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The Dehydration of Apricots and Peaches*

The dehydration of fruit has been investigated by C.S.I.R.O. over a period of five years, and techniques have been developed which give a product superior to the conventional sun-dried article.

This paper deals with procedures applicable to apricots and peaches.

Apricots

Raw Material.

Considerable care must be exercised in the selection of the fresh fruit if a choice product is to be obtained. The two most important considerations are variety and maturity. No varietal trials have been carried out, but it is known that Moorpark, Royal, Trevatt and Tilton varieties all give satisfactory results. The fruit should be picked as near tree-ripe as possible to ensure maximum flavour and colour. In dehydrating apricots colour is most important, since there is no opportunity for colour development during processing such as occurs in the longer sun-drying. Consequently, any green colour in the skin persists, and results in a dry sample which is not as attractive to the trade as the rich orange-red of the choice sun-dried apricot. It should be emphasized, however, that this is only an apparent defect since, on cooking, the dehydrated apricot reconstitutes to a colour indistinguishable from cooked fresh apricot, whereas the sun-dried sample remains distinctly different.

Where possible, the raw material should be processed immediately after harvesting. If it is necessary to hold the fruit for more than one or two days, cool storage is desirable.

Preparation of the Fruit.

Where fruit is variable in size, grading is advisable to ensure uniform behaviour during processing. The fruit is then halved, pitted and spread on wooden trays in precisely the same way as practised in sun-

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* Issued by the Dried Fruits Processing Committee, and based on the work of D. McBean and J. Shipton at the C.S.I.R.O., Division of Food Preservation and Transport, Homebush, N.S.W. The Dried Fruits Committee works under the ægis of C.S.I.R.O. and has the following membership :

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drying. A tray loading of 1·5 lb. per sq. ft. is recommended. Some thought needs to be given to the timber from which the trays are constructed, since some of the timbers are prone to taint the fruit, or discolour it, whilst others tend to twist very badly under alternate wetting and drying. Of a range of timbers tested hemlock was found most suitable.

Blanching.

In the United States, investigators such as Mrak, *et al.* (1943) have recommended the blanching of tree fruits prior to dehydration. In experiments carried out here, blanching has produced only one marked effect, viz. it largely removes the air from the tissue and results in a translucent dried product somewhat reminiscent of sun-dried fruit. The unblanched fruit, on the other hand, is opaque and retains the natural colour of the fresh fruit. There is no other detectable difference. Storage life is similar, and when cooked blanched and unblanched samples cannot be differentiated. The desirability of blanching thus depends on whether the translucent appearance of the blanched material has greater sales value than the natural appearance of the unblanched. It is suggested this is unlikely and, therefore, we do not regard blanching as necessary.

Sulphuring.

The presence of sulphur dioxide in dried fruit is essential to ensure satisfactory colour and keeping quality. Sulphuring is normally carried out by exposing the fruit to sulphur dioxide gas produced by burning sulphur in a sulphur house. With vegetables, however, sulphur dioxide is introduced by dipping the prepared material into a solution of sodium sulphite. The time required is only ten seconds compared with the several hours in the normal sulphuring procedure with fruit. In view of this, attempts were made to use a dipping method with fruit. No difficulty was experienced in achieving the necessary level of sulphur dioxide but the procedure was discarded since dipping usually produced an objectionable flavour in the dried fruit.

Consequently, the conventional procedure of treating the fruit with fumes from burning sulphur is recommended. No sulphuring time can be suggested since this is dependent on the type of sulphuring equipment and the method of burning the sulphur. The treatment should be continued for a time sufficient to give 2,500 p.p.m. sulphur dioxide in the dried fruit.

Dehydration.

The most important factors to be considered are the dehydrater, drying temperature, and the drying time.

(*a*) *The Dehydrater.* The type of dryer required will depend on the desired output. For large quantities, the two-stage tunnels such as were used in this country for vegetable dehydration during the war would be suitable. Operating one shift daily, the capacity of the one tunnel would be approximately five tons of fresh fruit. For smaller scale production the single-stage counterflow tunnel commonly used for prunes would suffice. The essential consideration is that the machine which is used should be designed to ensure uniform air-flow and temperature distribution throughout the drying chamber.

