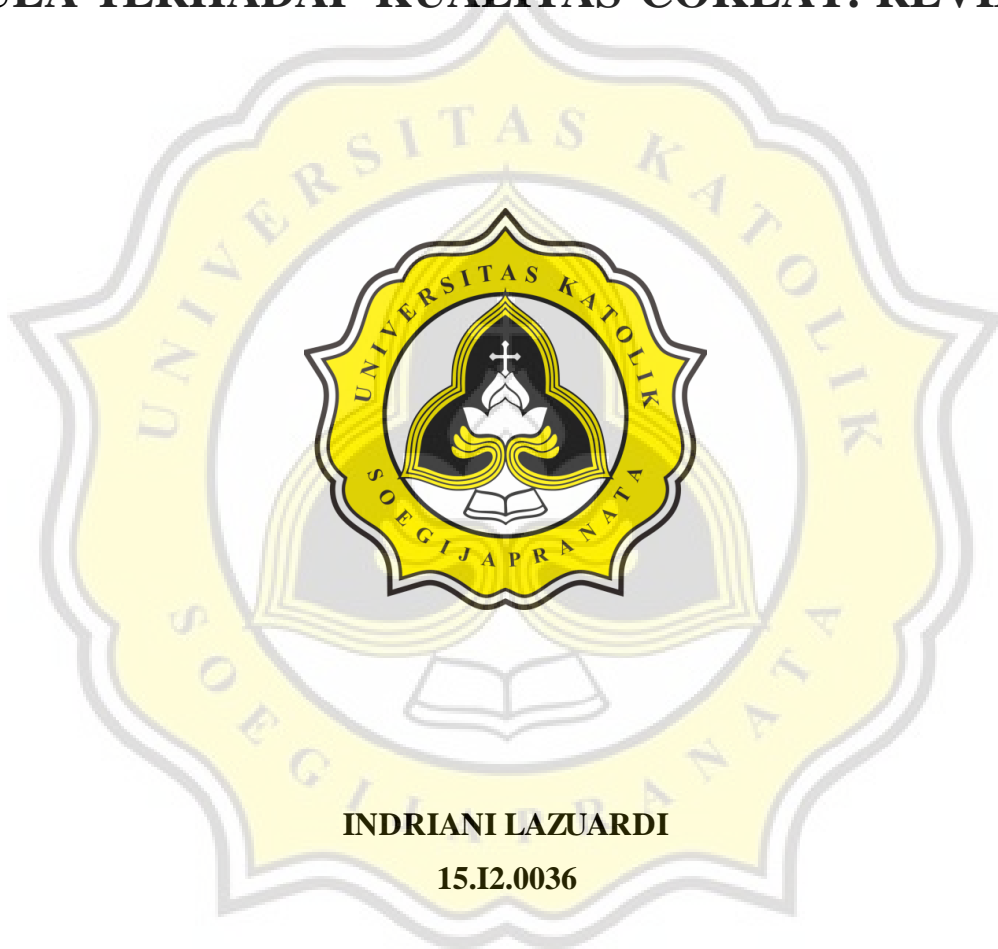


LAPORAN SKRIPSI

THE EFFECT OF SUGAR ALCOHOLS AS SUGAR SUBSTITUTES ON CHOCOLATE QUALITY: A REVIEW

PENGARUH GULA ALKOHOL SEBAGAI PENGGANTI GULA TERHADAP KUALITAS COKLAT: REVIEW



INDRIANI LAZUARDI

15.I2.0036

**PROGRAM STUDI TEKNOLOGI PANGAN
FAKULTAS TEKNOLOGI PERTANIAN
UNIVERSITAS KATOLIK SOEGIJAPRANATA
SEMARANG**

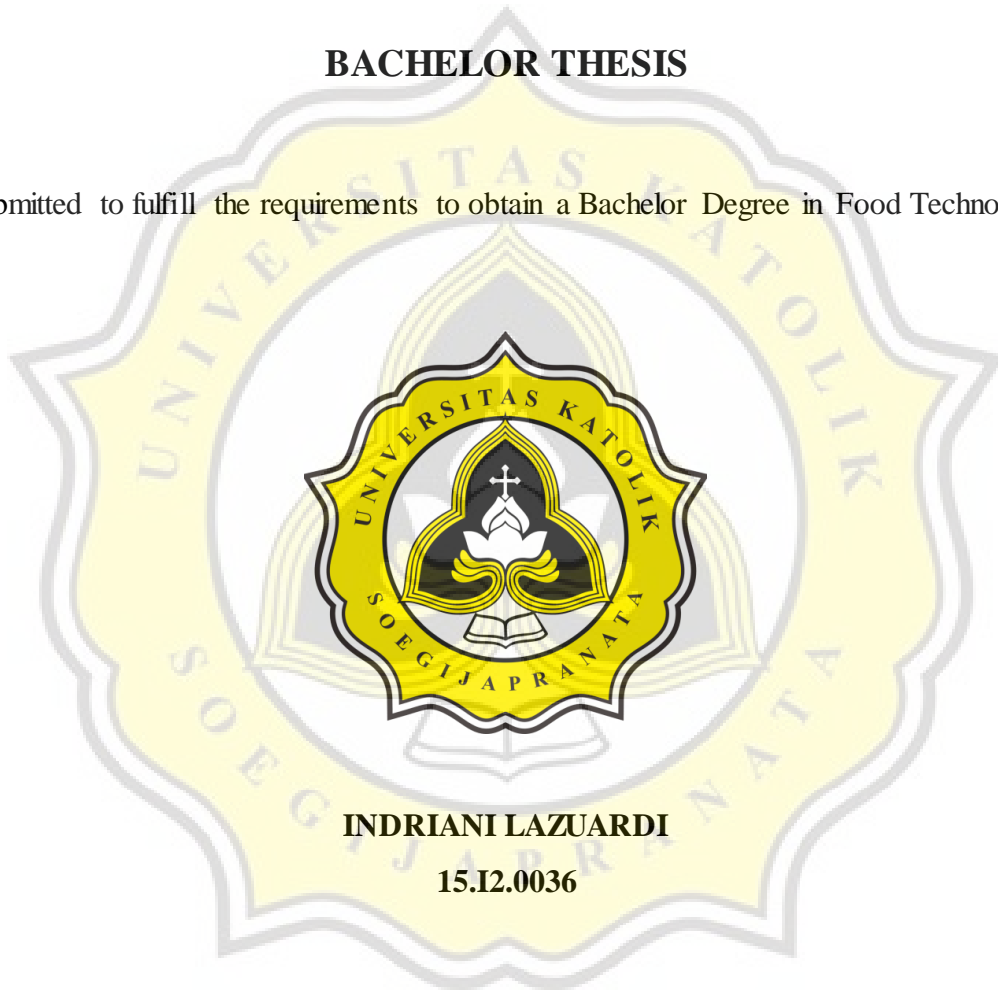
2022

**THE EFFECT OF SUGAR ALCOHOLS AS SUGAR
SUBSTITUTES ON CHOCOLATE QUALITY: A REVIEW**

***PENGARUH GULA ALKOHOL SEBAGAI PENGGANTI
GULA TERHADAP KUALITAS COKLAT: REVIEW***

BACHELOR THESIS

Submitted to fulfill the requirements to obtain a Bachelor Degree in Food Technology



INDRIANI LAZUARDI

15.I2.0036

