



PROCEEDINGS

INTERNATIONAL FOOD CONFERENCE 2016

“INNOVATION OF FOOD TECHNOLOGY
TO IMPROVE FOOD SECURITY AND HEALTH”

Surabaya, 20-21 October 2016

EDITORS:

Indah Epriliati, S.TP., M.Si., Ph.D.
Ir. Indah Kuswardani, MP.
Dr. Ir. Anna Ingani W., MP.
Prof. Dr. Ir. Y. Marsono, MS.
Prof. Ir. Endang Sutriswati R., M.Sc.
Prof. Ezekiel T. Otunola
Dr. Peter A. Sopade
Ir. Susana Ristiarini, M.Si.
Asst. Prof. Ekachai Chukeatirote, Ph.D.

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IMPROVE FOOD SECURITY AND HEALTH

October 20 – 21, 2016
Universitas Katolik Widya Mandala Surabaya
Surabaya – Indonesia

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Faculty of Agricultural Technology, Widya Mandala Catholic University Surabaya
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PREFACE

Honorable and Distinguished Guests, Ladies and Gentlemen,

First of all, I would like to thank God the Almighty Father, for pouring His grace and blessings upon our lives. Especially, on this very special occasion, Thursday, 20th October 2016, we all gather here on the 2nd International Food Conference 2016 with the following theme “Innovation of Food Technology to Improve Food Security and Health”. This great scientific event is held by the Faculty of Agricultural Technology, Widya Mandala Catholic University Surabaya (WMCUS), in collaboration with the Indonesian Association of Food Technologist (PATPI) Surabaya Chapter, P3FNI and is also supported by the Indonesian Society for Lactic Acid Bacteria (ISLAB), Pergizi Pangan Indonesia, and Asosiasi Profesi Keamanan Pangan Indonesia (APKEPI).

Therefore please allow me to express my sincerest gratitude and highest appreciation to all aforementioned parties which have actively expressed their strong care, commitment, and enthusiasm in handling various issues related to health promotion and well-being of the society through food consumption. This is, indeed, aligned with the theme of 56th Anniversary of WMCUS, namely “Together with all nation’s components, the University is strongly committed to establish a competitive Indonesian Golden Generation”.

I believe this scientific meeting will provide a great opportunity for researchers and industry practitioners to disseminate and discuss their latest research innovation and findings in the areas of food technology, health, and food securities. This will result in strategy formulation to overcome problems related to the above fields. I hope this meeting may also expand and strengthen the collaboration between academia and industry practitioners.

Through this important event, food technology may be proven to become one of important contributing factors in promoting the quality of human lives. Ultimately, our nation’s competitiveness will be enhanced and Indonesia will be more respected by other nations in the global era. May we continuously strive for excellence in our professional lives to serve the community at large so we may become the sign of God’s presence and love.

May God bless us all !

Surabaya, 20th October 2016

Rector

Drs. Kuncoro Foe, G.Dip.Sc., Ph.D.

INTRODUCTION TO THE SEMINAR

Honorable guests, ladies and gentlemen

First of all I would like to welcome you all in this beautiful city of Surabaya, Indonesia. We are delighted to have you here to meet and to share our knowledge, research, and discuss latest trend in the area of food technology and nutrition. The topics of our International Food Conference 2016 is “Innovation in food technology to improve food security and health” and this year is the second edition of the conference after successful first edition in 2011.

As we already aware that the field of Food Technology is growing rapidly and its development is making a great impact on the health and wellbeing of the society. Food technology covers wide range of area starting from the simplest food preservation such as sun drying, post harvest handling to reduce losses, to the advanced nanotechnology for functional food application. Therefore food technology has become one of the most important contributors in human life. Nowadays, food technology are not only intended to fulfill the foods needed for daily consumptions, but has also been an important factor playing role in combating health problems in the world. Research on health problems of the society has been polarized into two groups which are health problems because of malnutrition and health problems due to over nutrition and unbalanced dietary and lifestyle habit.