(*b*) *Drying Temperature.* In the case of the single-stage counterflow tunnel the temperature of the air at the inlet end is limited by the susceptibility of the driest material to heat damage. For this reason a temperature of 150° F. at the air inlet, that is, the dry end of the tunnel, is regarded as the safe maximum. In the two-stage tunnels higher inlet temperatures are permissible in the primary section.

(*c*) *Drying Time.* It is not possible to specify drying times beyond saying that they will be such as will give a final moisture content of 18 per cent. The drying time will be shorter in the two-stage than in the single-stage counterflow tunnel. A moisture content of 18 per cent. is low enough to prevent mould development and since keeping quality is not significantly improved by lowering the moisture content, there is no advantage to be gained by reducing it below 18 per cent.

Post-Drying Treatment.

Dehydrated fruit of 18 per cent. moisture content will tend to dry out further during storage under most Australian conditions. Since this could mean an appreciable loss in weight, it is desirable to pack the material in moisture-vapour-proof containers or wrappers. Such wrappers could be employed with one pound packages which would then be suitable for direct retailing. Such a method has much to commend it in comparison to the present practice of packing loose in boxes and retailing in the loose condition.

Peaches

The procedure adopted with peaches is essentially similar to that outlined for apricots with a few important modifications.

Raw Material.

Both freestone and clingstone peaches have been successfully dehydrated. Freestone varieties which have proved satisfactory are J. H. Hale (Million Dollar) and Blackburn Elberta, whilst among the clingstone types Golden Queen, Pullar and Phillips have been used successfully. Other varieties which have not been tested might also be amenable to dehydration.

As with apricots, maturity must be carefully controlled, and is probably the most important single factor contributing to the quality of the dried product. All fruit should be firm and fully ripe and, particularly in the case of freestone peaches, processed without any delay after harvesting.

Preparation of the Fruit.

If the fruit is to be processed in halves, size grading is desirable, but is unnecessary for sliced peaches.

Provided freestone peaches are fully mature, a short exposure of about one minute to live steam will loosen the skin to enable it to be readily removed. With clingstone peaches the conventional lye peeling (about one minute in boiling two per cent. caustic soda) followed by high pressure water washing is the only economic method.

Normally pitting, whether by hand or machine, is carried out prior to peeling. In the case of immature freestone peaches, in which the skins are not readily removable by steam peeling and resort must be made to lye, it is advisable to lye peel before halving and pitting, since the stone cavity is liable to be badly discoloured by caustic soda.

After the peeling and pitting is completed, the fruit should be subdivided into sixths (comparable to the slices used in canning) where the material is to be dried as slices.

In sun-drying, the fruit is normally unpeeled and dried as halves. The removal of the skin results in a much more attractive product which, when cooked, is devoid of the unpleasant texture caused by the presence of the skins. In addition, peeling greatly reduces the drying time required to reach comparable moisture contents. Dehydrated halved peaches are considerably better than the sun-dried article, but are considered inferior to dehydrated sliced peaches. The drying time for the latter is only 30 per cent. of that required for halves (comparative figures would be four hours for slices and fourteen hours for halves), and in addition these slices reconstitute very rapidly. Whereas the halves need soaking for some hours to reconstitute properly, the slices can be completely prepared by simply boiling in water for 20 to 30 minutes.

The recommended procedure is, then, to pit, peel and subdivide into sixths. The tray loading is 2 lb. and 1 lb. per sq. ft. for halves and slices respectively. Whilst the tray loading with slices is lower, the potential output is still much greater than with halves.

Blanching, Sulphuring and Dehydration.

The procedures and comments concerning apricots apply equally well to peaches.

Discussion

In assessing the merits of dehydration as a method of preserving apricots and peaches, it is interesting to compare the process with sun-drying and canning. In such a comparison two points need consideration, namely quality and economy.

In relation to sun-dried fruit, there is little doubt that the quality of dehydrated fruit is markedly superior. The only point on which any real contention could exist would be in respect of the colour of dehydrated apricots. This, as mentioned previously, is an apparent rather than a real defect. Economically the process compares favourably. White (1950) estimates that dehydrated fruit would cost $1\frac{1}{2}$d. per pound more to produce than sun-dried fruit. With the quality difference so markedly in its favour, however, it can be said that the dehydrated fruit would retail at a highly competitive price.

When the losses which periodically occur in the sun-dried fruit industry, due to unsuitable weather conditions, are taken into account, it is considered that the production of dehydrated fruit is an economically sound proposition.

