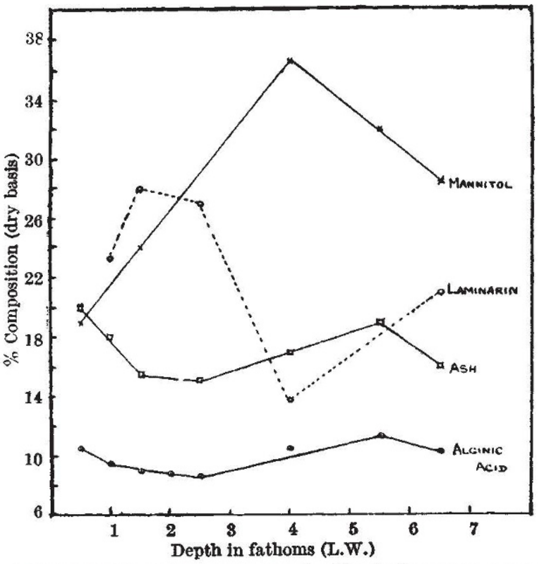
Seasonal Variation in Chemical Constitution of some Common British Laminariales

It is well known that seaweed, vast quantities of which grow around the coast of Scotland, undergoes wide seasonal variation in chemical constitution. Very little use has been made of these seaweed resources, which may be due to the fact that in Britain they have never been studied intensively from a chemical point of view, and no simple analytical methods have been available for the estimation of the various constituents. The future of any seaweed industry now depends on a thorough knowledge of the organic constituents, which are mainly polysaccharide in nature, and it is the latter which are subject to such wide seasonal variation. It is important, therefore, that the variation of the chemical constituents throughout the year be known, so that the seaweed may be harvested at the appropriate period in order that the constituent required will be at its maximum.

During the past three years, the Scottish Seaweed Research Association has each month been collecting, off the west coast of Scotland and in the Orkneys, samples of the principal British Laminariales. Before drying and preparing the plants for analysis, they are separated into fronds and stipes and analysed individually. Previous workers[1] have apparently analysed the whole plant, and they give no details of the methods of sampling, drying, etc., which are of great importance in plant analysis. During our investigations, every effort has been made to collect the plants from the same habitat and to dry and prepare the samples for analysis under controlled conditions.

Our results have shown that the wide seasonal variations in constitution previously recorded are due almost entirely to variations in the composition of the fronds, which are annual, whereas the stipe is perennial, and it is in the frond where most of, if not all, the photosynthesis occurs. In the spring of each year the frond is renewed, when its composition is approximately the same as that of the stipe; that is, high in mineral matter, proteins and alginic acid; low in mannitol, and containing no laminarin. As photosynthesis proceeds, the mannitol accumulates in the frond and reaches a maximum about midsummer, while laminarin reaches a maximum in the late autumn when the mineral matter is at a minimum and the dry-weight content at a maximum.



Variation in composition of *L. Cloustoni* fronds from Orkney with depth of immersion (August, 1946)

It is interesting to note that, in all the samples analysed, very little or no laminarin was found in the stipes; and it is quite probable that it is entirely absent.

Variation in chemical composition, however, depends on another important factor, the depth of immersion of the seaweed. The relationship between the depth of immersion of Algæ and their metabolism, as expressed by their chemical composition, has previously been noted by Haas and Hill[2] and Barbara Russel-Wells[3], who found a direct increase of fats and fat-like substances with degree of emergence and an increase in the unsaponifiable residue with depth of immersion. No other work appears to have been carried out on this important aspect.

In August 1946, samples of *L. Cloustoni* were taken from the Orkney waters at depths of ½–6½ fathoms (dead low water ordinary spring tides), and the analysis of the fronds, given in the accompanying graph, show remarkable variations.

The mannitol content (36·7 per cent), even when expressed on the whole plant, is considerably greater than any figure previously recorded. In addition, the iodine content increases with depth of immersion and reaches the remarkable figure of 1·25 per cent (on the anhydrous basis) at 7½ fathoms.

Further samples of the *Laminaria Cloustoni*, *Laminaria digitata* and *Laminaria saccharina* have been taken in Orkney in May and July of this year, and the results so far obtained support the previous findings.

This work is being continued and a more detailed report will be published later.

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[1] Lapicque, M. L., *C.R. Acad. Sci. Paris*, **169**, 1426 (1919). Colin, H., and Ricard, R., *C.R. Acad. Sci. Paris*, **190**, 1514 (1930). Ricard, R., *Bull. Soc. Chem. Biol.*, **13**, 417 (1931). Lunde, G., *Z. ang. Chem.*, **50**, 731 (1937); *Papir J.*, **28**, 147 (1940). Dillon, T., *Chem. Age*, **49**, 279 (1943).

[2] Haas, P., and Hill, T. G., *Ann. Bot.*, **47**, 55 (1933).

[3] Barbara Russel-Wells, *Nature*, **129**, 654 (1932).

Aerobic Mesophilic Bacteria in Composts

In a previous communication[1], an account was given of the activity of the thermophilic flora which develops in composts made from grass cuttings (lawn mowings). This thermophilic flora can be seen as a white coating on the cuttings, particularly in the upper layers during the high-temperature phase. From it true and facultative thermophilic bacteria were isolated. Recently, in addition, evidence of the presence of a thermophilic actinomycete has been obtained (cf. Waksman *et al.*[2]).

The object of this communication is to give a general account of the behaviour of the aerobic mesophilic bacterial flora of this type of compost. The accompanying table gives the results of bacterial counts using the dilution plate technique (plates incubated at 25° C. for seven to nine days) obtained from samples taken from the centre of composts at different times during the composting period. The moisture content remained practically constant throughout this period.