The aim of this conference is to provide forum for researcher and industries to disseminate their latest research innovation in food technology, health, and food security, create opportunities for researcher to discuss health and food security problems around the world as well as the strategy to manage such problems and also Strengthen the collaboration between universities and industries by designing an event for researcher and industries to gather and discuss opportunities for collaborations.

The participants including invited speakers are coming from different countries such as Australia, Malaysia, Vietnam, Italia, Nigeria, and Indonesia. There are total of 81 papers presented in both oral and poster presentation.

We would like to express our sincere gratitude to all of the invited speakers Ibu Tetty Sihombing from BPOM, Prof Son Radu, Dr. Peter Sopade, Prof. Endang Sutriswati, Prof. Hany Widjaja, Ir. Indah Kuswardani, Prof. Rindit Pambayun, Prof. Achmad Subagio, Prof. Anang Legowo, Dr. Tyas Utami, Dr. Agustin Wardani, Prof. Nuri Andarwulan, Mr. Lino Paravano, Prof Hardinsyah, and Prof. Marsono. We would like to express our gratitude to P3FNI and PATPI Surabaya for the assistance in preparation for this conference.

We would also like to thank our sponsors that made this event possible. Last but not least, I would like to thank all members of organizing committee for their full supports and commitments in preparing this conference. I wish that all of us will have a fruitful discussion and for all of you having a pleasant stay in Surabaya. Thank you.

Warm regards

Ignasius Radix AP Jati
Chair of Organizing Committee IFC 2016

CONTENTS

Preface	iii
Introduction to the seminar.....	iv
Contents.....	vi
Designing Program to Calculate Micronutrient Status and Recommendation: A Case of Indonesia	1
<i>Hans K. Biesalski</i>	
Mycotoxins Contamination in Food and Feed	5
<i>Latiffah Zakaria</i>	
Food Processing and Product Properties, Focusing On Glycaemia	14
<i>Peter A. Sopade</i>	
The Role and Mechanism of Resistant Starch (RS) in Reducing Plasma Glucose Concentration	23
<i>Y. Marsono</i>	
Equations Models to Estimate Basal Metabolic Rate Based on Body Weight and Height of Indonesian Young Adults	29
<i>Hardinsyah, Nisa Mawadaturrohmah, and Nikita Debora Putri</i>	
The difference on under nutrition children risks in mojawarno subdistrict, Jombang Regency (Studies in Under and Normal Nutrition Children, Mother Nutritional Knowledge Level, Energy-Protein Consumption and Protein Foods Quality)	35
<i>Adelia Herine Fofid, I Nengah Tanu Komalyana, and Bernadus Rudy Sunindya</i>	
Variation of Seaweed Addition on the Nutritional Content of <i>Cendol</i>	44
<i>Adriyani Adam and Nurbaya</i>	
Chemical Constituents of Ginger (<i>Zingiber officinale</i> Roscoe) Essential Oil and Its Potency as Natural Preservative on Fresh Chicken Meat.....	51
<i>Alwani Hamad, Muliastri Mentari, Asmiyenti Djaliasrin Djalil, and Dwi Hartanti</i>	
Instant Tiwul Made of <i>Colocasia esculenta</i> (L.) Schott as A Current Functional Food Development for Hypercholesterolemic Patients.....	57
<i>Ambar Fidyasari, Sentot Joko Raharjo, and Erik Widiarto</i>	
The Effect of Calcium Carbonate (CaCO ₃) Concentration on the Physicochemical and Organoleptic Properties of Black Rice-Lady Finger Banana Breakfast Cereal.....	65
<i>Andrew Hartono and Thomas Indarto Putut Suseno</i>	
Texture of Cookies with Pregelatinization Time and Substitution Level of Red Kidney Bean Flour.....	69
<i>Anita Maya Sutedja, Chatarina Yayuk Trisnawati, and Ayu Anggraeni Handoko</i>	

