Note

Semi-quantitative estimation of the composition of alginates by infra-red spectroscopy

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It has been noted previously that the 1800–700 cm^{-1} region of the i.r. spectra of alginic acids can provide useful qualitative information concerning their composition[1]. The purpose of this communication is to indicate that if the i.r. spectra are good enough they may be utilised to provide at least a semi-quantitative estimate of the proportions of mannuronic and guluronic acids in alginate samples.

The i.r. spectra of polymannuronic and polyguluronic acids are shown in Fig. 1. There are several differences between these two spectra in the 1800–700 cm^{-1} region, but the bands of particular interest occur at 808 and 787 cm^{-1} in the spectra of polymannuronic acid and polyguluronic acid, respectively. In Fig. 2 are shown the spectra and ManUA/GulUA ratios of samples of alginic acid differing widely in composition. These alginate samples were generously provided by Dr. A. Haug of the Norwegian Institute of Seaweed Research, and the proportions of mannuronic and guluronic acids were determined previously according to the methods devised by

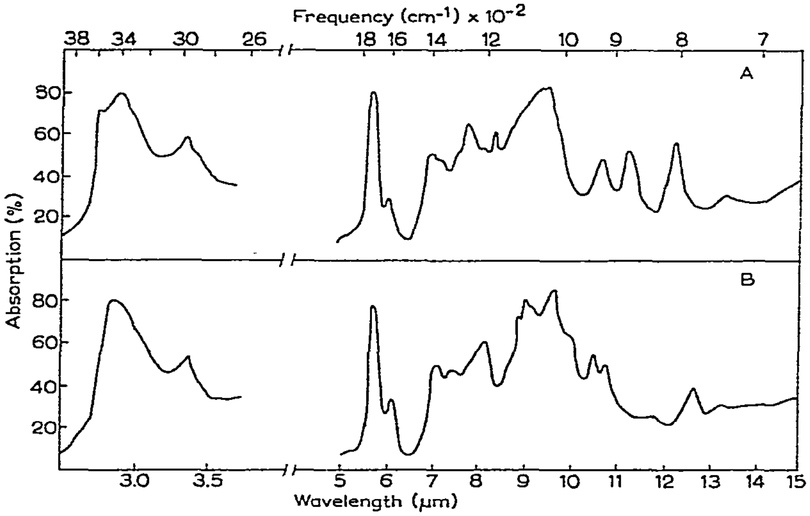
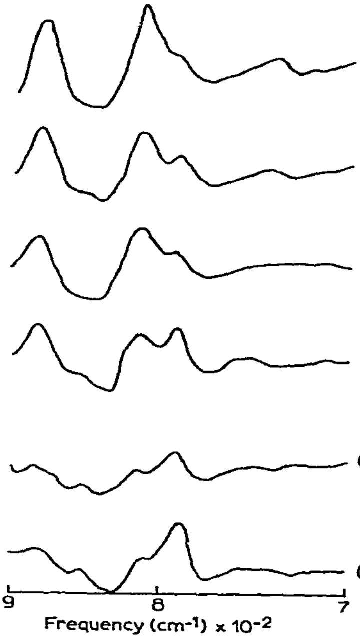


Fig. 1. I.r. spectra of polymannuronic acid (*A*) and polyguluronic acid (*B*).

Haug and Larsen[2]. During recent studies of the crystalline structures of polymannuronic acid and polyguluronic acid[3,4], it was found that the areas of the bands at 808 and 787 cm^{-1}, measured directly from the i.r. traces, gave values which were generally in very good agreement with the ratios of mannuronic and guluronic acids determined earlier. The figures obtained from the i.r. spectra were reproducible to within 10% and apparently not dependent on the sample preparation. I.r. spectra were recorded by means of a Grubb–Parsons GS2 double-beam spectrometer from films of alginic acid prepared by immersing solutions of sodium alginate (0.5–1%) in 0.5M hydrochloric acid. The films so obtained were washed through a series of aqueous ethanol solutions to 70% ethanol and dried on glass plates prior to mounting for i.r. examination.



	ManUA/GulUA	
	Infra-red	Ref. 2
(a)	2.3	2.1
(b)	1.8	1.3
(c)	1.8	1.6
(d)	0.92	0.80
(e)	0.50	0.50
(f)	0.33	0.38

Fig. 2. I.r. spectra and ratios of D-mannuronic and L-guluronic acids (ManUA/GulUA) in alginic acid samples of different composition.

Although the agreement between the two sets of values is surprising, it is not intended to claim the i.r. method as a substitute for other established procedures[2,5]. However, in view of its simplicity and the rapidity with which a result can be obtained, it is suggested that the method might find application in instances where large numbers of samples are to be screened. For example, it has been invaluable for monitoring the composition of alginates extracted by various solvents from different algal tissues and in instances where only small amounts (1–2 mg) of alginic acid are available.

ACKNOWLEDGMENT

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