**DEPARTMENT OF FOOD TECHNOLOGY
FACULTY OF AGRICULTURAL TECHNOLOGY
SOEGIJAPRANATA CATHOLIC UNIVERSITY
SEMARANG**

2022

LEMBAR PENGESAHAN

***THE EFFECT OF SUGAR ALCOHOLS AS SUGAR
SUBSTITUTES ON CHOCOLATE QUALITY: A REVIEW***

**PENGARUH GULA ALKOHOL SEBAGAI PENGGANTI
GULA TERHADAP KUALITAS COKLAT: REVIEW**

Oleh:

INDRIANI LAZUARDI

NIM : 15.I2.0036

Program Studi : Teknologi Pangan

Konsentrasi : Nutrisi & Teknologi Kuliner

Skripsi ini telah disetujui dan dipertahankan di hadapan sidang penguji pada tanggal

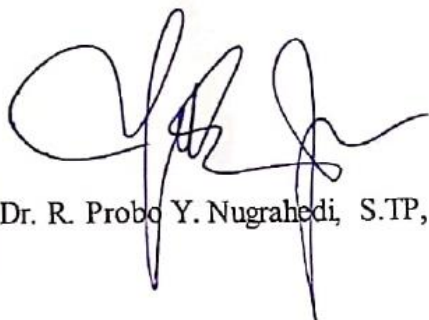
12 Juli 2022

Semarang, 12 Juli 2022

Fakultas Teknologi Pertanian

Universitas Katolik Soegijapranata

Pembimbing I



Dr. R. Probo Y. Nugraedi, S.TP, M.Sc.