Safety Evaluation of <i>Lactobacillus plantarum</i> Mut-7 as a Potential Indigenous Probiotic Strain Using <i>Sprague Dawley</i> Rats as a Model	76
<i>Atika Yahdiyani Ikhsani, Emma Riftyan, Y. Marsono, Tyas Utami, Jaka Widada, and Endang S. Rahayu</i>	
The Effects of Washing on the Chemical Properties and Bacteria Content of Fermented Cassava (a Case Study in the Growol Rural Industry, Kalirejo Village, Kokap, Kulon Progo, DIY).....	85
<i>Chatarina Wariyah and Sri Luwihana</i>	
Effect of Egg Reduction and Xanthan Gum Concentration on the Physicochemical Properties of Reduced Fat Rice Cake	91
<i>Chatarina Yayuk Trisnawati, Anita Maya Sutedja, Siti Kaniawati, and Johny Sutanto</i>	
Quercetin Encapsulation from Extract as a Natural Antioxidant with Emulsion Solvent Evaporation Method.....	99
<i>Clarissa, Rita Arbianti, Tania Surya Utami</i>	
The Risk Factors of Incidence of Stunting on Children (1-2 Years) in Region of District Health Center Kokar, Alor Regency NTT	108
<i>Dewi Natalian Lion, I Nengah Tanu Komalyana, Tapriadi</i>	
Lipase from <i>Mucor miehei</i> as Biocatalysts for The Hydrolysis –Esterification Sequential Reaction of Coconut Oil in Natural Flavor Production	118
<i>Dwina Moentamaria, Maria Angelina Suku, Khoirul Nurasih Herningrum, Via Siti Maslulah, Arief Widjaja, and Tri Widjaja</i>	
Effect of Unsaponifiable Fraction from Palm Fatty Acid Distillate on LDL/HDL Ratio of Hypercholesterolemia Rats.....	124
<i>Emalia Rhitmayanti, Teti Estiasih, Kgs. Ahmadi, and Tri Dewanti Widyaningsih</i>	
Soft Bran of Sorghum Potential for High Fiber Supplement Food	131
<i>Endang Noerhartati and Tri Rahayuningsih</i>	
Anti-Hypercholesterolemia Effect of Black Rice Bran in Male Wistar Rat	138
<i>Fadjar Kurnia Hartati, Arlin Besari Dj., and M. Bambang Sigit S.</i>	
Nanoencapsulation of <i>Andrographis paniculata</i> Extract As Inhibitors Enzyme α -Glucosidase And In-Vitro Release Study	144
<i>Farisa Imansari, Tania Suryani, and Rita Arbianti</i>	
Production Of <i>Aspergillus Oryzae</i> Crude Enzyme Based on Tofu Waste and Tapioca Dregs for Biotransformation of Salvianolic Acid B	151
<i>Fhani Meliana, Tania Surya Utami, and Rita Arbianti</i>	
Utilization of Pregerminated Jackbean and Soybean For Increasing The Protein Content of Instant <i>Tiwul</i>	162
<i>Friska Citra Agustia, Herastuti Sri Rukmini, and Rifda Naufalin</i>	

