Preservation of Whole Fruit with Sulphur Dioxide.

J. M. ARTHUR, *Orchardist, and* **M. S. BENJAMIN, D.I.C., A.A.C.I.**,
Lecturer in Chemistry, Hawkesbury Agricultural College.

SULPHUR dioxide, as well as its various compounds, such as bi-sulphite of potash, bi-sulphite of lime, has long been used for the preservation of wines, beers, fruit beverages, and various articles of food. Sulphur dioxide has also been employed to some extent for the preservation of fruit pulp.

At the suggestion of the Fruit Branch, some experiments were recently carried out at the orchard of Hawkesbury Agricultural College with a view to determining if whole fruit could be suitably preserved under local conditions by the use of dilute aqueous solutions of sulphur dioxide. Similar experiments were sometime ago carried out by Baker and Grove at Campden Fruit Research Station, Glos., England, and are described by those workers in a recent issue of the *Journal of Pomology and Horticultural Science* (Vol. V, No. 1, December, 1925). In the experiment referred to satisfactory results are reported as having been obtained in the preservation of raspberries, blackberries, strawberries, plums, and other fruits by the use of this preservative.

The following is a brief report of Preliminary trials at Hawkesbury Agricultural College, and of the results obtained so far with plums and grapes.

Trial with Plums.

Trials with plums were commenced on 13th January, the variety used being Cyca Smomo (a blood plum). Half-gallon screw top jars were used, being filled with fruit of uniform size and maturity.

Aqueous solutions of sulphur dioxide, with concentrations of 0·08, 0·09 and 0·10 per cent. respectively were prepared. These solutions were poured over the fruit contained in three separate sets of jars, which were subsequently labelled sets 1, 2 and 3. After the solutions had been added the jars were tighty sealed, and the contents examined a week later. All the fruit was found to be in good state of preservation, but the skin had become considerably bleached.

The contents of sets 2 and 3 developed strong acidity, while the fruit in set 1 was only slightly sour. A further experiment made two months later showed that the fruit in all the sets was still fresh and sound, and that no fermentation had occurred, but it was still sour, and the skin as well as the flesh had undergone considerable bleaching, so that the latter was now a faint pink colour.

An attempt was then made to see whether cooking would restore the fruit to its natural colour, or diminish its acidity, the tests being :—

(a) By heating a portion of the fruit in an open boiler.

(b) By steaming a portion while still in its container.

In both cases it was found that the natural colour of the fruit was partly restored by these methods, and that the acidity was considerably reduced. The restoration of the colour was more complete when the cooking was done in an open boiler than when in its container.

The experiments would seem to indicate so far that 0 :08 per cent. sulphur dioxide solution was sufficiently strong for the preservation of the variety of plums tested, but it would appear desirable to try the effect of lower concentrations, say, :06 and :04 per cent. of sulphur dioxide on these and other varieties of plums. It is proposed to do this next season.

Trials with Grapes.

Experiments with grapes were also carried out. Four varieties were selected, namely—Gros Moroc (black grape), Gros Guillaume (black grape), Flame Tokay (pink grape), Waltham Cross (white grape).

On 24th February, 1927, three 1-quart jars of each variety were prepared and covered with the preservative solution, as in the experiments with plums. It was thought desirable in the case of grapes, these being more delicate fruit, to try the effect of a more dilute solution of sulphur dioxide. With this end in view, concentrations of 0 :08, 0 :06, 0 :04, 0 :01, and 0 :08 per cent. of sulphur dioxide, which was labelled Nos. 1, 2, 3, and 4 respectivey, were used.

The fruit was examined on 10th March, and it was noted that Nos. 3, 4, and 5 had undergone more or less fermentation. In the case of Nos. 1 and 2, no fermentation could be detected, but bleaching of the skins in the case of the coloured grapes had occurred. The natural flavour of the grapes had been retained.

On 1st June (over three months after the fruit had been preserved) cooking experiments, on similar lines to those adopted with the plums were carried out with Nos. 1 and 2, and the original colour of the black grapes was partly restored, but no change took place with the Flame Tokay variety. It remains quite bleached.

An interesting point was noticed with the black grapes. A control jar of grapes that was not cooked, but of which the lid was left, in twenty-four hours developed a similar colour to that of fruit that had been cooked. The probable explanation of this, and of the colour changes obtained when the fruit was cooked, is that the sulphur dioxide has a slight reducing effect on the natural pigment found in the fruit, and on the removal of the excess sulphur dioxide, which is brought about when the fruit is heated or simply aerated, a re-oxidation of the pigment substance occurs, and the fruit is restored wholly, or in part to its natural colour.

The changes observed naturally lead one to enquire whether, apart from its preservative action, sulphur dioxide has any direct chemical effect on other constituents of the fruit. In connection with this point it is interesting to note that some studies—vide *Journal of Pomology and Horticultural Science,* Vol. V. No. 1, December, 1925—has been carried out lately by Appleyard at the Campden Research Station, England, dealing with this aspect of fruit preservation with sulphur dioxide. It was found that the enzymes present in the fruit were inactivated by treatment with the preservative, just as such enzymes are inactivated or destroyed when the fruit is boiled during the process of manufacture into pulp. It has also been observed that the fruit so treated undergoes some loss in "jelling" powers when used in the manufacture of jam.

Further trials with different fruits and varieties are necessary in order to determine how far the method described is applicable and practicable under Australian conditions. If it should be found from subsequent investigations that ordinary varieties of Australian-grown fruits could be satisfactorily preserved in this way, this process would seem to compare more than favourably with other methods of fruit preservation in common use. It would, for example, allow of fruit being kept and marketed in a more attractive form than when it is reduced to pulp.

Apples, for instance, could be preserved whole or in sections, instead of being reduced to pulp, and the product would probably command a higher market value. Moreover, the preserved product could be used as an article of food in the same way as bottled or canned fruit, and the labour and time involved in its preparation would be considerably reduced. In addition, surplus fruit obtained during a glut season could be stored and profitably utilized for jam manufacture, the labour and time involved in its preservation being less than that required to preserve it, as at present, in the form of pulp.—*The Agricultural Gazette of New South Wales,* Vol. XXXVIII. Part 2., 1927.