Dekan



Dr. Dra. Laksmita Hartajanie, MP.

**HALAMAN PERNYATAAN PUBLIKASI KARYA ILMIAH UNTUK
KEPENTINGAN AKADEMIS**

Yang bertanda tangan di bawah ini:

Nama : Indriani Lazuardi
NIM : 15.I2.0036
Progdi / Konsentrasi : Teknologi Pangan / Nutrisi & Teknologi Kuliner
Fakultas : Teknologi Pertanian

Menyetujui untuk memberikan kepada Universitas Katolik Soegijapranata Semarang Hak Bebas Royalti Noneksklusif atas karya ilmiah yang berjudul **“THE EFFECT OF SUGAR ALCOHOLS AS SUGAR SUBSTITUTES ON CHOCOLATE QUALITY: REVIEW”** beserta perangkat yang ada (jika diperlukan). Dengan Hak Bebas Royalti Noneksklusif ini Universitas Katolik Soegijapranata berhak menyimpan, mengalihkan media/formatkan, mengelola dalam bentuk pangkalan data (*database*), merawat, dan mempublikasikan tugas akhir ini selama tetap mencantumkan nama saya sebagai penulis / pencipta dan sebagai pemilik Hak Cipta.

Demikian pernyataan ini saya buat dengan sebenarnya.

