are all negative. Electrical conductivities of molten salt mixtures containing lithium ions showed definite deviations from additivity.

A description was given by Prof. M. Chemla (Paris) of measurements on diffusion and electrical mobility of cations in various halide or nitrate melts containing lithium, sodium, and potassium. The Nernst-Einstein relation was not obeyed, and relative mobilities of the ions changed with increasing temperature. The results suggested formation of complexes or incipient clusters, the size of which decreased and number increased with increasing temperature. Queries were raised about the validity of the method used (counter-current electromigration) in determining relative ionic mobilities, and about the strict applicability of the Nernst-Einstein relation to molten salts.

The importance of measurements of the temperature dependence of the excess heats of mixing was emphasized. Direct experimental values of excess functions would be more helpful than indirect measurements. Any statistical theory would give the excess free-energy, G^E , as a function of temperature, T , pressure, P , and composition, x .

Since critical points cannot be determined, the theory of corresponding states is not applicable to melts. Lattice theory applied at constant pressure tends to be uninformative, but constant volume measurements ought to be more useful. Experimental methods are now available for obtaining both first and second derivatives of G^E , but there is no satisfactory theory for G^E itself. This is unfortunate since it is very difficult to construct sensitive partition function theory for liquids based on second derivatives.

It was reported that the heat of solution of water molecules in lithium, sodium, potassium nitrate mixtures had been found to be about 14 kcal. If the greater part of the solution energy is due to ion-dipole interaction, the experimental results are in good agreement with theory. Finally, various speakers urged the need for an effort to correlate and assess the relative accuracy of various thermodynamic data available on molten salts. At the present time, thermodynamic data of increasing accuracy is gradually becoming available, but a satisfactory theoretical description of excess functions of molten salts is still lacking.

A. R. UBBELOHDE

PLANT WAXES AND CUTINS

A ONE-DAY meeting on "Plant Waxes, Cutins and Associated Compounds" was organized by the Phytochemical Group at the School of Pharmacy, London, on January 7. The object of the meeting was to review the progress that has been made in this field since the 'thirties when Prof. A. C. Chibnall and his colleagues separated and identified the odd- and even-numbered long-chain fatty acids in plant waxes. The chairman, Dr. G. S. Hartley (Chesterfield Park Research Station, Saffron Walden), in his opening remarks, referred to the very considerable complexity of leaf surfaces and to the importance of knowing more about them, since much of present-day agriculture depended on the successful application of herbicides which would penetrate the leaves of weeds, leaving crop plants undamaged.

A very elegant but simple method for obtaining close-up pictures of intact leaf surfaces has recently been developed by Dr. B. E. Juniper (University of Oxford), who gave the opening paper. He showed electron-microscope photographs of the many different and complex crystalline patterns of the waxes that coat the leaf surfaces of most plants and described how leaf waxes provide a mechanism in pitcher plants for the retention of insects by preventing them from climbing out. In the second paper, Dr. G. E. Eglinton (University of Glasgow) reviewed the chemistry of leaf surface waxes, mentioning that besides the well-known n -alkanes and their alcohol, aldehyde and acid derivatives, long-chain β -diketones, alkenes and branched-chain alkanes had recently been found. Besides the intrinsic interest of these substances as wax constituents, there were indications, according to Dr. Eglinton, that alkane derivatives were of taxonomic value. Though there was much qualitative and quantitative variation in the chain-lengths of these hydrocarbons, their identification, by gas-phase chromatography, had become a routine matter.

Another technique that has been developed in recent years for separating leaf waxes is thin-layer chromatography, and in the third paper Dr. E. V. Truter (University of Leeds), the pioneer in this field, described the use of thin-layer chromatography for the separation and analysis of the leaf waxes of the cabbage. Of the twenty-nine compounds present, the most important were nonacosane and its related primary alcohol, acid and esters. The related ketones, ketols and secondary alcohols, which were also present, were characterized by oxidative

fission and identification of the chain fragments by thin-layer chromatography on damp kieselguhr.

The plant cuticle, the non-cellular membrane which covers the epidermis, appears to be chemically distinct from the wax above it. This is so, for example, in the apple fruit, which has been extensively investigated by Dr. J. T. Martin of the Long Ashton Research Station, Bristol. While the wax contains the usual range of hydrocarbon derivatives and also the triterpenoid, ursolic acid, the cuticle consists almost entirely of esters of 10,16-dihydroxyhexadecanoic and 9,10,18-trihydroxy-octadecanoic acids. Dr. Martin also found tannins, quercetin glycosides and other phenols in the cuticle, but commented that they did not appear to participate directly in the cutin complex. The next paper, by Dr. P. Mazliak of the Sorbonne, Paris, dealt with the metabolism of apple fruit waxes. Radioactive acetate was supplied to growing apple peel and the waxes were later saponified and analysed by gas chromatography. To his surprise, Dr. Mazliak found that, although the alcohols and acids such as linoleic and oleic acids were labelled as expected, there was no radioactivity in the paraffins. He obtained the same result with mature peel and could only conclude that the paraffins were synthesized by a separate pathway from the other wax constituents.

The final paper, by Dr. D. F. Meigh (Ditton Laboratory, Maidstone), was concerned with the relationship between apple waxes and storage disorders. He described his own investigations of superficial scald, the most important cause of wastage in the stored apple crop. Although the condition is controlled by wrapping apples in oiled tissue, its cause is as yet undetermined. Attempts to correlate the rise in concentration of linoleic acid in the apple skin at maturity with the incidence of scald have failed. Dr. Meigh did have some evidence that the paper wraps reduced the concentration of carboxyl compounds in the apple wax; another possibility was that volatile substances were involved. It was clear from this and other papers that much more information is needed before practical problems involving leaf surfaces can be solved. As Dr. Hartley pointed out in his closing remarks to the meeting, besides its main purpose as a skin to protect the plant from its immediate environment, the plant surface presumably has to fulfil a range of other functions, about which we are still very ignorant.

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