper, and the total quantity of sulphite pulp used for this purpose is quite large. Bleached sulphite pulp finds wide use in book, magazine, and writing papers when mixed with pulps of other types, and is also used in the production of specialties, glassine, and certain grades of wrappings.

At present practically all sulphite pulp is produced from the soft woods. Spruce is the species most commonly used. Hemlock is quite extensively employed for newsprint sulphite, and a limited quantity of hardwood is now pulped for use in certain specialties.

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* The sulphite studies were made under the supervision of Mr. W. H. Monsson.

† Calcium is the " base " most commonly used. Certain liquors, however, contain considerable quantities of magnesium, and practically any alkali or alkaline earth might serve as a base.