Semarang, 12 Juli 2022

Yang menyatakan

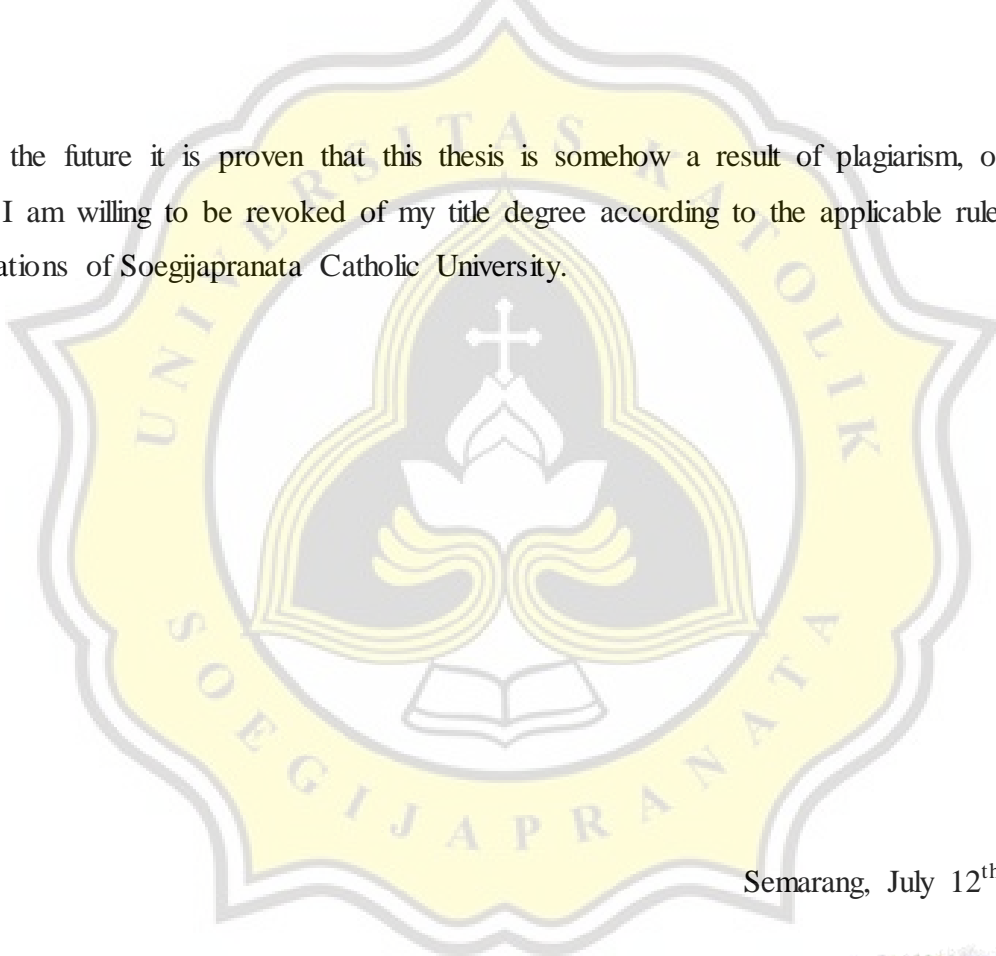


Indriani Lazuardi

STATEMENT OF AUTHENTICITY OF BACHELOR THESIS

I hereby declared my bachelor thesis entitled **“THE EFFECT OF SUGAR ALCOHOLS AS SUGAR SUBSTITUTES ON CHOCOLATE QUALITY: REVIEW”** has never been submitted to obtain a bachelor degree in any institution. To the best of my knowledge, no other work has ever been written or published, except for the referred literature mentioned in the bibliography in this review.

If in the future it is proven that this thesis is somehow a result of plagiarism, on that note I am willing to be revoked of my title degree according to the applicable rules and regulations of Soegijapranata Catholic University.



Semarang, July 12th 2022



Indriani Lazuardi

15.I2.0036

ABSTRACT

Chocolate is a top confectionery product consumed worldwide that comprises the biggest market share in the overall snack category. Its exquisite taste and mouthfeel makes chocolate consumption a particularly indulging experience. Nevertheless, rising concerns about health had called for new innovations as chocolates generally have a high caloric value due to its high sugar content. However, replacing sugar components in chocolate formulation is not as simple as chocolate has a set of complex sensory parameters that determine its quality. Implementing sugar alcohols/polyols as sugar replacers in chocolate manufacturing offers an alternative for this issue as polyols, mainly xylitol, maltitol, isomalt, sorbitol, erythritol, mannitol, and lactitol possess sucrose-like characteristics yet lower in caloric value compared to sucrose. There are some literature studies that mention about the polyols potential as sugar replacer in chocolate manufacturing, however there has been no comprehensive reviews that touch upon the subject of their effects to rheology. The aims of this review are to describe the chocolate quality and analyze the effect of polyols as sugar replacer to the chocolate rheology.

Chocolate quality is determined by its rheological and sensory properties. Rheologically, good quality chocolate has particle sizes $<30\ \mu\text{m}$, lower moisture content, and adequately low in viscosity. Lower particle size results in smoother texture. Moisture in chocolate promotes agglomeration that results in higher viscosity chocolate. High viscosity chocolate is linked to unfavorable sensory characteristics such as slow melting rate and pasty mouthfeel. The replacement of sugar components with maltitol, isomalt, and xylitol showed similar particle size distribution, specific surface area, moisture content, and viscosity compared to control. This indicates that polyols are suitable to be used as a sugar replacer in chocolate manufacturing. Out of the three polyols used in the experiments, the highest viscosity is found in xylitol-containing formulations.

Keywords: chocolate, chocolate quality, rheology, particle size, moisture, viscosity

ABSTRAK

Coklat adalah produk kembang gula yang populer dikonsumsi di seluruh dunia dengan tingkat penjualan tertinggi di kategori snack/makanan ringan. Rasanya yang istimewa membuat mengkonsumsi coklat menjadi saat yang menyenangkan. Di sisi lain, dengan mulai meningkatnya kesadaran masyarakat mengenai kesehatan maka dibutuhkanlah inovasi baru karena produk coklat pada umumnya memiliki nilai kalori yang tinggi akibat tingginya kadar gula di dalamnya. Namun, mengganti komponen gula pada formulasi coklat bukanlah hal yang mudah karena coklat memiliki sekumpulan parameter sensori kompleks yang menentukan kualitasnya. Implementasi gula alkohol/poliol sebagai zat pengganti gula pada produk coklat dapat memberikan alternatif terhadap isu ini karena polioliol-polioliol, terutama xylitol, maltitol, isomalt, sorbitol, erithritol, mannitol, dan laktitol memiliki karakteristik yang menyerupai gula sukrosa namun lebih rendah secara nilai kalori. Beberapa studi literatur telah menyinggung potensi polioliol sebagai zat pengganti gula pada proses pembuatan coklat, namun masih belum ada review komprehensif yang membahas mengenai efeknya terhadap rheologi. Tujuan dari review ini adalah untuk mendeskripsikan kualitas coklat dan menganalisa efek polioliol sebagai zat pengganti gula terhadap rheologi coklat.