In comparing the process with canning, in general a slight quality margin may exist for canned fruit. However, when one examines the relative cost of each on the basis of price per pound as prepared for eating, that is after the dehydrated material has been reconstituted and cooked, there is a considerable difference in favour of the dehydrated material. White (1950) estimates the cost on this basis as 6d. and 11½d. per pound for dehydrated and canned fruit respectively.

References

MRAK, E. M., PHAFF, H. J., FISHER, C. D., and MACKINNEY, G. (1943).—Food Inds. 15 (4): 59.

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Preparation of Sugared Fruits*

Introduction

For many years glacé and crystallized fruits have been familiar and widely marketed products. The methods used in their production commonly involved successive steeping of the prepared fruit in syrups of increasing strength. The time in each syrup was one to two days and the total processing time varied from ten days to three weeks. Other disadvantages inherent in the method are excessive handling, the difficulty of preventing deterioration of the lower concentration syrups, and the necessity for adjusting a series of syrup strengths at frequent intervals.

Several workers have suggested methods by which some of these disadvantages may be overcome. Atkinson and Strachan (1941) proposed a process in which the fruit was held in syrup tanks in a dehydrater, thus giving continuous concentration of the syrup. Jang and Cruess (1949) found that a vacuum treatment of the fruit in syrup was quite successful.

A consideration of the problem indicated that, provided it was compatible with a good quality product, a method in which the prepared fruit was steeped only in a concentrated syrup for a minimal time and then dehydrated to the requisite moisture content would overcome the disadvantages of the conventional methods. A procedure based on these considerations, which has been successfully applied to a range of fruits, is outlined in this report.

Raw Material

Since this product is essentially a confection which commands a higher price than other types of processed fruit, it is possible to impose more stringent selection of the raw material. For the production of a choice product in which the natural flavour of the fruit is retained it is essential that only fully mature fruit be used. However, the fruit should not be soft-ripe, as it tends to disintegrate during processing. The texture of the product is also dependent on the maturity, immaturity being reflected by a tendency to toughness. The colour of the product of this nature constitutes a large part of its sales appeal, and this again makes maturity of prime importance.

The need for using only mature fruit is further emphasized by the fact that the rate of uptake of sugar from the syrup is also adversely affected by immaturity.

In discussing the raw material it is desirable to consider the fruits which may be successfully treated by the proposed method. Apricots, freestone peaches, pears and pineapple have given very satisfactory products. Clingstone peaches have been less successful, having very little flavour and a rather tough texture, although these defects may, in

* Based on the work of D. McBean and J. Shipton at the C.S.I.R.O. Division of Food Preservation and Transport, Homebush, N.S.W., and issued by the Dried Fruits Processing Committee. For constitution of latter committee, see page 59.

part, be traced to immature fruit. It is thought that tree-ripe clingstone peaches would give a much improved product. An attempt to prepare sugared bananas was not successful, the product being unattractive in appearance and flavour. However, with a few possible exceptions it is felt that the method would be readily applicable to a wide variety of fruits.

Preparation of the Raw Material

(*a*) *Grading.*

The fruit should be inspected and all fruit not conforming to the requirements above rejected. In the case of fruit which is processed whole, for example apricots, size grading is desirable, since fruit of widely different sizes will vary in its rate of sugar uptake and particularly in the time required for drying.

(*b*) *Peeling and Pitting.*

With some exceptions, for example apricots, figs and cherries, the fruit should be peeled and, where necessary, the stones or cores should be removed. With apricots and cherries the stones should be punched out and the fruit processed whole. This has been found essential with apricots, as halved fruit tends to " slab " badly and is very difficult to handle.

(*c*) *Subdivision.*

With the exception of those fruits which will be processed whole, subdivision is necessary and the following points need consideration in determining the optimal sizes of the pieces.

(i) The smaller the size the greater labour involved in preparation and the more susceptible the fruit is to damage. On the other hand, it will take up sugar more rapidly and the subsequent dehydration time is reduced.

(ii) The pieces should be of a size suitable for eating " out of hand " as a confection.

The size is obviously not critical. A satisfactory result has been obtained with peaches divided into sixths, and with pineapples in the form of rings or half-rings half an inch in thickness.

