

FURTHER STUDIES ON DEHYDRATION OF PRAWNS IN ROTARY DRUM DRYER

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The paper deals with studies made to modify the process of drying of prawns in rotary drum dryer reported by the authors earlier. Prawns belonging to any species except *M. monoceros* can be satisfactorily dried. With *M. monoceros* invariably considerable adherence of shell occurs. Prawns of any size group can be dried provided in the case of medium and big size prawns they are beheaded prior to drying. In all size groups, beheading prior to drying results in better appearance of the end product in addition to the output of the dryer per charge being increased.

INTRODUCTION.

The development of a method of dehydration of prawns using a drum dryer, where cooking, drying and deshelling take place in a single operation at a much less time and yielding a very good quality end product has been reported by the authors in a recent communication (Balachandran and Bose, 1964). The advantages of this process over the tunnel drying of prawns reported by the authors (Balachandran and Bose, 1965) also have been described therein. When the process was applied for the dehydration of different species and size grades of prawns, instances of adherence of shell and substantial amount of breakage of the muscle were observed in certain cases, making the

method unsuitable to such species and size grades. In order to assess the reason for the above and also to effect necessary modification to the process so that it can be applied for prawns belonging to all species and size grades, detailed study was undertaken to find out the effect of size, species, removal of head prior to feeding etc. on the quality of the end product. The optimum load of material the dryer can take per charge was also studied.

MATERIALS AND METHODS

The Dryer

The dryer reported by the authors earlier (Balachandran and Bose, 1964) was used in the experiments after removing the inner aluminium lining since it retarded the

effective heat transfer from the drum walls to the material, thereby prolonging the drying time. The drawback of the contamination of the prawn meat with iron from the dryer walls was overcome by frequent use of the drum without allowing it to get rusted.

It has been observed earlier that the drying rate was very low when the load of the dryer was increased upto 15 Kg. due to condensation of moisture expelled from the muscle inside the dryer. This was found to be due to the low exhaust capacity of the fan provided for the purpose and hence it was replaced by a more powerful one of capacity 8-12 cu.m/min. connected through a regulator for proper control of exhaust.

Materials

Prawns of different species and size grades, both of marine and backwater origin as well as from paddy field cultures were utilised in these experiments. They were brought to the laboratory and preserved in ice till used for experiment. The prawns were prepared for drying by washing them free of dirt and beheading was done whenever required.

RESULTS AND DISCUSSION.

Earlier work (Balachandran and Bose 1964) was carried out with the dryer with the inside aluminium lining, which, it was established from later experiments, could be removed to the advantage of the drying process. It must be mentioned here that by properly washing the drum after every charge and keeping it clean and dry, contamination of subsequent batches by iron could be prevented. Thus the purpose served by the aluminium lining, i.e. prevention of contamination of the prawn meat with iron, could be achieved otherwise.

Effect of species on the nature of the finished product.

Prawns belonging to different species viz., *Metapenaeous dobsoni*, *M. affinis*, *M. monoceros*, *P. indicus* and *Parapenaeopsis styliifera* in the size group 200-240 nos./ Kg. were utilized for this study. Under identical conditions of processing all species of the above size group gave satisfactory end products, with very little adherence of shell towards the tail side in certain species and negligible breakage of the muscle except *M. monoceros* where there occurred considerable adherence of shell to the meat distributed unevenly throughout the surface of the meat coupled with a fair amount of breakage of the meat as evidenced by the data in Table I.

This can, perhaps, be attributed to the peculiar biological nature of the prawn, since this defect was not encountered in any other species.

Effect of size of prawns on the nature of finished product.

The quality of the finished product as affected by the size of prawns is represented in Table II.

Prawns of medium and higher size grades, when dried in drum dryer were found to undergo considerable breakage of the order of 40-50% rendering this method unsuitable to such size grades. But further studies made by beheading the prawns of such size grade prior to feeding resulted in a satisfactory end product.