Kualitas coklat ditentukan berdasarkan atribut rheologi dan sensorinya. Secara rheologis, coklat berkualitas baik memiliki ukuran partikel $<30 \mu\text{m}$, tingkat kelembaban/moistur yang rendah, dan viskositas yang cenderung rendah. Ukuran partikel yang kecil akan menghasilkan tekstur yang lebih lembut. Kandungan air di dalam coklat akan mendorong terjadinya aglomerasi yang menyebabkan meningkatnya viskositas. Coklat dengan viskositas yang tinggi dihubungkan dengan karakteristik sensori yang tidak diinginkan, seperti tingkat leleh yang lambat dan *mouthfeel* yang tidak enak. Penggantian komponen gula dengan maltitol, isomalt, dan xylitol menunjukkan nilai distribusi ukuran partikel, area permukaan spesifik, tingkat kelembaban, dan viskositas yang tidak jauh berbeda. Hal ini menunjukkan bahwa polioliol cocok digunakan sebagai zat pengganti gula pada coklat. Dari ketiga polioliol yang telah disebutkan, viskositas tertinggi didapatkan dari formulasi yang mengandung xylitol.

Kata kunci: coklat, kualitas coklat, rheologi, ukuran partikel, kelembaban, viskositas

FOREWORD

Praise and thank God for His good grace blessed upon the writer to finish this thesis entitled “THE EFFECT OF SUGAR ALCOHOLS AS SUGAR SUBSTITUTES ON CHOCOLATE QUALITY: REVIEW”. This thesis is compiled as one of the requirements to obtain a Bachelor Degree of Food Technology at Faculty of Agricultural Technology, Soegijapranata Catholic University.

The completion of this thesis would be impossible without the help and support of dear friends, families, and colleagues. The author would like to thank:

1. Almighty God for His grace and guidance throughout the whole process of completing this thesis.
2. Dr. R. Probo Y. Nugrahedhi, S.TP, MSc as a supervisor who has given time and tremendous care to provide guidance for the author until this thesis is finally finished.
3. All of the lecturers and staffs of the Faculty of Agricultural Technology that has taught many valuable things to the author during her study.
4. Family members that have inspired and motivated the author.
5. All dear friends that have been the mental support for the author.

The author realizes that this thesis still has many limitations and shortcomings. Therefore, author would like to apologize in advance for flaws and errors that would be deemed unpleasant for the readers. The author would also accept critics and suggestions for this thesis. Last but not least, the author hoped that this thesis could be kindly accepted and hopefully could convey some useful knowledge for the readers.