(*d*) *Blanching.*

Blanching is carried out in the normal manner by subjecting the fruit to live steam in a suitable cabinet. It is one of the crucial points in the whole process. Its importance is not so much related to enzyme inactivation as to thorough pre-cooking, which will break down the cell organization and permit satisfactory uptake of sugar. Inadequate blanching is reflected by marked shrinkage of the tissues and a low uptake of syrup, resulting in a less attractive product as well as a lowered yield.

Syrup Treatment

Sucrose syrups are prepared by dissolving sucrose in boiling water to obtain 67° Brix solution. Invert syrups are conveniently obtained by hydrolysing 67° Brix sucrose by boiling for 30 min. with 0·4 per cent. citric acid.

The syrup used for steeping the fruit is normally a combination of sucrose and invert sugar, although in specific cases sucrose alone is quite satisfactory. The composition of the syrup has a very marked influence on the characteristics of the finished product. With pure sucrose solutions and a final moisture content in the 23-25 per cent. range, the fruit tends to crystallize more readily than when invert syrup sugar is added. With increased concentrations of invert sugar the dehydrated material loses the tendency to crystallize, but becomes sticky with a tougher texture and often a "jammy" flavour. In addition there is usually a slightly increased rate of deterioration in storage.

The exact composition of the syrup used will, therefore, depend on the fruit being processed and also the characteristic desired in the product. In most cases a syrup containing 10 per cent. invert syrup and 60 per cent. sucrose has proved suitable. With pineapple, however, pure sucrose has given very satisfactory results.

The rate of uptake of syrup by the fruit is influenced by the blanching effect previously mentioned, and by the temperature of the syrup. No extensive work on this aspect has yet been carried out, and the only data determined have been for cold syrup and for syrup with an initial temperature of 70° C. falling slowly to 45-50° C. after 16 hours.

The sugar absorption was more rapid at the higher temperature and the ultimate yield was significantly increased. The relatively high temperature had no deleterious effect on quality. In fact it gave a definite improvement.

The period for which the fruit needs to be steeped in the syrup is a major factor in determining the total length of the process. It was considered that two procedures were feasible for commercial practice. The time should be short enough (say one hour) to permit the material to be dehydrated the same day; alternatively it could be steeped overnight, which would also make a reasonably good operating schedule possible. It was clear that the overnight period of about 16 hours was much better than the shorter time as the total uptake of sugar, and consequently the yield, was markedly increased. Longer times have not been investigated. Although a further increase in uptake is probable, the quality of the material from the 16 hour steeping was highly satisfactory. The increase in quality, if any, which would be achieved by increasing the syruping time would have to be assessed in relation to the additional outlay involved in extra containers and floor area.

At the completion of syruping the sugar solution is removed and the fruit allowed to drain prior to dehydration.

In commercial practice the most suitable procedure would probably be to use the same trays throughout. The prepared fruit would be loaded on to trays at a rate of about 1·5 lb. per sq. ft. and the latter stacked into a tank of appropriate size. The hot syrup would then be pumped into the tank. At the completion of syruping, the syrup would be pumped out and the fruit allowed to drain. It may be an advantage at this stage to rinse the trays with water to remove excess syrup which will otherwise tend to contaminate the factory and the dehydrater.

The ratio of the fruit to the syrup which is suggested is 2 : 3. If excess fruit is added, inadequate uptake of sugar will result.

Sulphuring

Sulphur dioxide needs to be incorporated in the fruit to prevent initial darkening and to ensure reasonable storage life. The usual method of sulphuring is to place the fruit, after removal from the syrup, in an atmosphere of burning sulphur fumes. A much simpler and equally satisfactory method is to use potassium metabisulphite in the sugar solution. This saves additional handling and prevents any discoloration during the time the fruit is in the syrup.

In determining the level of sulphur dioxide desirable in the dried products, two points have to be considered. First, it should be sufficient to give a storage life of at least six and preferably twelve months under normal temperature conditions, for example, a mean temperature of 70° F. Secondly, since the material is to be consumed "out of hand" as a confection, and as there is no opportunity for removing sulphur dioxide, such as occurs in cooking dehydrated fruit, the level should not be such as would give an objectionable flavour, or constitute a health hazard. A level of 500 p.p.m. has sufficed to ensure satisfactory keeping quality and has had no unfavourable effect on flavour. The question of the permissible level in relation to health is more difficult. British regulations preclude the import of this commodity with more than 100 p.p.m. sulphur dioxide, which is so low that it would be practically impossible for fruit to be landed in England in good condition. There is no such limit in Australia and it is considered that the best policy is to adopt the lowest concentration of sulphur dioxide which will give a reasonable storage life. This will be about 500 p.p.m., a value which is achieved by using 0·15-0·25 per cent. potassium metabisulphite in the syrup, the concentration varying for different fruits. If burning sulphur fumes are used it will be necessary to determine the time for any particular equipment, as very divergent results are obtained with this method by different operators.