Competitive Advantage of Purse Liquid Sugar as Natural Sweeteners Materials	170
<i>Fungki Sri Rejeki, Diana Puspitasari, and Endang Retno Wedowati</i>	
Optimisation Process of Twin Screw Extruder Technology for Instant Artificial Rice Production	180
<i>Heny Herawati, Feri Kusnandar, Dede R. Adawiyah, and Slamet Budijanto</i>	
Gluten Free Noodle and Pasta Process Production Technology	190
<i>Heny Herawati and Sunarmani</i>	
Inactivation of <i>Staphylococcus aureus</i> GMP4 on Tofu with Pasteurization Process in Gamatahu KP4 UGM Yogyakarta	197
<i>Herni Purwantari, Aan Sofyan, Yudi Pranoto, Devi Yuni Susanti, Saiful Rochdyanto, and Endang Sutriswati Rahayu</i>	
Optimization Alginat Extraction from Brown Algae (<i>Sargassum polycystum</i>).....	207
<i>Douglas L. Wattimury and Hostalige Hutasoit</i>	
Effect of Carrageenan Concentration on Physicochemical and Organoleptic Characteristics of Mulberry (<i>Morusnigra</i> L.) Sheet Jam	216
<i>Kezia Samantha, Thomas Indarto P. S., and Adrianus Rulianto U.</i>	
Nanoencapsulation of <i>Andrographis paniculata</i> Extract as α -Glucosidase Inhibitors on the Formation of Hepatitis B Virus Envelope.....	224
<i>Khansa Zahrani, Tania Surya Utami, and Rita Arbianti</i>	
Comparative Investigation of Five Chilled Basic Taste Absolute Thresholds on Coastal and Inland Region : A Case Study at Tabanan Regency, Bali	230
<i>Kiki Fibrianto and Levy Indrawan Wicaksana</i>	
Gelatine from Cricket (<i>Gryllus assimilis</i>) through Acid Method, Characterization, and Application as Clarifier in Apple Juice Industry.....	235
<i>Lovitna Novia Puspitasari, Silviana Ike Setiawan, Rosalie Windy Maria, Suratno Lourentius, and Yohanes Sudaryanto</i>	
Characteristics of Baby Food Composed of Pre-Gelatinized Canna and Rice Flour	241
<i>Maria Matoetina Suprijono and Theresia Endang Widodoeri Widyastuti</i>	
Modeling and Optimising Tensile Strength of Biodegradable Film as the Effect of Fungal Fermented Cassava (“Gathotan”) Flour	247
<i>Adje Darmawan, Novi Indah Permatasari, and Umi Purwandari</i>	
Sensory Properties and Antioxidant Activity of Steamed Rice with Various of Black and White Rice Ratio	253
<i>Oki Krisbianto, Mega Mustika, and Mary Astuti</i>	
Mold Contamination and Aflatoxin B ₁ Levels in Salted Fish Comodities	261
<i>Rafli Zulfa Kamil, Yulius Damara Darma Putra, Andika Sidar, Widiastuti Setyaningsih, and Endang S. Rahayu</i>	

Physico-chemical Characteristics and Sensorial Attributes of Steamed Orange-Fleshed Sweet Potato Genotypes	269
<i>Rahmi Yulifianti, Erliana Ginting, and Joko Susilo Utomo</i>	
Characterization of Modified Corn Flour and Coarse Grits Using several soaking Treatments	276
<i>Ratnaningsih, Agus S. Somantri, and Dwi Amiarsi</i>	
Ethanol Producing Yeast Isolation from Indonesian Local Fruits for Ethanol Production.....	280
<i>Ryan Haryo Setyawan, Fahmi Irfan, Tyas Utami, Endang Sutriswati Rahayu, and Muhammad Nur Cahyanto</i>	
Conditions of Hygiene and Sanitation “Otak-Otak Bandeng” Production in Distric of Gresik	285
<i>Sri Handajani</i>	
The Physical Properties and Acceptability of Duck Meat Cured in Curcumin Extract with Added STPP	293
<i>Sri Hartati Candra Dewi, Chatarina Wariyah, and Niken Astuti</i>	
The Improvement of Nutritional Value of Analog Rice from Lesser Yam Tubers (<i>Dioscorea Esculenta</i> L.) Enriched with Soybean Flour.....	300
<i>Sri Winarti, Enny Karti Basuki Susiloningsih and Ramdan Hidayat</i>	
Do Indonesian Teenage and Young Adult Females Consume Foods Adequately?	307
<i>Wardina Humayrah, Hardinsyah, Ikeu Tanziha, and Umi Fahmida</i>	
The Effects of Cooking Methods on the Chemical (β -Carotene and Water Content), Physical (pH and Color) and Organoleptic (Color, Flavor, Texture) Characteristics of Papaya Leaf (<i>Carica papaya</i> , Linn)	316
<i>Yanesti Nuravianda Lestari, Roekistiningsih, and Nur Rahman</i>	
Effect of Gelatin and Sugar Concentration on the Characteristic of Panna Cotta.....	327
<i>Yohana Handani, Anita Maya Sutedja, and Chatarina Yayuk Trisnawati</i>	
Mineral Composition and Antioxidant Reducing Power of Green Algae <i>Caulerparacemosa</i> from Talango Islands, Indonesia.....	333
<i>Yushinta Aristina Sanjaya, Simon B. Widjanarko, Masruri, and Dwi Setijawati</i>	

