



**FOAM PROPERTIES OF BAHULU BATTER AS
INFLUENCED BY STABILIZERS**

by

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TABLES OF CONTENTS

ACKNOWLEDGEMENT.....	ii
LIST OF TABLES	v
LIST OF FIGURES	vi
LIST OF ABBREVIATION.....	vii
LIST OF SYMBOLS	viii
LIST OF APPENDICES	ix
ABSTRAK	x
ABSTRACT.....	xi
CHAPTER 1 INTRODUCTION.....	1
1.1 Background of research	1
1.2 Rationale of study	2
1.3 Objective	3
CHAPTER 2 LITERATURE REVIEW	4
2.1 Bahulu	4
2.1.1 Bahulu cake batter	5
2.2 Formation of foam in Bahulu cake batter	6
2.3 Stabilization of Bahulu cake batter	7
2.4 Hydrocolloids.....	8
2.5 Main ingredients in the making of bahulu.....	10
2.5.1 All purpose flour	10
2.5.2 Sugar	11
2.5.3 Egg.....	12
2.5.4 Vanilla essence.....	14
2.5.5 Gum Arabic.....	15
2.5.6 Carboxymethylcellulose.....	15
2.6 Processing of Bahulu.....	18
2.6.1 Whipping	18
2.6.2 Baking	19
2.6.3 Cooling	20
CHAPTER 3 MATERIALS AND METHODS.....	21
3.1 Preliminary study.....	21
3.2 Design of experiment	21
3.3 Preparation of Bahulu	22
3.3.1 Ingredients	22

3.3.2 Procedure of Bahulu making	22
3.4.1 Viscosity of batter.....	24
3.4.2 pH of the batter	24
3.4.4. Density of batter	25
CHAPTER 4 RESULTS AND DISCUSSION.....	26
4.1 Preliminary study.....	26
4.1.2 Viscosity measurement of batter.	26
4.1.2 pH of batter	28
4.1.3 Overrun measurement of batter	30
4.1.4 Density of batter	33
CHAPTER 5 CONCLUSIONS.....	36
REFERENCES.....	37
APPENDICES	43

LIST OF TABLES

Table Caption	Page
Table 3.1: Formulations of Bahulu incorporated with same levels of Gum Arabic and CMC.....	23
Table 4.2: pH of batter incorporated with same concentration of GA and CMC during the mixing process of the batter	29
Table 4.3: Density of batter incorporated with control and same concentration of GA and CMC during the mixing process of the batter.....	33

LIST OF FIGURES

Figure Caption	Page
Figure 4.1 and 4.2: Comparison in viscosity of batter between control samples with different level of concentration in GA and CMC	26
Figure 4.3 and 4.4: The overrun achieved after 15 minutes of mixing in different level of concentrations on GA and CMC	31

LIST OF ABBREVIATION

Abbreviation	Caption
ANOVA	Analysis of Variance
CMC	Carboxymethylcellulose
cm^3	Cubic centimeters
$^{\circ}C$	Degree celsius
Df	Degree of freedom
GA	Gum Arabic
g	Gram
mL	Milliliter
pH	Potential of hydrogen
ρ	Density
SPSS	Statistical Package for the Social Science

LIST OF SYMBOLS

Symbol	Caption
\pm	Plus-minus
$<$	Less than

LIST OF APPENDICES

Appendix A: ANOVA statistical analysis.....	43
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SIFAT BUIH YANG MEMPENGARUHI ADUNAN BAHULU DISEBABKAN PENSTABIL

ABSTRAK

Pembentukan dan kestabilan buih dan emulsi dalam adunan Bahulu adalah kriteria kualiti yang sangat penting dalam memastikan kualiti produk akhir seperti struktur, kelembutan, kelembapan, dan rasa, terutama dalam industri makanan, di mana persepsi pengguna terhadap kualiti sangat dipengaruhi oleh penampilan. Dalam kajian ini Gum Arabic (GA) dan Carboxymethylcellulose (CMC) dipilih sebagai penstabil dengan tahap kepekatan yang sama (0.25%, 0.50%, 0.75%, 1.0%) untuk dimasukkan ke dalam adunan bahulu untuk mengkaji kesan penstabilan dan kualiti buih. Ujian kelikatan, pH, pengukuran dan 'overrun' ketumpatan dilakukan pada semua sampel. Kelikatan sampel dengan penambahan GA menurun dengan ketara kerana sumbangan terhadap berat molekul rendah berbanding CMC sehingga menyebabkan tegangan permukaan rendah. Dalam eksperimen ini, berat molekul pada kedua penstabil berkaitan dengan kelikatan dimana menunjukkan bahawa adunan cenderung untuk menyerap pada emulsi permukaan air-air. Ketumpatan CMC meningkat dengan ketara berbanding dengan GA kerana penggabungan udara yang menurunkan ketumpatan dan kelikatan adunan yang diubah. Semakin banyak udara yang disatukan semasa **mencambuk**, semakin banyak ketumpatan **busa** untuk mengurangkan keupayaan mencambuk meningkat. Kemudian, pH CMC meningkat dengan ketara kerana muatan yang sama dengan protein telur. Pengukuran berlebihan yang diambil untuk kedua-dua penstabil ini berlawanan satu sama lain kerana kapasiti berbuih GA lebih tinggi daripada CMC yang berkaitan dengan berat molekul yang lebih rendah atau kumpulan hidrofobik yang lebih tinggi dalam struktur.