Drying

Any conventional cross draught dehydrater of satisfactory design can be used for drying sugared fruit.

The drying temperature which has been used extensively is 140° F., and under these conditions the drying times necessary to reach 23-25 per cent. moisture contents were :

Apricots (whole)	24 hours
Peaches, freestone (sixths)	13-15 hours
,, , clingstone (sixths)	13-15 ,,
Pineapple (half-inch rings)	11-12 ,,

These drying times are indicative, but are affected by fruit maturity and size and dehydrater efficiency. The use of higher temperatures than 140° F. needs further study to see whether an appreciable reduction in drying time can be achieved without sacrificing quality.

Since the drying time is dependent on the moisture content required, the latter needs careful determination. On the one hand it must be high enough to give an attractive texture and, on the other, low enough to prevent mould development. The upper limit to inhibit microbial action is usually taken as 25 per cent. Fruit at this level has a desirable texture, indicating that moisture contents in the 23-25 per cent. range meet both the texture and keeping quality requirements.

Coating Treatments

Sugared dehydrated fruit has a tendency to stickiness, particularly if syrups with a high invert sugar concentration are used. Experiments are in progress to determine a suitable technique for obviating this defect. Of methods so far investigated, the coating of fruit with low ester pectin has shown most promise.

Packaging

Under most climatic conditions the problem in packaging sugared fruit of the recommended moisture content is to prevent loss of moisture. No experimental work has been carried out to determine suitable packaging material, but the use of moisture-vapour-proof wrappers for say 1 lb. packages, which would be packed in a master metal container, should meet most conditions.

Re-Use of Syrups

Of major importance in the commercial application of this technique is the continuous use of syrups. After the fruit has been removed a syrup will show a lower Brix reading, a loss of potassium metabisulphite and possibly an alteration in the relative concentration of sucrose and invert syrup. Before this syrup can be restored to its original composition analyses for the total and reducing (invert) sugar contents and the sulphur dioxide concentration will be necessary. However, the equipment required for these determinations is simple and the analyses could be readily made in any factory by a person with suitable technical instruction.

Since the composition of the syrup can exert a profound influence on the quality of the product, it is essential that the above analyses and the adjustments based on them be carefully made if a high standard is to be maintained.

References

Atkinson, F. E., and Strachan, C. C. (1941).—Fruit Prod. J. 20 : 132.

Jang, R., and Cruess, W. V. (1949).—Fruit Prod. J. 28 : 229.

Gas Packing of Spray Dried Whole Egg Powder

By

A. R. Prater

Introduction

With the methods of preparation and packaging in use early in World War II, dehydrated egg powder had a storage life exceeding 22 months at temperatures of 50° F. or less, but at higher temperatures prevailing in tropical areas, for example 86° F., the storage life was less than 12 weeks. Investigations were, therefore, undertaken in several countries in order to discover means by which the storage life at higher temperatures could be extended. To measure deterioration in quality, tasting tests, solubility, fluorescence and pH measurements were used.

Among the many factors investigated was the effect of packing egg powder in an inert gas such as nitrogen or carbon dioxide. Bate-Smith *et al.* (1943) found that packing in nitrogen was only beneficial when the temperature of storage was low (59° F. or less). They concluded that the development of " burnt " flavours at higher temperatures masked any beneficial effects resulting from exclusion of oxygen.

White *et al.* (1943) found that packing in nitrogen for six months at a storage temperature of 75° F. was of no value, but using comparative fluorescence values and solubility in potassium chloride as indices, they found that a considerable increase in storage life was possible through packing in carbon dioxide. Later Thistle *et al.* (1944) confirmed these results and showed too, that, at a temperature of 118° F., the solubility was unchanged, while the flavour deteriorated. Pearce *et al.* (1946) reported work which indicated that the rate of deterioration in flavour was lower in carbon dioxide than in nitrogen which, in turn, was lower than in air.

