

UNIVERSITI TEKNOLOGI MARA

**EFFECTS OF XANTHAN GUM
AND HYDROXYPROPYL
METHYLCELLULOSE ON BATTER
PROPERTIES AND STALING OF
SPONGE CAKE DURING STORAGE**

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ABSTRACT

The incorporation of hydrocolloids in sponge cake was aimed to reduce the staling process through its interaction with starch and water. Initially, the preliminary studies was conducted to select the hydrocolloids (xanthan gum, locust bean gum and hydroxypropylmethylcellulose) to be incorporated into cake mixture by using simplex lattice mixture design in which moisture content and texture were used as the response. Xanthan gum and hydroxypropylmethylcellulose were selected for this study since it gave significant high moisture content ($p < 0.05$) and low hardness values ($p < 0.05$), respectively. These optimised hydrocolloids (1% XG and 1% HPMC) were compared in terms of batter properties and staling behaviour of sponge cake during storage. The addition of 1% HPMC significantly increased the flow behaviour index of batter, while addition of 1% XG significantly increased the density, specific gravity, viscosity and consistency index of batter. The viscoelastic study shows an early onset temperature for gelatinization, denaturation and aggregation for batters containing hydrocolloids during heating (30-95°C). The freshly baked cakes containing 1% XG were found to have significant high values ($p < 0.05$) of hardness compared to 1% HPMC and control. In addition, sponge cake containing hydrocolloids had significant low volume ($p < 0.05$) compared to control cake. The stored cake (day 6) containing 1% XG significantly ($p < 0.05$) increased the hardness, chewiness and gumminess values compared to 1% HPMC and control cake. The significant moisture loss ($p < 0.05$) and increase of hardness ($p < 0.05$) from day 0 to day 6 of storage confirmed that crumb staling occurred in all sponge cake formulations. The addition of hydrocolloids in cakes was found to minimize the moisture loss compared to control sample but it could not prevent starch retrogradation during storage. This study concludes that xanthan gum has potential to minimize the moisture loss of cake during 6 days storage.

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CHAPTER ONE

INTRODUCTION

1.1 RESEARCH BACKGROUND

Sponge cake has a stable aerated emulsion system. However, the cake tends to stale during storage at room temperature. Staling is referred to the undesirable changes like crumb firming and drying which are taking place between the times of cakes is baked and consumed (Gómez, Ronda, Caballero, Blanco, & Rosell, 2007). Crumb staling or storage stability of baked product at storage temperature greater than 0°C involves starch retrogradation and moisture migration from the crumb to dry regions through evaporation and redistribution (Angioloni & Collar, 2009; Goesaert, Slade, Levine, & Delcour, 2009).

The possible solutions to reduce the staling are through the interference of the starch network either through the interaction of the additives with the starch and water or by disrupting the chain of starch itself (Kohajdová, Karovičová, & Schmidt, 2009). This shows that the polymeric interaction within the cake may play a main role in staling process to slow down the distribution of water within cake structure (Peressini, Pin, & Sensidoni, 2011).

The addition of additives in baked products usually involves the structural changes in the texture properties and has main effect on feeling of richness and fullness. The structural changes in crumb will definitely relate to the satiety expectations that take place in mouth. Finally, it will affect the consumer acceptance (Morell, Fiszman, Varela, & Hernando, 2014; Funami, 2011; Sozer *et al.*, 2009). Hence, the addition of additives in bakery products always focuses on improving the batters or dough of baked products, so that it will produce high quality cakes, which includes the cake volume and crumb texture.

Xanthan gum (XG) is a non-adsorbing polymer in emulsion that possess excellent thickening properties even at low concentration (Krstonošić, Dokić, Nikolić, & Milanović, 2015; Murray, Dickinson, Gransard, & Söderberg, 2006; Zhao, Zhao, Yang, & Cui, 2009). Besides, it shows good water holding capacity and water