Effect of Gelatin and Sugar Concentration on the Characteristic of Panna Cotta

Yohana Handani*, Anita Maya Sutedja, Chatarina Yayuk Trisnawati

*Department of Food Technology, Agricultural Technology Faculty, Widya Mandala Catholic University Surabaya, Jl. Dinoyo 42-44
Surabaya 60265 Indonesia*

E-mail: yohana_sby94@yahoo.com

Abstract

Panna cotta is an Italian dessert made from heavy whipping cream, milk, gelatin and sugar. The formula of Italian panna cotta is less suitable to be applied in Indonesia because heavy whipping cream is unavailable in Indonesia and people don't like thick cream. Replacement of heavy whipping cream with light whipping cream and change in light whipping cream-milk ratio into 1:9 were done to adjust panna cotta with the preference of panelist. This affected on the concentration of gelatin and sugar should be added. The purpose of this study was to determine the effect of gelatin and sugar concentration and their interaction on the characteristic of panna cotta and to determine gelatin and sugar concentration that could produce the most prefer of panna cotta. The research design was a factorial randomized block design that consisted of two factors: the concentration of gelatin (1%; 1,25%; and 1,5%) and the concentration of sugar (2,5%; 5%; and 7,5%) to obtain nine combination treatment and replicated three times. Data were analyzed using ANOVA test at $\alpha = 5\%$, if the results showed a significant effect, data were analyzed by Duncan's Multiple Range Test at $\alpha = 5\%$ to determine the combination treatment that gave a significant difference. The results indicated interactions between gelatin and sugar concentration provided significant effect on texture (hardness) of panna cotta. Increasing gelatin concentration caused an increased in hardness, but when sugar concentration was increased, the increasing of hardness were declined. Increasing concentration of gelatin and sugar caused a decreased in syneresis. Hedonic score of gel firmness was increased as increasing of gelatin and sugar concentration up to 1,25% gelatin and 5% sugar. Hedonic score of ease to melt and ease to swallow were increased as decreasing in gelatin concentration and increasing in sugar concentration. The recommended treatment was 1% of gelatin and 7,5% of sugar.

Keywords: Panna Cotta; Gelatin; Sugar

Introduction

Milk is one source of animal protein that is very important for health because it contains complete nutrition. According to USDA Foreign Agricultural Service (2014), the average milk consumption in Indonesia is still low. Badan Pusat Statistik (2013) showed that the low of milk consumption was caused by people that don't like the taste of milk and prefer soft drinks and other beverage. This indicate that milk consumption has to be improved by processing milk into a product, such as dessert.

Panna cotta is an Italian dessert made from heavy whipping cream, milk, gelatin and sugar then served cold. Panna cotta has the character resembles pudding with more soft gel, but it can maintain its shape when it was cut. One thing that make panna cotta different from the other dessert is it will melt in the mouth.

Panna cotta in Italia is made by heavy whipping cream and milk with the same ratio (1:1). This type of cream and the formula is less suitable to be applied in Indonesia because heavy whipping cream is

unavailable in Indonesia and people don't like thick cream. Replacement of heavy whipping cream with light whipping cream and change in light whipping cream-milk ratio into 1:9 were done to adjust panna cotta with the preference of panelist. This affected to the concentration of gelatin and sugar should be added. This change caused a decreased in fat content of 69,10% of the original formula thereby affected to the texture of panna cotta and give impact on the concentration of gelatin should be added.

Gelatin is protein extracted and processed by partial hydrolizing from collagen tissue in bone, cartilage and skin of animals (Karim, 2009). Gelatin in panna cotta play a role as gelling agent. Gelatin form thermoreversible gel at temperature below 35°C (Mariod dan Adam, 2013). Gelatin gel will melt when heated above the melting temperature, 27-34°C, thus gelatin gels tend to melt in the mouth (deMan, 1999).

According to deMan (1999), gel formation occurs in two stages process. The first stage is denaturation of the native protein into unfolded polypeptides. The second stage is association of polypeptides to form gel matrix. Gel formation is the phenomenon involving the association or cross-linking of the polymer chains to form a three dimensional network that traps or immobilises the water within it to form a rigid structure that is resistant to flow. The associated regions known as junction zone, may be formed by two or more polymer chains. Junction zones are bound by weak hydrogen bonds (Saha and Bhattacharya, 2010).