Boggs and Fevold (1949), using mainly lyophilized (dried in the frozen state) egg powders of low moisture content, studied the effect of packing in inert gases at a storage temperature of 97·7° F. Moderate increases in storage life, as measured by palatability scores, were obtained for nitrogen packs and more marked increases for carbon dioxide packing. Very little work was done on spray dried egg powder by these investigators.

Experiments were carried out in Australia by the author (1950) to test the value of carbon dioxide and nitrogen packing, particularly in retarding flavour change in spray dried powder of medium moisture content (3·5 to 6 per cent.) exposed to temperatures in the range 50° to 86° F. The effect of gas packing on the solubility of the powder was also determined.

Early in 1941 several high temperature cabinet driers (" Chinese " driers) were brought to Australia from China. These were used to produce the bulk of the Australian powder, smaller amounts of better quality powder being produced in Gray Jensen driers.

Results

A very small increase in storage life was noted for powder packed in nitrogen and stored at 86° F., whereas a considerable increase, in the order of 50 per cent., was noted for carbon dioxide packs. The effects of gas packing were more marked at 50° and 68° F. and there were significant differences between air and nitrogen packs and between nitrogen and carbon dioxide packs. The overall increase in storage life in a carbon dioxide atmosphere was approximately 50 per cent. for all three temperatures, but in a nitrogen atmosphere it was approximately 20 per cent. at 68° F. and 10 per cent. at 50° F. Packing in carbon dioxide gave an increase in storage life of approximately 5 weeks at 86° F., 20 weeks at 68° F. and 44 weeks at 50° F.

The results of the solubility tests confirmed the palatability results, the differences being more marked in most cases.

It was possible to trace changes in oxygen content in the air packs where a theoretical initial oxygen content was calculated. Oxygen absorption increased with time and temperature, while palatability and solubility decreased. It is difficult to say if oxygen is a causal factor in the deterioration of the powder, because after the oxygen in the headspace is used up, deterioration still continues.

For powders of medium moisture content the author has confirmed the beneficial effects of gas packing found by overseas investigators for powders of low moisture content. It should be noted here that the "Chinese" drier was unsuitable for production of a satisfactory quality low moisture content powder, the storage life of which is longer than that of higher moisture content powder of similar initial quality.

It is probable that deterioration in palatability and solubility of egg powder during storage in air cannot be explained wholly by oxygen absorption because of the relatively large differences in storage life between samples packed in carbon dioxide and nitrogen.

The application of gas packing on an industrial scale in Australia would be relatively simple. Suitable equipment is now being used in production of gas packed milk powder and the problems associated with the two products are of a fairly similar nature. A U.S. Military Specification (Mil-E-1075A, 17 May 1950) specified the use of a mixture of 80 per cent. nitrogen and 20 per cent. carbon dioxide to avoid straining of can seams due to reduced pressure caused by uptake of carbon dioxide by the powder. Naturally the larger the pack the more important this becomes; the smaller cans, such as the 30 oz., could withstand up to an atmosphere difference in pressure.

In conclusion it may be said that the main requirements for production of good quality egg powder are good raw material, dehydraters capable of reducing the moisture content below 2 per cent. without overheating the powder and, finally, the application of gas packaging to ensure a good shelf life.

References

Bate-Smith, E. C., Brooks, J., and Hawthorne, J. R. (1943).—Dried egg. I. The preparation, examination and storage of spray dried whole egg. J. Soc. Chem. Ind. 62: 97.

Boggs, Mildred M., and Fevold, H. L. (1949).—Dehydrated egg powders. Factors in palatability of stored powders. Ind. Eng. Chem. 38: 1075.

Recent Publications by the Staff of the Division of Food Preservation

(1) Thermal Destruction of *Clostridium botulinum* in Canned Vegetables. By W. J. Scott and D. F. Stewart (1950).—Australian Journal of Applied Science 1 : 188.

(2) Thermal Destruction of Type A *Clostridium botulinum* Toxin. The Nature of the Protective Substances in Canned Vegetables. By W. J. Scott (1950).—Aust. J. App. Sci. 1 : 200.

