Effect of CMC concentration and moisture content on the physico-chemical properties of masa-water mixture

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ABSTRACT

CMC increases the viscosity of a masa/water mixture during thermal processing, and is hypothesized to compete with the masa constituents for the water. During cooling, the gum may inhibit retrogradation of gelatinized starch granules, influencing the flexibility of tortilla. Little is known about the interaction of the different components in the masa system at the super-structural level.

In this work, a medium viscosity CMC(7MF) was added at 0.5% and 1% levels to a masa/water systems with 50% and 60% moisture. At higher mc, the % "freezable" water and moisture loss were greater. CMC concentrations did not affect the % "freezable" water and moisture loss . The enthalpy of the peak around 70°C attributed to amylopectin melting and the peak around 200°C attributed to amylose melting were not different among samples with same mc. However, TGA results show that CMC does have an impact on the distribution of water in the mixture.

INTRODUCTION

- Carboxymethylcellulose (CMC) is an anonic water-soluble polymer derived from cellulose, which is widely used as food gum. For food use, the average degree of substitution 0.7.
- Carboxymethyl cellulose (CMC) is a widely used hydrocolloid. In corn tortillas it helps maintain softness, thus increasing the shelf life of the product.
- CMC is hypothesized to compete for water with other components in the dough and increase the viscosity of the mixtures, thus maintain the softness of tortilla.
- The behavior of CMC and the distribution of water in the food system are unknown.
- Thermal and thermomechanical analysis techniques have been shown to be particularly well suited for such characterization.

OBJECTIVE

This study will help to characterize the impact of different amounts of CMC on variable moisture masa mixtures.

MATERIALS & METHODS

Masa-water mixture

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Adjusted to 50% moisture content and 60% moisture content

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Adjusted the mixtures with 7MF CMC at 0%, 0.5% and 1% levels.

7MF CMC: 7-Degree of substitution. M-Medium viscosity. F-Food grade.

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Stored for 0-14 days @ 4°C.

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Analyzed by High-Res TGA 2950 – TA Instrument (Thernogravimetric Analysis).
25°C to 200°C @ 20°C/min with sensitivity 3.0 and resolution 3°C

Analyzed by DSC 2920 – TA Instrument (Differential scanning Calorimeter)
-50 °C to 110 °C @ 5 °C/min

RESULTS

Figure 1. TGA Results Without

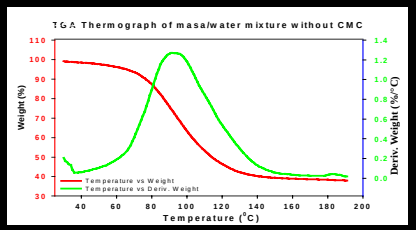


Figure 2. TGA Results With

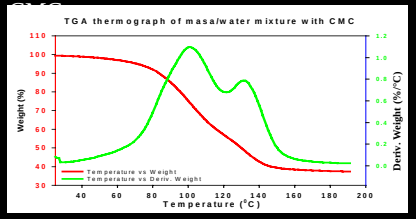


Figure 3. DSC Results for Variable Moisture

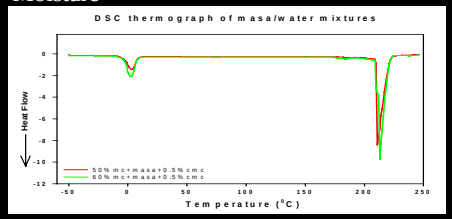


Figure 4. DSC Results for Variable CMC

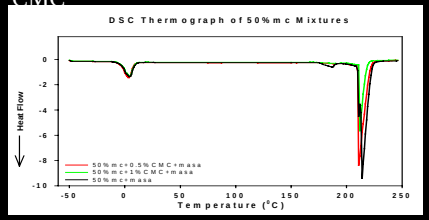


Figure 5. Melting enthalpy attributed to amylopectin melting for 50% mc mixtures

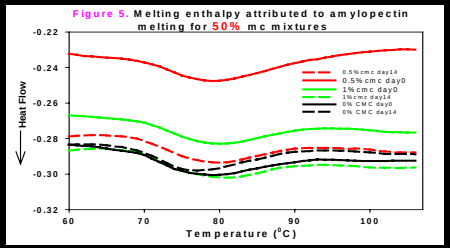


Figure 6. Melting enthalpy attributed to amyloptectin melting for 60% mc mixtures

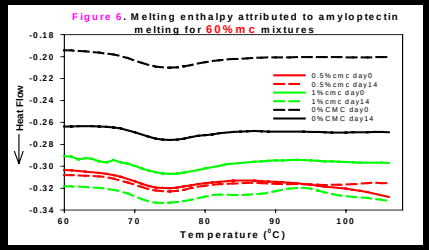
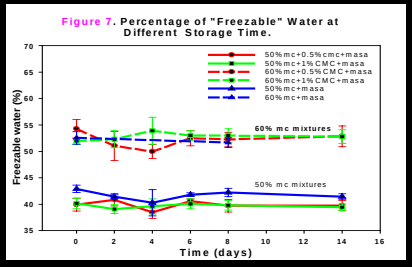


Figure 7. Percentage of "Freezable" Water at Different Storage Time.



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Conclusion & Discussion

- There are no differences in moisture loss between samples with 50% mc or 60% mc and those with and without CMC.
- TGA results show that CMC does have an impact on the distribution of water in the mixture. Water was not homogeneously partitioned within the masa/water/CMC mixture. (Figure 1&2)
- The transition in DSC around 0°C is attributed to "freezable" water (Figure 3&4). The transition around 70°C is attributed to amylopectin melting (Figure 5&6). The transition around 200°C is attributed to amylose melting (Figure 3&4). No change was observed due to different moistures or amount of CMC added in these transitions.
- The sample with 60% mc had a higher percentage of "freezable" water than the samples with 50% mc. No change was observed the "freezable" water content in either 50% mc or 60% mc during storage. (Figure 7)
- These results show that CMC had little impact on the thermo-analytical properties of the raw masa mixture except for a change in water distribution. Future work will be focused on changes during storage of a heated masa/water/cmc mixture.