The characteristic of gelatin gel is affected by concentration of gelatin. As the concentration of gelatin increases, the rate of gelation also increases, thereby increasing the firmness (Mariod and Adam, 2013). If the concentration of the gelatin is too low, it will form a soft gel. This research used three levels of gelatin concentration, that are 1%; 1,25%; and 1,5%.

According to Weaver and Daniel (2003), gelatin gel is also affected by presence of another compound, such as sugar (sucrose). Sucrose is hygroscopic because thier polyhydroxyl group capable to form hydrogen bonds with water. This can interfere gelatin to trap water and affect to the characteristic of gelatin gel, so it should be determined the most appropriate concentration of sucrose for the best characteristic of panna cotta. This research used three levels of sucrose concentration, that are 2,5%; 5%; and 7,5%.

Various level in concentration of gelatin and sugar affect to characteristic of panna cotta. This become an underlying suspicion that there is interaction effect between concentration of gelatin and sugar to the characteristic of gelatin gel, therefore reasearch about effect of gelatin and sugar concentration on the characteristic of panna cotta should be done.

Materials and Methods

Materials

Light whipping cream, pasteurized milk and sugar are comercial products obtained from supermarket in Surabaya. Gelatin used for making panna cotta is bovine gelatin. Filter paper was used for syneresis analysis and mineral water for sensory analysis.

Instrument

Gas stove (*Rinnai*), refrigerator (*Electrolux*), weigher (*Acculab*), cylinder cup (volume 22 mL), spoon, stirrer, pan, thermometer 0-100°C, measuring cup 200 mL (*Iwaki Pyrex*) and beaker glass 250 mL (*Iwaki Pyrex*) were used for producing panna cotta. Cylinder cup (height: 4 cm, radius: 2 cm), analytical weigher (*Mettler Toledo*), spoon, weighing bottle, exicator, silica gel, Texture Analyzer (*TA-Xt Plus*), thermometer infrared (IRtek IR 60), plastic container (10x15 cm), oven (*Binder*), refrigerator (*Electrolux*) and questionnaire were used for physic and sensory analysis.

Experimental Design

The research design was a factorial randomized block design that consisted of two factors: the concentration of gelatin (1%; 1,25%; and 1,5%) and the concentration of sugar (2,5%; 5%; and 7,5%) to obtain nine combination treatment and replicated three times. Data were analyzed using ANOVA test at $\alpha = 5\%$, if the results showed a significant effect, data were analyzed by Duncan's Multiple Range Test at $\alpha = 5\%$ to determine the combination treatment that gave a significant difference. Concentration of gelatin and sugar for the best panna cotta were determined by the highest score in sensory analysis.

Panna Cotta Making

Some of pasteurized milk were set aside to soak with gelatin in ratio 1:15 (gelatin:milk) for 15 minutes (mixture 1). The rest of pasteurized milk were cooked with light whipping cream and sugar until 70°C (mixture 2). Mixture 1 were blended to mixture 2 and were cooked until 70°C then stand for 1 minute. This mixture were pour into several cup size adjusted to the requirement for analysis. This mixture was cooling down until reached the room temperature to prevent condensation at the lid of the cup, then was setting in refrigerator at $\pm 5^\circ\text{C}$ for overnight.

Texture Analysis

Textural parameter (hardness) was measured by Texture Analyzer (Pang *et al.*, 2014) at $15 \pm 1^\circ\text{C}$. A 0,5" (12,7mm) radius cylindrical probe was used to penetrate the sample. Sample in the cylinder cup was put on the container filled by ice cube in order to maintain the temperature. This container were put under the probe, then probe will penetrate the sample and back to the initial position. Hardness was defined by the maximum peak force during the first compression cycle.