In these two papers some of the factors affecting the heat stability of types A and B *Clostridium botulinum* toxins are discussed. Although the toxins are relatively easily destroyed by heat, their stability varies a good deal between different vegetables. This variation is due mainly to differences in pH and to the concentration of substances which protect the toxin against heat damage. In the second paper it is shown that type A toxin is protected by a variety of ionized substances, the heat stability being greatest in solutions of high ionic strength.

(3) Studies in the Preservation of Shell Eggs. I. The Nature of Wastage in Australian Export Eggs. By Lucey R. Alford, N. E. Holmes, W. J. Scott and J. R. Vickery (1950).—Aust. J. App. Sci. 1 : 208.

(4) Studies in the Preservation of Shell Eggs. II. The Incidence of Bacterial Rotting in Unwashed Eggs and in Eggs Washed by Hand. By J. M. Gillespie, W. J. Scott and J. R. Vickery (1950).—Aust. J. App. Sci. 1 : 215.

These papers are the first two of a series describing the results of investigations on shell eggs which have been carried out in the last ten years. In the first paper the different types of wastage are discussed and it is shown that the most important type is bacterial rotting, this being due to treatments which the eggs receive prior to cold storage. In the second paper the results show the general good keeping quality of unwashed eggs, for which the average wastage in 168 experiments was approximately 1 per cent. For eggs washed by a number of hand methods the wastage was almost always low, but in about 10 per cent. of the experiments losses greater than 10 per cent. were experienced.

(5) Effect of Gas Packing and Storage Temperature on the Keeping Quality of Spray Dried Whole Egg Powder. By A. R. Prater (1950).—Aust. J. App. Sci. 1 : 224.

(6) Use of Oxalic Acid in the Determination of Ascorbic Acid. By F. E. Huelin (1950).—Analyst 75 : 391.

Solutions of oxalic acid have been found to develop traces of hydrogen peroxide on exposure to light. The peroxide rapidly oxidizes ferrous ions and interferes in the standardization of 2·6 dichlorophenolindophenol with ferrous salts. The presence of peroxide renders deteriorated oxalic acid solutions of doubtful value for stabilizing ascorbic acid.

Note.—Since this paper was published, Lampitt, Baker and Knight (Chem. and Ind. 1950 : 699) have shown that oxalic acid extracts of potato lose ascorbic acid rapidly on exposure to light. Hence oxalic acid should only be used for the determination of ascorbic acid if the solution and extracts are adequately protected from light.

Answers to Enquiries

MINCED BEEF LOAF

The following information was given to an inquirer who sought information on recipes for minced beef loaf with cereals. Formulæ suggested were :

	(*a*)	(*b*)	(*c*)
Beef	100 lb.	100 lb.	100 lb.
Salt	2 lb.	2 lb.	2 lb.
Pepper	$\frac{1}{4}$ oz.	$\frac{1}{4}$ oz.	$\frac{1}{4}$ oz.
Agar	1 lb.	1 lb.	Nil
Flour	Nil	3 lb.	8 lb.
Sodium nitrite ..	1/6 oz.	1/6 oz.	1/6 oz.
Water	1 lb.	1 lb.	1 gallon

In the meat loaf formulæ given it will be noted that agar and/or flour are used as the binding ingredients. The cereal ingredient is often a biscuit meal. Formula (*c*) provides for additional water.

In preparing these mixtures the most satisfactory method is to add the nitrite dissolved in water to the cut up raw meat in a mixer. Uniformity of distribution is improved by spraying on the solution. After thorough mixing, the other mixed ingredients such as salt, pepper and agar (preferably powdered) are added and a further mixing is given. The texture of the loaf can be adjusted by varying the method of preparing the raw meat which may be minced or a mixture of sliced and minced meat may be used. In order to avoid excess fat the meat should be trimmed before slicing or mincing. At the same time excess connective tissue should be discarded.

Other meats may be used instead of beef, but if previously cured meats are incorporated in the mixture it will be necessary to adjust the added amounts of salt and nitrite accordingly.

The most common type of mixer is that used for mixing dough.

Meat packs prepared according to the instructions outlined can be regarded as solid packs and the approximate safe processing times at 240° F. are as follows :

	Initial Temperature	
	70° F.	140° F.
12 oz. cans (307×212) ..	105 minutes	100 minutes
1 lb. cans (401×301) ..	120 minutes	115 minutes

Heat exhaust for these solid packs should be 20–25 minutes in steam at 208–210° F.