Decortication Level and Particle Size Effect on Direct-Expanded White Sorghum Extrudates

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Abstract
White sorghum samples prepared by combining 4 different decortication levels (0, 10, 20, and 30%) and three particle sizes were extruded in a Maddox single screw friction-type extruder. A commercial yellow cornmeal and polished rice were extruded as controls. The extrusion conditions were held constant for all samples. The expansion ratio, bulk density, color and texture of the extrudates were significantly affected by both particle size and decortication level. As the decortication level increased, the extrudates tended to be whiter, more expanded, less dense, crispier and more viscous. The extrudates made from coarse particle size material had more desirable characteristics when compared to the other particle sizes used. Some sorghum products had a higher expansion ratio than both rice and corn, and had similar bulk density and texture characteristics.

Introduction
Extrusion cooking is used to produce a wide variety of food products with unique sensory attributes (Deonnaux et al., 1999). Exuded food materials undergo various transformations, including starch gelatinization and fragmentation, and protein denaturation, which affect the product properties. The most common cereals used in the extrusion of snacks and breakfast cereals are corn, wheat, rice and oats. Sorghum is not a major ingredient in extruded snacks and breakfast cereals (Riaz, 1997). New extrusion of snacks and breakfast cereals are corn, wheat, rice and oats. Sorghum is not a major ingredient in extruded snacks and breakfast cereals (Riaz, 1997). Some sorghum samples expanded more than corn or rice; these extrudates had similar bulk densities and texture characteristics. Decorticated sorghum samples yielded extrudates with bland flavor.

Objective
Determine the effects of decortication and particle size on the characteristics of direct-expanded white sorghum extrudates.

Materials and Methods
Samples
Grain of a white sorghum (ATx631 x TX438) was decorticated to remove 0, 10, 20 and 30% of kernel weight. The whole sorghum and the decorticated samples were hammer-milled using a Fitz mill and sieved. Oves of US Standard Sieves # 20 (coarse) and #50 (meat) were retained. Samples of each decortication level without milling (whole, decorticated grain) were used also. CornAgra yellow corn meal and polished long grain rice were used as controls.

Extrusion was performed in a single screw, friction-type Maddox Extruder Model MX-3001. All samples were tempered to 14% moisture; 300 rpm screw speed was used. The die used had 6, 1/8 inch holes. The temperature varied according to the friction each sample produced. Each sample was extruded until a steady state was reached and extrudates were sampled. Baking of samples was performed after extrusion in a dry oven at 100 C for 30 min. After baking, the samples were cooled and packaged in metallic plastic film.

Expansion ratio was the diameter of the extrudates measured with an electronic caliper divided by the diameter of the die.

Particle size was obtained by dividing the weight of extrudates that filled a container of known volume.

Texture of the extrudates was evaluated using a Texture Analyzer TA-XT2 with an aluminum blade as a probe. 10 randomly selected extrudates per treatment were analyzed. The area under the curve F* and the number of peaks were recorded.

Color (L and chroma) was determined on ground extrudates passing through US standard no. 40 sieve (Hsieh et al., 1993) with a Minolta Colorimeter using CIE L*a*b* values.

Statistical Analysis was performed with SAS V9 for Windows software, using n=0.05.

Results

<table>
<thead>
<tr>
<th>Decortication Level</th>
<th>Extrudates at Each Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% WHOLE</td>
<td>0.063</td>
</tr>
<tr>
<td>10% WHOLE</td>
<td>0.062</td>
</tr>
<tr>
<td>20% WHOLE</td>
<td>0.062</td>
</tr>
<tr>
<td>30% WHOLE</td>
<td>0.062</td>
</tr>
</tbody>
</table>

Some sorghum samples expanded more than corn or rice; these extrudates had similar bulk densities and texture characteristics. Decorticated sorghum samples yielded extrudates with bland flavor.

Conclusions
- Whiter, more expanded, stronger, crispier, and bland flavored extrudates were produced using sorghum with increasing decortication level.
- Extrudates with better characteristics were prepared with coarse particle size ingredients.
- Extrudates from some sorghum samples were similar to corn or rice extrudates.
- Variation in decortication level and particle size affect extrudate characteristics such as expansion ratio, crispness and bulk density.
- Extrudates with good characteristics can be produced without milling or by decorticating sorghum.
- Low-cost, friction extruders can be used to produce an array of products.

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References