

# Tortillas of blue maize (*Zea mays* L.) prepared by a fractionated process of nixtamalization: analysis using response surface methodology

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## Abstract

In the present study an alternative to the traditional nixtamalization process was studied. Pericarp, tip cap and germ (PGT) were separated from the endosperm in a prototype decorticating device. The fractions were nixtamalized in an intermittent blender using steam injection. First the PGT fraction (18.2%) was nixtamalized in an alkaline solution (0.29–1.71% w/w) of boiling water, in a proportion of 1:1 (alkaline solution:PGT). The endosperm fraction (81.8%) was then immediately added to the same container, mixed thoroughly and kept at constant temperature of  $92 \pm 2$  °C, for cooking times from 9.2 to 51.2 min. The nixtamalized fractions of maize were dried at 60 °C for 5 h and milled. Tortillas made from nixtamalized flour prepared with 1.0% (w/w) calcium hydroxide and a nixtamalization time of 45 min showed functional characteristics similar to the traditional blue tortilla.

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## 1. Introduction

Maize was the principal source of food for the pre-Columbian civilizations of the New World. Today maize tortillas and derivative products are still the staple food of Mexico and Central America. Also, maize tortillas, corn chips and tortilla chips have widely penetrated the market of the United States and some countries of Asia and Europe. Mexico has been recognized as the center of origin of maize, and about 45 different maize races have been reported. Among these species are some colored maize grains with colors that range from blank to pink, the most common being blue and red. These grain colors are attributed to the presence of anthocyanins found mainly in the pericarp and/or the aleurone layer. These natural pigments are considered to be safe for

human consumption and are effective food additives (Lee, Chang, Rhim, Ko, & Choi, 1997; Marcus, 1992; Nakatani, Fukuda, & Fuwa, 1979; Salinas-Moreno, Martínez-Bustos, & Soto-Hernández, 1999; Thadens & Verstryngge, 1989). Also, anthocyanins may prevent damage caused by active oxygen radicals in living systems (Lee et al., 1997; Stavric, 1994).

Blue and red maize are used by small communities where they are cultivated to prepare traditional food such as tortillas, tlacoyos, gorditas, tostadas, atoles and others. These products are in demand by many consumers due to their soft texture and good taste. Also, nixtamalized products can make a positive contribution to the human diet due to their calcium content. Owing to the present legal and health tendencies toward reducing the use of synthetic colorants, naturally pigmented grains are of great interest to traditional farmers, industrial producers and consumers. In previous studies, several authors have reported the use of pigmented maize in different foods. Maga and Liu (1993)

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