Prawns as they are fed into the dryer undergo cooking at the first instance followed by the head being broken off as the drum rotates. With small size prawns, the head alone is broken off, leaving the meat with shell as a discrete unit, whereas with big size prawns, during the earlier stages of drying, when the meat should

TABLE I. EFFECT OF SPECIES ON THE NATURE OF THE FINISHED PRODUCT

Material : Small size prawns (200-230 nos. / Kg. beheaded prawns, 10 kg. each
 Steam pressure : 1 kg / sq. cm.
 R. P. M. of the dryer : 10 for 2 hours, 30 for rest of the drying period

| Species | % breakage of meat | % adherence of shell |
|---------------------|--------------------|---|
| <i>M. dobsoni</i> | 2 — 3 | negligible only towards tail side |
| <i>P. stylifera</i> | 2 — 3 | „ |
| <i>P. indicus</i> | 2 — 4 | „ |
| <i>M. affinis</i> | 2 — 3 | „ |
| <i>M. monoceros</i> | 15 — 20 | shell adherence throughout the surface. |

TABLE II

Material ... *P. indicus*. 10 Kg. each.
 Steam pressure ... 1 kg/sq. cm.
 R. P. M. of the dryer ... 10 for 2 hours, 30 for rest of the drying period.

| Size grade count / kg. | Nature of raw material | Time taken to dry to 15% moisture content. hours | Nature of the finished product. |
|------------------------|------------------------|--|---------------------------------|
| 200—220 | whole | 2½—3 | negligible breakage |
| 100—120 | „ | 3½—4 | muscle breaks during drying |
| „ | beheaded | „ | negligible breakage. |

TABLE III.

Material ... *P. stylifera* (beheaded)
 Steam pressure in jacket ... 1 kg/sq. cm.
 R. P. M. of the drum ... 10 for 2 hours and 30 for rest of the period.

| Quantity of prawns fed to dryer Kg. | Time for drying to 15% moisture content. hours. |
|-------------------------------------|---|
| 10 | 2½ |
| 15 | 3 |
| 20 | 3 — 3½ |
| 22 | 4 — 4½ |

not have become sufficiently firm, owing partly to the weight of prawn as they are taken up by the baffles of the drum and then allowed to fall, one segment of the meat also is found to be broken off along with the head resulting in the increased percentage of breakage. By beheading, the tendency of any portion of meat to be broken off along with head will be reduced, as also the weight of individual prawn being handled, which will be reduced by about half which may, perhaps, add to the prevention of breakage of the muscle. Beheading was found to have the added advantage that the quantity of prawns handled by the dryer could almost be doubled.

Effect of removal of heads of prawns prior to feeding the drum on the quality of the final product.

Because of the observation made with large size grades of prawns that they could be dried satisfactorily only if beheaded prior to drying, the technique was extended to the dehydration of small sizes of prawns also. Prawns dried in the drum dryer after beheading had the maximum colour among dry prawns prepared by the other methods, viz., in drum dryer without beheading, in tunnel dryer or in sun. The prawn head contains about 6% (D. W. B.) fat (Kaimal and Seshagiri Rao, 1965) besides a coloured juicy matter, which during the time of drying at some stage or other get admixed with the meat with the result that the bright natural colour gets faded. Removal of head prior to feeding into the drum eliminates this possibility and so the colour remains better.

The experiments reported above were carried out with quantities of prawns of 15Kg. and less. With a view to finding out the maximum amount of prawns that can satisfactorily be dried in a drum of this size, experiments were carried out

with different quantities of prawns and the time taken to reach 15% moisture level was noted. The results are given in table III.

By increasing the load of the dryer by further 2 Kg. above 20, the drying time is increased by about one hour, hence 20kg. can be taken as the optimum load of the dryer.

SUMMARY

Results of further experiments carried out on the dehydration of prawns using rotary drum dryer are reported. Results indicate that :

(i) All species of prawns could be satisfactorily dried except *M. monoceros*, where sticking of shell on the meat and breakage of meat are considerable, a characteristic of the species,

(ii) All size grades of prawns could be dried; however, in the case of medium and big size prawns beheading prior to drying was found to be necessary,

(iii) By beheading prawns prior to drying the colour of the product was brighter in addition to the added advantage that the throughput of the dryer could be nearly doubled; and

(iv) The optimum capacity of the dryer was found to be 20 kg. beheaded prawns equivalent to 35-40 kg. of whole prawns.

REFERENCES

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