

juice. Ten fluid ounces (half a pint), or ten ordinary rations of lime juice, may by careful evaporation be reduced to a semi-solid extract, which can be nearly all contained in a tablespoon. This extract, further, may be mixed with sugar, or with rum, or with rum and sugar, in the proper proportional quantities of each for use as a ration, and the inconvenience of separate measurements be avoided, while the sugar or rum, or both of them, would tend to preserve the extract unchanged. A concentrated preparation, having a semi-liquid form at low temperatures, and being, therefore, readily divided into definite rations, may also be obtained by mixing extract of lime juice with glycerine, in such proportion as may be found most convenient—the freezing point of glycerine being so low as -40° Far.; and this preparation, like the others mentioned, would be less liable to undergo decomposition than the simple extract, and still less so than the crude juice, on account of the well-known preservative power of glycerine. One of the most convenient concentrated preparations of lime juice is, however, that in which the extract is converted into the form of lozenge, of which two kinds, prepared by Mr. Gale, were submitted to the Committee and to several of the witnesses, and pronounced to be pleasant and to possess the characteristic fragrance of lime juice (5395, 8617). In one of them the ordinary ration of an ounce of lime juice is represented by four lozenges, and in the other by three lozenges. Four of either kind weigh only half an ounce, and no fuel would be consumed nor time lost were they used by sledge travellers. A preparation was also submitted to the Committee by Mr. White, in which extract of lime juice is contained in biscuits. As the biscuits, however, are not very palatable, their regular use would probably become distasteful.

None of these preparations, however, have been subjected to actual trial, and until it has been experimentally demonstrated that they are as efficient as crude lime juice in preventing or curing scurvy, it would be highly imprudent to use them in sledge travelling. The whole teaching of Pharmacology, at the same time, undoubtedly indicates, so far as can be done in the absence of experiment, that they would be found to possess the valuable properties of lime juice.

Lime juice when carried in the ordinary and crude state by sledge parties has not only the inconvenience of materially adding to the weight of the equipment, but also of being difficult to use on account of its assuming the solid frozen form when subjected to a low temperature,* and on account of its requiring to be diluted with water. Additional fuel must, therefore, be carried on the sledge, and additional time must be occupied in thawing it, and in thawing the water with which to dilute it. In order to some extent to obviate these difficulties, it has been proposed that the lime juice should be mixed with tea, rum, or pemmican when these substances are about to be consumed. The most feasible of these proposals is undoubtedly the last, with respect to which Sir Alexander Armstrong observed, "I believe that if the lime juice were so added to the pemmican when the mess was made, it would render the pemmican much more palatable, the men would take to it more readily, and it would aid very materially the assimilative process of digestion, and thus, in my opinion, would enable them to eat their full allowance, or even more if they could get it." (9008).†

The further inconvenience results from the freezing of lime juice, of the bottles in which it is carried being broken by the expansion of the juice. Besides the adoption of obvious precautions to lessen the risk of this accident occurring, advantage would probably be gained by carrying the lime juice in conical bottles, as suggested by Professor Macdonald (4937).

The question of the deterioration of lime juice by its subjection to very low temperatures (3472) has been set at rest by the observations made with the lime juice found at Polaris Bay. It had been subjected to the temperature of an arctic climate for five years, and was found at the end of that time to possess most marked antiscorbutic properties; for it is stated to have materially aided the recovery of a large number of patients suffering from scurvy who were treated with it (2886–2902).

The fully established value of lime juice and the conveniences attending its use render it greatly superior to all other suggested antiscorbutic remedies. Owing to the great difficulty of obtaining fresh vegetable food in arctic regions, some advantage may no doubt be derived from cultivating quickly-growing hardy vegetables, as was done in the recent and in previous expeditions. A list of the plants most suitable for this purpose is contained in a letter from Dr. Hooker, which was brought before the

* Unfortified lime juice freezes at $+25^{\circ}$ Far.; and when fortified with 10 per cent. of spirit, at about $+15^{\circ}$ Far. (4936).

† It is interesting to find that Solomon Albertus, when recommending the use of lemons and oranges in scurvy (1573), indicates that their juices may be sprinkled on roast meats. See also Extracts from John Woodall's "The Surgeon's Mate," foot note, p. xxvii.