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Taro (*Colocasia esculenta*) extrusion

Joseph A. Maga, Ming Bang Liu & Timothy Rey

Department of Food Science and Human Nutrition, Colorado State University, Fort Collins, Colorado 80523, USA

Taro, containing 15% moisture, was extruded at 80, 100, 120 and 140°C. Resulting extrudate expansion ratio, breaking strength and water absorption properties were determined. Optimum properties were found to occur at an extrusion temperature of 120°C.

INTRODUCTION

Taro (*Colocasia esculenta*) is an ancient crop that originated in Asia, but is now grown in many parts of the world where it is also known as eddo, dasheen or cocoyam. It is a member of the family, Araceae, and is one of the most important edible aroids (Bradbury & Holloway, 1988). Currently it is grown as a subsistence crop and eaten as a staple because of its high starch content (Wills *et al*., 1983). The cooked corms have a relatively bland flavor, similar to that of potatoes or cereals, and its volatile composition has been recently characterized (MacLeod, 1990).

Due to its high starch content, it is postulated that taro has good expansion properties and thus, perhaps, would have application as an expanded snack product that could be extrusion processed. Therefore, the major objective of this study was to evaluate the role of extrusion temperature on certain physical properties of resulting extrudates, to predict the practicality of producing an expanded snack based solely on taro.

MATERIALS AND METHODS

Fresh taro corms averaging 1 kg each, were directly imported from the Caribbean. Upon receipt, they were manually peeled and mechanically sliced into 0·5 mm slices. The slices were placed in a heated forced air dehydrator operating at 90°C and held for 8 h. The resulting dehydrated product was ground, to pass through a 2 mm screen. The moisture content of the resulting flour was determined using standard gravimetric procedures and the moisture content adjusted to 15% using tap water.

The moisture-adjusted flour was then extruded using a single-screw Brabender Model PLV 500 laboratory extruder equipped with a 3/1 compression screw operating at 100 revs/min. The unit was equipped with a die having an opening of 3·75 mm. Dough temperatures just before the die exit were maintained at 80, 100, 120 or 140°C. Extrusion processing was repeated on three consecutive days.

The resulting extrudates were permitted to air dry overnight at room temperature and then various measurements were taken. Expansion ratio was determined by dividing the die diameter into the average extrudate diameter, which was manually measured. Extrudate breaking strength was measured by placing representative pieces of extrudate in a Warner-Bratzler shear press and recording the amount of force in pounds required to break the extrudates. These values were converted to breaking strength in *N*. Per cent water absorption was measured by placing a weighed amount of intact extrudate in water at 40°C for 10 min, removing the extrudate and reweighing to calculate the amount of water that was absorbed.

RESULTS AND DISCUSSION

The influence of extrusion temperature on resulting extrudate expansion ratio is summarized in Table 1. As can be seen, extrudate expansion continued to expand up to 120°C and then expansion decreased at 140°C. With any starch-based food, optimum expansion temperature needs to be determined. Product moisture content, which in this study was held constant at 15%, as well as the type and amount of starch, are important contributors to overall product expansion. In this

Table 1. Influence of extrusion temperature on resulting extrudate expansion ratio

Extrusion temperature (°C)	Expansion ratio
80	2·4
100	5·7
120	16·2
140	9·3

study, a maximum expansion ratio of slightly over 16 was observed, thus demonstrating that taro has the very good expansion properties normally associated with an expanded snack.

Extrudate breaking strength is another important property of an expanded snack. If the product has a high breaking strength, consumers will have difficulty biting into the product. On the other hand, if the breaking strength is too low, the product will be quite fragile and thus will break down during packaging and distribution. In this study, the breaking strength was found to steadily decrease as extrusion temperature increased (Table 2). This is normal since more cooking, and thus starch denaturation, are associated with higher temperatures, thereby lowering the structural properties of the resulting product. From subjective evaluation, it was concluded that taro extruded at 120°C had optimum breaking strength. Products resulting from extrusion at lower temperatures were tough, while the product extruded at 140°C was very fragile.

Water absorption is an indicator as to the functional property of the degree of starch cooking and subsequent denaturation. A starch denatured by overheating will have lower water absorption properties. Likewise, starch that has not been completely heat gelatinized will also have low values. As can be seen in Table 3, in this study, water absorption continued to increase as extrusion temperature increased, thereby indicating that maximum gelatinization was not achieved under the conditions evaluated. However, normally, values in excess of 500% usually indicate effective gelatinization. Therefore, extrusion at 120°C was effective.

Table 2. Influence of extrusion temperature on resulting extrudate breaking strength

Extrusion temperature (°C)	Breaking strength (*N*)
80	6·3
100	5·1
120	4·5
140	1·1

Table 3. Influence of extrusion temperature on resulting extrudate water absorption

Extrusion temperature (°C)	Water absorption (%)
80	280
100	355
120	540
140	590

CONCLUSIONS

Overall, the study clearly demonstrated that taro could be effectively extruded to produce an extrudate that possesses properties associated with an expanded snack food.

REFERENCES

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