FOAM PROPERTIES OF BAHULU BATTER AS INFLUENCE BY STABILIZERS

ABSTRACT

The formation and stability of foams and emulsions in Bahulu cake batter is a critical quality criterion in ensuring the quality of the final product such as structure, tenderness, moisture, and flavour. Especially in the food industry, where consumer perceptions of quality are heavily impacted by appearance. In this study, Gum Arabic (GA) and Carboxymethylcellulose (CMC) was selected as stabilizers with same levels of concentration (0.25%, 0.50%, 0.75%, 1.0%) to incorporated into Bahulu to study the effect on stabilization and quality of foam. Tests on viscosity, pH, overrun measurement and density were performed on all samples. Viscosity of batter with GA decreased significantly due to the contribution to low molecular weight compared to CMC resulting in low surface tension. In this experiment found, molecular weight in both stabilizers are related to viscosity whereby it indicates that batter have tendency to adsorb at air- water surface emulsion. The density of batter with CMC increased significantly compared to GA due to incorporation of air which decreases the density and modified batter viscosity. The more the air incorporated during whipping, the more the foam density to reduce whipping ability to increase. Then, pH of CMC increased significantly due to the same charge with egg protein. Overrun measurements taken for both stabilizers are opposite with each other due to GA foaming capacity being higher than CMC which is related to lower molecular weight or higher hydrophobic group in the structure.

CHAPTER 1 INTRODUCTION

1.1 Background of research

Traditional Malay snack foods such as bahulu, loyang, kapit, and others are frequently eaten and served among locals in Malay culture. In Malaysia, the majority of micro bahulu producers are 'orang lama,' who continue to make bahulu in the traditional fashion (Abdul Wahid & Mudor, 2016). The popularity of bahulu has won it a spot on the Malaysian National Heritage list with other cuisines like nasi lemak, Penang char kuey teow, ketupat, and kuih bulan (Mudor, 2010). It is offered in a variety of outlets including hypermarkets, convenience stores, and micro stores.

When it comes to bahulu texture, foam stabilisation during batter preparation is crucial. The creation of a rigid structure by crystallisation, denaturation, or gelatinization of the continuous phase is an important approach to stabilise the foam (Nisha et al., 2005). Hydrocolloids such as Gum Arabic (GA) and Carboxymethylcellulose (CMC) are very effective functional agents in making stable foam products because they act as whipping agents to allow aeration and foam formation, and then act to stabilise the interfacial film, preventing air leakage and structure collapse (Glicksman, 1986).

However, the foam that forms during the bahulu mixing process is unstable over time. By limiting retrogradation and preventing gelling and weeping, stabilisation can provide textural and freeze/thaw stability as well as extended shelf life of bahulu. Pregelatinization, a physical modification, impart swift viscosity development, cold-water swelling and process tolerance (Yang et al., 2020). The present work focused on

studying the effects of incorporation of GA and CMC on the quality and stability of bahulu.

With the rising demand for new varieties of food with superior qualities or providing maximum functioning in particular parameters, new challenges for food technologists and engineers to design new products toward the development of new products will continue to grow in the coming years. One of the rising demands for future food applications is the design of air-filled systems such as foam creation with long-term stabilisation (Green et al., 2013).

However, foamed food stability is difficult to maintain due to a restricted palette of molecules and new individual molecules that are difficult to identify. Food gums are used to thicken foamed foods and add to viscosity. Each food gum's functionality varies and is limited by its own physical and chemical features. Importantly, when selecting stabilisers, crucial factors such as particle principle and attachment energy should be taken into account.

1.2 Rationale of study

The production of foam in bahulu batter is unstable over time, according to the literature, and foamed food stability is difficult to sustain due to a limited palette of molecules. Foams stabilisation is crucial since it impacts the finished product's texture, volume, and shelf life. Foam will begin to collapse, resulting in whey separation during storage when a ready-to-cook batter is held for an extended length of time, the quality and safety of the batter will deteriorate since it has not been conserved and stabilised causing whey separation and hard texture of final product

1.3 Objective

The objective of this study was to analyse the effect of stabilizers which are Gum Arabic (GA) and Carboxymethylcellulose (CMC) on stabilization of bahulu batter based on foam properties