

**The Rubber Hydrocarbon in Hevea Latex \***

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The average molecular weight of the rubber hydrocarbon in Hevea latex as it leaves the tree can be rapidly estimated by viscometric or osmotic measurements if the latex is brought into solution in benzene and the water phase removed by partial evaporation under reduced pressure. The use of a non-polar solvent such as benzene is preferred to the use of vistex solvents since a highly polar component in a mixed solvent can produce a coiling-up of the rubber molecule thereby reducing its intrinsic viscosity and the magnitude of this reduction is a function of the molecular weight and of the presence of gel structure. The molecular weight distribution, however, can be satisfactorily obtained by fractionation of vistex solutions prepared from latex as it leaves the tree.

The hydrocarbon in Hevea latex samples obtained at the tree is found to be of high average molecular weight with a broad molecular weight distribution from several million down to below 100,000 (estimated using Magat's values of the constants  $K$  and  $\alpha$  in the Flory-Houwink equation  $[\eta] = KM^\alpha$  and confirmed by osmotic measurements); the major portion of the hydrocarbon lies in the high molecular weight range with intrinsic viscosity in excess of 6 (mol. wt. above  $10^6$ ). The presence of small proportions (generally  $<1\%$ ) of oxygen chemically combined with the rubber is confirmed in the most-soluble fractions of low mol. wt. (below 100,000) isolated in fractionation procedures, even when the latex is extracted from the tree under considerations precluding access of air. These are soft plastic rubbers which on treatment with alkali are converted into viscous cold-flowing gums without producing any appreciable change in their intrinsic viscosity.

Considerable differences in average mol. wt. are found between trees and although significant differences are also observed between days within given trees through-

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out the course of a year's observations there are no indications of significant trends in mol. wt. during periods of biological activity such as refoliation.

Although in a number of cases intrinsic viscosity can be correlated with plasticity of different rubbers, there are such wide deviations from this correlation that intrinsic viscosity cannot be used as a reliable guide to plasticity. Pairs of hard and soft rubbers can be selected which have the same intrinsic viscosity, but osmotic measurements reveal considerable differences in mol. wt. The measurement of plasticity appears to be much more sensitive to the effect of structure (in the sense of regions of cross-linking) than is intrinsic viscosity. True microgel structure in which cross-linking is confined to the individual latex particles may in fact have little effect on the intrinsic viscosity while rendering the rubber very hard, and some experiments with benzidine hardening confirm this view. Although the hydrocarbon in fresh latex passes readily into solution on shaking, static diffusion into petroleum ether does in fact reveal the presence of microgel, the proportion of which is greater in hard rubbers than in soft ones.

