



Fig. 3. Differential spectra of olive and rape seed oils and their mixtures with olive oil as reference

chart paper. Differences in the spectra of the two oils, which are not apparent by normal recording, are clearly indicated by deviations above and below the reference spectrum. These deviations are characteristic of the type of oil, and in some cases may be used for identification purposes.

Fig. 1 shows the differential spectra of olive, cotton seed, safflower seed and soybean oils relative to olive oil in the reference beam. Similarly, Fig. 2 shows the differential spectra of olive, coconut and palm kernel oils against olive oil. In both figures the percentage transmission scale has been displaced for each spectrum in order to permit the presentation of several spectra in the same figure.

The differential spectral procedure was also applied to mixtures of oils. Fig. 3 shows the differential spectra for mixtures of olive and rape seed oils relative to olive oil. As little as 20 per cent of rape seed oil may easily be detected in olive oil by this method. A similar sensitivity has been attained for the detection of several other oil mixtures.

Using this procedure, more than two hundred samples of olive oil have been examined for adulteration. Rape seed oil was detected in several samples, and its presence confirmed by isolation and characterization of the erucic acid. All olive oil samples found to be pure by the infra-red procedure were shown to be free of adulteration by all other methods tried.

The correlation between the various peaks and depressions in the differential spectra with the chemical composition of the oil has not been completed, but the peak at $1,078 \text{ cm}^{-1}$ which is apparent in the rape seed - olive oil mixtures appears to be proportional to the erucic acid content of the rape seed oil.

This differential infra-red technique also shows promise for the detection of foreign fats in butter fat, and can be used for the rapid identification of unknown oils. A full report on this work will be published elsewhere.

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Influence of Ion Exchange on Size and Shape of Chain-like Polyelectrolyte Molecules

ON conversion of the sodium salt of alginic acid (poly-*d*-manuronic acid) into the magnesium salt, a marked alteration of molecular weight and viscosity properties takes place, as shown by the figures in Table 1. The molecular weights were determined by light scattering and refractivity measurements ($\lambda = 536$ and $446 \text{ m}\mu$, angular scattering dependence, in some tests, between 135 and 25° , 19 angles), and the viscosities were measured in Flory and Couette viscometers, the rate of shear being varied from 0.4 to $2,500 \text{ sec}^{-1}$. In most experiments the solvent was an unbuffered aqueous solution of, respectively, 0.100 M sodium chloride and 0.0200 M magnesium chloride, pH about 5 , but some of the viscosity tests were also made in solutions of different ionic strength and in the presence of sodium or magnesium veronal buffers, $pH = 7.43$.

Table 1

	Weight average molecular weight $\times 10^{-3}$ ($26 \pm 2^\circ$)	Intrinsic viscosity $100 \text{ cm}^3 \text{ sol./gm.}$ (25.0°)	Influence of rate of shear on viscosity at low ionic strength
Sodium alginate	110 ± 20	9.34 ± 0.09	Relatively large
Magnesium alginate (I)	$1,250 \pm 300$	6.86 ± 0.07	Small
Magnesium alginate (II)	350 ± 100	7.80 ± 0.10	

Magnesium alginate (I) was prepared from a non-oriented sodium alginate gel by treatment with 2 M magnesium acetate, the alginate concentration being $0.5 \text{ gm.-equiv./l.}$ reaction mixture. Magnesium alginate (II) was obtained by dialysing solutions of the same sodium alginate, $0.015\text{--}0.05 \text{ gm.-equiv./l.}$, against 0.02 M magnesium chloride. On reconversion of (I) into sodium alginate a material of average molecular weight $(96 \pm 8) \times 10^3$ was obtained.

The results indicate that the bivalent magnesium ions combine with carboxylate groups of the alginate to form inter- and intra-molecular salt bridges, while the monovalent sodium ions are not capable of producing such links. The relative number of inter- and intra-molecular bridges must depend on: (a) the degree of orientation of the alginate chains at the moment of the sodium magnesium ion exchange; (b) the concentration conditions. In the magnesium alginates (I) and (II), both inter- and intra-molecular bonds appear to play a part: the former are made responsible for the large molecular weights, while the latter bring about a more compact configuration, which in turn gives rise to relatively small intrinsic viscosities and rate of shear dependence.

A detailed description of these experiments and molecular dimensions will be given elsewhere.

We are grateful to Prof. J. A. V. Butler who made it possible for us to use the Couette viscometer at the Chester Beatty Research Institute.

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