ANALYSIS OF CARBONYL COMPOUND FORMATION ON MAILLARD REACTION USING RARE SUGAR D-SORBOSE AND THREONINE

BACHELOR THESIS

Composed by

FAHMI ILMAN FAHRUDIN

FOOD TECHNOLOGY STUDY PROGRAM
DEPARTMENT OF AGRICULTURAL SCIENCES
FACULTY OF ANIMAL AND AGRICULTURAL SCIENCES
DIPONEGORO UNIVERSITY
SEMARANG, INDONESIA
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ANALYSIS OF CARBONYL COMPOUND FORMATION ON MAILLARD REACTION USING RARE SUGAR D-SORBOSE AND THREONINE

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As One of Requirements for Bachelor Degree in Food Technology
Study Program Faculty of Animal and Agricultural Sciences
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ENDORSEMENT LETTER

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ORIGINALITY STATEMENT OF BACHELOR THESIS

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Hereby declare as follows:

1. Scientific work entitled:
   Analysis of Carbonyl Compound Formation on Maillard Reaction Using Rare Sugar D-Sorbose and Threonine, and the research related to this scientific work is the result of my own work.
2. Each core or citation from other people in the form of publications in this scientific work has been recognized in accordance with standard procedures.
3. I also recognize that this scientific work has been done under supervision of: **Ahmad N. Al-Baarri, S.Pt., M.P., Ph.D. and Prof. Dr. Ir. Anang M. Legowo, M.Sc.**

Semarang, August 2017

Author

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RINGKASAN

FAHMI ILMAN FAHRUDIN. 23020113140048. Analisis Senyawa Karbonil pada Reaksi Maillard antara Gula D-sorbose dan Asam Amino Treonin. (**Pembimbing : Ahmad N. Al-Baarri and Anang M. Legowo)**

Polisakarida merupakan senyawa yang umumnya terdapat pada bahan pangan dan juga termasuk sumber nutrisi tubuh. Bahan utama pembentuk gula D-sorbose adalah polisakarida yang melalui reaksi enzimatik menggunakan D-tagatose 3-epimerase. D-sorbose yang terbentuk memiliki tingkat reaktifitas yang tinggi dibandingkan dengan gula alami lainnya. Reaksi Maillard merupakan reaksi yang terjadi antara gula dan asam amino dengan perlakuan panas, reaksi ini biasa terjadi pada proses pengolahan pangan seperti pemanggangan dan pengovenan. Reaksi Maillard memiliki dampak positif dan negative yang timbul dari perlakuan suhu tinggi dan dapat mempengaruhi kesehatan.

Penelitian ini menggunakan sorbose (Sor) dan Threonine (Thr) sebagai model reaksi Maillard untuk menghasilkan MRPs (*Maillard Reaction Products*) dan mendapatkan dampak positif tanpa menimbulkan dampak negatif dari reaksi Maillard. Penelitian ini bertujuan untuk menunjukan intensitas kecoklatan, indeks kecoklatan, pengukuran spectrum, aktivitas antioksidan dan korelasi antara intesitas kecoklatan dan aktivitas antiosidant MRPs yang dihasilkan dari Sor-Thr pada suhu 50℃.

Bahan yang digunakan pada penelitian ini adalah D-sorbose, Threonine, ABTS atau 2,2'-azino-bis (3-ethylbenzthiazoline-6-sulfonic acid). Sorbose dan Threonine digunakan untuk memproduksi MRPs menggunakan perlakuan pemanasan pada suhu 50°C selama 48 jam. MRPs dengan intensitas coklat diperiksa dengan pengukuran spektral yang menggunakan spektrofotometer pada 420 nm dan aktifitas antioksidan dianalisis dengan menggunakan panjang gelombang 734nm dengan metode ABTS, sedangkan indeks browning menggunakan colorimeter untuk menentukan nilainya. Korelasi antara intensitas kecoklatan dan aktivitas pemulungan dianalisis dengan menggunakan *GraphPad Prism* 6.0 untuk mendapatkan nilai signifikansi 60% sehingga mendapatkan korelasi antar data yang dihasilkan.

Selama proses reaksi Maillard berlangsung untuk menghasilkan MRPs, Sor-Thr menunjukkan aktivitas yang lebih baik daripada Sor. Intensitas kecoklatan, perubahan warna, dan aktivitas antioksidan meningkat seiring dengan meningkatnya durasi perlakuan pemanasan. Berdasarkan pengukuran spektral, MRPs dari Sor-Thr awalnya terdeteksi pada 48h pada saat perlakuan pemanasan berlangsung. Korelasi antara intensitas kecoklatan dan aktivitas oksidan dilakukan sebagai korelasi positif non linier dan korelasi signifikan. Karena proses reaksi glikasi yang berlangsung secara terus menerus disarankan harus adanya kontrol dengan memberi perlakuan khusus lama pemanasan dan suhu yang digunakan pada gula dan asam amino.

SUMMARY

FAHMI ILMAN FAHRUDIN. 23020113140048. Analysis of Carbonyl Compound Formation on Maillard Reaction using Rare Sugar D-Sorbose And Threonine. (**Supervisor : Ahmad N. Al-Baarri and Anang M. Legowo)**

Polysaccharides are commonly used in various foods processing, including the sources of food nutrients, food additives, and source of biologically active molecules. Polysaccharides are also found as a main resource to produce rare sugar D-sorbose through the enzymatic reaction using D-tagatose 3-epimerase. Through the various foods processing including heat treatment, fructose may be glycated to amino groups result the Maillard Reaction Product or MRPs that may contains negative impact for health. This research was used sorbose (Sor) and Threonine (Thr) as a model of glycation reaction to generate the MRPs. This study is aimed to demonstrate the browning intensity, browning index, spectra measurement, scavenging activity, and the correlation between browning intensity and scavenging activity of the MRPs generated from Sor – Thr at 50°C.

The materials on this research are D-sorbose, Threonine, ABTS or 2,2'-azino-bis (3-ethylbenzthiazoline-6-sulfonic acid). Sorbose and Threonine were used to producing MRPs using heating treatment at 50°C for 48 hour. The browning intensity MRPs was investigate with spectral measurement used spectrophotometer at 420 nm and scavenging was analyzed at 734nm with ABTS method, while browning index used colorimeter for determining the value. The correlation between browning intensity and scavenging activity was analyzed using GraphPad Prism to obtain the significance value of correlation about 83%.

During Maillard reaction process to generate MRPs, Sor-Thr were showing better performance than Sor. The browning intensity, color development, and scavenging activity were improved along with the increasing of duration heating treatment. Based on spectral measurement, MRPs from Sor-Thr was initialy detected at 48h of heating treatment. The correlation between browning intensity and scavenging activity were assigned as a positive non-linear correlation and significant correlation. Since the further process of glycation should be controlled using duration of heating treatment of sugar-amino it be advised.

PREFACE

Praise and great gratitude to Almighty God, Allah s.w.t., who always gives His gracious mercy and tremendous blessing that has helped the author to successfully finish this bachelor thesis with the title, "Analysis of Carbonyl Compound Formation on Maillard Reaction Using Rare Sugar D-sorbose And Threonine". This bachelor thesis is as a requirement in accomplishing the Bachelor Degree of Agricultural Technology at Food Technology Study Program, Department of Agricultural Sciences, Faculty of Animal and Agricultural Sciences, Diponegoro University.

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Final words, the author would like to thank very much for those who cannot be mentioned the names individually. Hopefully this bachelor thesis can be useful for us and can be the references for the parties in need.

Semarang, Indonesia, July 2017

Author,

Fahmi Ilman Fahrudin

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