

Production of Soybean-Corn Tortillas

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Tortillas are widely used to make tacos, burritos, and enchiladas. Usually tortillas are made from wheat or corn flour. In this project, soybean presscake was mixed with corn flour to improve the nutritional value of tortillas. Different percentages of soybean presscake were used in the project. The objective of the project was to determine the influence of the level of soybean added on the color, texture, and ash content and trypsin inhibitor activity (TIA) of corn tortillas.

The Masa corn flour used for this project was white in color while the soybean presscake appeared to be more green-yellow. For corn tortillas, consumers expect a product that is soft, flexible, rollable and corn-colored, so it is necessary to measure the color of fortified tortillas. In addition, TIA of soybean presscake-corn tortillas was measured because trypsin inhibitors can reduce the availability of trypsin which is necessary for protein digestion. The inhibitor naturally present in soybeans can interact with trypsin, thereby limiting its availability to digest protein (Kunitz, 1947). Therefore, it is essential to have control of the trypsin inhibitor activity in food products.

The ingredients used to prepare the tortillas were corn Masa mix flour, soybean presscake, salt, xanthan gum and water. Soybean presscake (provided by the Richardson Centre for Nutraceuticals and Functional Foods) was used to replace the corn Masa at levels of 0, 10, 20, 30, and 35%. Xanthan gum was added to make the dough since soybean presscake was not as sticky as corn flour. Six samples were prepared at each level of soybean. Doughs were prepared, pressed and cooked using an electric pan at a temperature of $228 \pm 8^\circ\text{C}$. Each tortilla was cooked for 15s on one side, 20s on the second side and an additional 5s on the first. Tortillas were cooled for 8 min (covered for 6 of the 8 min) prior to testing. Texture was evaluated using a burst test with a TA-XT 2 plus texture machine; force to break (maximum force), elasticity (slope of the curve) and work (area under the curve) were measured. Colour (L^* , a^* and b^* values) was measured using the Minolta spectrophotometer. Samples were freeze dried for ash and TIA analysis. Ash was measured by heating at 550°C after a pre-ashing step. Samples for TIA

analysis were then defatted using hexane, pH adjusted to between 8.4 and 10 and TIA determined following the method of Kakade et al. (1974).

Addition of soybean presscake had an effect on tortilla colour (Table 1). With increasing levels of soybean presscake in the tortillas, L* values decreased and a* and b* values increased. This indicated that the tortilla containing soybean were not as light and had higher levels of red and yellow pigments. It should be noted, however, that these differences were relatively small and the tortillas containing soybean, looked very similar to the corn tortilla (Figure 1).

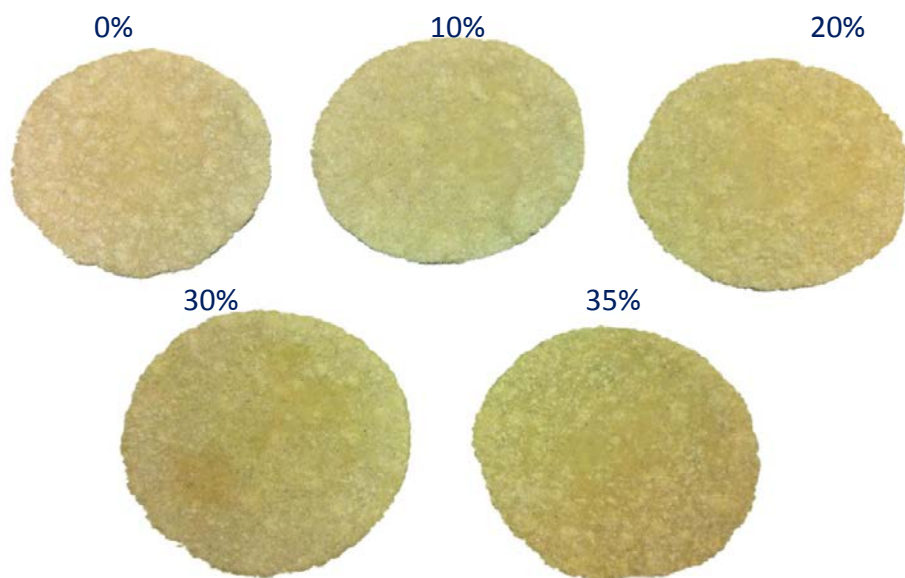


Figure 1. Picture of soy-corn tortillas with different amounts of soybean presscake.

The addition of soybeans also had an effect on texture (Table 1). Lower values for work and force to break were obtained as the level of soybean increased; changes in elasticity were minor. It would appear that the addition of soybean is resulting in a softer product.

One of the benefits in the process (nixtamalization) used to treat corn flour for use in tortillas is that it increases the ash content. The addition of soybean presscake to the corn tortillas further increased the ash content with values for the 35% addition being almost double those of the corn control (Table 2). Addition of soybean presscake to the corn tortillas also resulted in an increase in the level of trypsin inhibitor activity. As trypsin inhibitors are more prevalent in soybean than corn, this is not surprising. Unfortunately the cooking protocol used was not sufficient to

completely inactive these inhibitors, some of which are relatively heat stable. The press cake may need to be subjected to more severe heat treatment prior to incorporation into tortillas to further reduce these levels.

Table 1. Color and texture of corn-soybean tortillas

% soybean in tortillas	Colour			Texture		
	L* value	a* value	b* value	Work	Force to break	Elasticity
0	73.07	-0.38	20.55	1.705	0.301	0.025
10	72.10	-0.44	21.68	2.042	0.356	0.028
20	70.23	-0.51	22.74	1.744	0.328	0.028
30	71.19	-0.27	25.36	1.469	0.292	0.028
35	69.76	0.77	28.75	1.362	0.274	0.028

Table 2. Levels of ash and trypsin inhibitor units (TIU) in corn-soybean tortillas

% soybean in tortillas	Ash content (%)	TIU/mg
0	1.77±0.04	0.78±0.34
10	2.32±0.00	2.34±0.16
20	2.64±0.02	3.57±0.17
30	3.11±0.01	4.74±0.22
35	3.38±0.04	4.74±0.17

Overall the addition of soybean presscake to corn tortillas resulted in a product that was slightly darker, but softer. The increase in ash content could be beneficial but the higher level of trypsin inhibitors could be a problem, particularly for anyone on a diet with limited protein intake. A heat pretreatment of the press cake may be required to address this issue. Otherwise the product was very similar to the control corn tortilla.

References

- Kakade, M.L., Rackis, J.L., McGhee, J.E., & Puski, G. (1974). Determination of trypsin inhibitor activity of soy bean products: a collaborative analysis of an improved procedure. *Cereal Chemistry*, 51, 376-382.
- Kunitz, M. (1947). Crystalline soybean trypsin inhibitor. *The Journal of General Physiology*, 30(4), pp. 291-310.