ment to the plant, the agitation rate of the small equipment is adjusted to obtain the same selectivity ratio by using the same oil, catalyst, temperature, and pressure as the plant. Usually, with two or three trial batches, one may match up the equipment and thus be able to produce the same product in the laboratory or pilot plant as the plant equipment produces.

Not only do the reaction conditions and the catalyst determine the selectivity ratio but also many minor components in the oil affect the selectivity ratio. The most dramatic is the effect of gossypol on the hydrogenation of cottonseed oil. Figure 6 shows the change in selectivity ratio with an addition of small amounts of purified gossypol. The rate of the hydrogenation of cottonseed oil is not affected by the presence of gossypol but only the selectivity of the catalyst. Evidently the gossypol is absorbed on the catalyst in such a way that the over-all rate of the hydrogenation is not affected but the relative rates of the various reactions are. Many other materials which are present in oils affect the hydrogenation in a similar way.

The selectivity ratio is the ratio of the rate of linoleic hydrogenation to the oleic hydrogenation, but there is another important reaction involved in hydrogenation, and that is the hydrogenation of the linolenic acid which is present in soybean oil. The linolenic acid is believed to contribute to the flavor reversion of this oil so the primary aim of hydrogenation of soybean oil is to reduce the linolenic content as much as possible. Several schemes have been outlined to calculate the linolenic selectivity of a hydrogenation reaction or catalyst. A simple method, based on Albright's work, is shown in Figure 7 and compares the ratios of the beginning and ending linoleic and linolenic acids. The linolenic selectivity ratio or the ratio of the reaction rates of the hydrogenation of linolenic compared with the reaction rate of linoleic acid may be estimated from the calculated curves. These were calculated from the same equations which were used for the selectivity ratio. In all of the publications and hydrogenations with soybean oil the linolenic acid shows a reaction rate considerably higher than the linoleic acid. A selectivity ratio for linolenic acid of about two is the usual ratio for nickel catalysts. Surprisingly, the reaction conditions do not affect the linolenic selectivity to any great extent.

It was found also that palladium has a somewhat higher linolenic selectivity and shows the ratio to be about three whereas at the same time the linoleic selectivity or the SR of a palladium catalyst is somewhat lower than that of the nickel catalyst. Also, palladium forms much more *trans* than nickel under conditions to give the same SR. It can be seen that the type of catalyst affects the comparative speeds of the various reactions. Thus there is no one catalyst that is best for all products. It can be seen that the selection of the hydrogenation catalyst should be made only after a study of the reaction product which is desired, the particular equipment which is being used, and, of course, the type of oil as well as degree of refining because all of these things affect the catalyst and thus the product which is formed.

The use of the selectivity ratio in the future should make possible a better comparison of catalyst and reaction conditions. If this selectivity ratio is used in future publications, it will be possible to compare catalysts and to aid in the preparation of catalysts which will hydrogenate one single type of molecule over those others that are present in the mixture.

• *Obituaries*

L. B. Parsons (1938, retired), died Feb. 28, 1968, in Ridgewood, N. J.

W. S. Singleton (1943), research chemist at the Southern Regional Research Laboratories, New Orleans, died recently, according to word received at Chicago headquarters.