Semarang, July 1st 2022

Author,



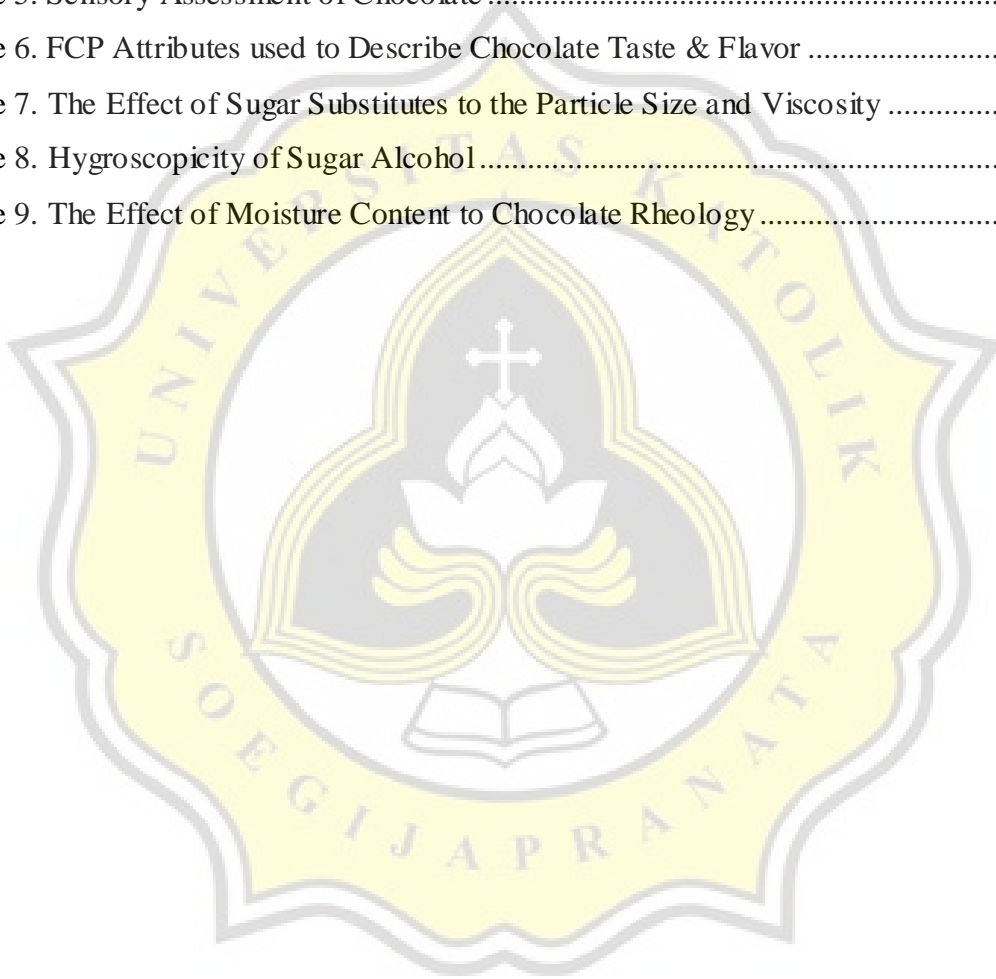
Indriani Lazuardi

TABLE OF CONTENTS

LEMBAR PENGESAHAN	i
HALAMAN PERNYATAAN PUBLIKASI KARYA ILMIAH UNTUK KEPENTINGAN AKADEMIS.....	ii
STATEMENT OF AUTHENTICITY OF BACHELOR THESIS	iii
ABSTRACT	iv
ABSTRAK.....	v
FOREWORD.....	vi
TABLE OF CONTENTS	vii
LIST OF TABLES.....	viii
LIST OF FIGURES	ix
1. INTRODUCTION.....	1
1.1. Background.....	1
1.2. Previous Review Studies	2
1.3. Chocolate Manufacturing	3
1.4. Sugar and Sugar Replacer in Chocolate Manufacturing.....	5
1.5. Objective of Review	7
2. METHODOLOGY OF RESEARCH.....	8
2.1. Research Design	8
2.2. Conceptual Design.....	10
3. CHOCOLATE QUALITY	11
3.1. Rheological Properties of Chocolate	11
3.2. Sensory Properties of Chocolate.....	14
4. SUGAR ALCOHOL IN CHOCOLATE MANUFACTURING.....	18
4.1. The Effect of Particle Size to Chocolate Rheology.....	19
4.2. The Effect of Hygroscopicity & Moisture to Chocolate Rheology	22
4.3. Other Factors Influencing Chocolate Rheology	25
5. CONCLUSION & SUGGESTION	27
6. BIBLIOGRAPHY	28
7. PLAGIARISM CHECK.....	34

LIST OF TABLES

Table 1. Existing Reviews about Low Calorie Chocolate	2
Table 2. Properties of Sugar Alcohols	7
Table 3. Keywords used in Literature Finding	9
Table 4. Rheology Assessment of Chocolate	12
Table 5. Sensory Assessment of Chocolate	14
Table 6. FCP Attributes used to Describe Chocolate Taste & Flavor	16
Table 7. The Effect of Sugar Substitutes to the Particle Size and Viscosity	19
Table 8. Hygroscopicity of Sugar Alcohol	23
Table 9. The Effect of Moisture Content to Chocolate Rheology	23



LIST OF FIGURES

Figure 1. Processing Steps for Chocolate	3
Figure 2. Flow of Research.....	8
Figure 3. Conceptual Design	10