Syneresis with modification

Syneresis was measured by measuring the water expelled from the sample panna cotta which has been stored overnight in refrigerator at 5°C (Anggraini, 2008). Water expelled was measured by tilting the cylinder cup filled by sample, then the water was absorbed by the filter paper, then the weight of the water was measured. Syneresis was measured every day until seven days storage in refrigerator.

Sensory Characteristic

Sensory analysis were done using 9-point hedonic scale which score 1 for dislike extremely and score 9 for like extremely. This research was done by 80 untrained panelists to record their opinion about gel

firmness, ease to melt and ease to swallow. The test consisted of two steps, the first step for gel firmness and ease to melt, then the second step for ease to swallow. A new sample come from refrigerator was prepared for every steps.

Result and discussion

Hardness

Hardness is defined as the force that should be given to deform an object. Hardness is measured as the maximum peak force during the first compression cycle (Bourne, 2002). The higher hardness, the more force needed to deform panna cotta, so it indicated the gel more firm. Hardness of panna cotta ranged from 8,684 g to 26,732 g as shown in Figure 1. The result indicated that interactions between gelatin and sugar concentration provided significant effect on hardness of panna cotta.

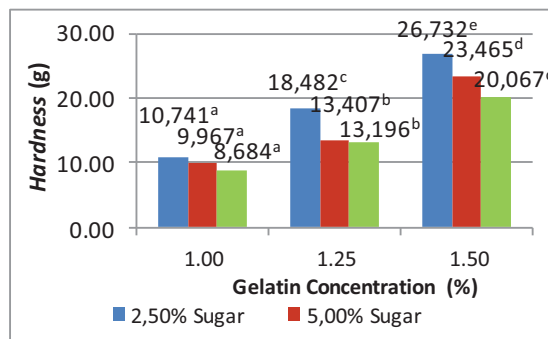


Figure. 1. Hardness of panna cotta as the function of gelatin and sugar concentration. Different superscripts letter indicate significant differences between samples ($\alpha = 5\%$).

The difference effect of gelatin concentration on hardness in every concentration of sugar indicated interaction between gelatin and sugar. Increasing concentration of sugar interfered gelatin gel formation because of competition of water available between gelatin and sugar. Increasing gelatin concentration caused increased in hardness, but when sugar concentration was increased, the increasing of hardness were declined. The higher concentration of sugar, the more water were bound therefore the less water available for gelatin. This caused gelatin gel weaken due to a lack of water available to maintain gel integrity. According to Choi (2004), sugar retarded gelatin gelation. The presence of sugar reduce gelation rate and prevent of gelatin chains from approaching each other kinetically during gelation because of increased viscosity. The movement of the protein aggregates were slow down in sugar system because increasing the viscosity. This may resulting in increasing distance between entagled points of the chain thereby decreasing the gel firmness.

Syneresis

The result showed that concentration of gelatin and sugar provided significant effects on syneresis of panna cotta respectively. Increasing concentration of gelatin caused decreased in syneresis because of the ability of gel to trap water in matrix system. The higher concentration of gelatin, the more matrix that can trap water therefore the less water expelled from gel during storage and impact on decreasing syneresis.

Increasing concentration of sugar caused more water will be bound by hydrogen bond. The higher concentration of sugar, the more water bound. This resulting decreased in water that has to be trapped by gelatin therefore the ability of gel matrix to retain water in it became higher therefore reduced the level of syneresis. Decreasing syneresis were also evidenced in the research done by Sugiarto (2011) which showed that the higher concentration of sugar in reeds jelly drink with the addition of carrageenan caused the amount of water expelled was reduced so that the syneresis.

Percentage syneresis of panna cotta also increased during storage. Syneresis occur due to the instability of gel matrix in trapping water. According to Glicksman (1983), the instability were caused by the formation of cross-linking between gelatin chains continuously during storage. This process caused gel shrank and loss of elasticity. As the result, the gel becomes brittle and loss the ability of trapping water. The percentage of syneresis was also increased due to the weakening ability of sugar in binding water in gel system during storage. Percentage syneresis of panna cotta can be seen in Table 1.

Table 1. Syneresis of Panna Cotta for 7 Days

Percentage of Syneresis on Day -	Gelatin (%)			Sugar (%)		
	1,00	1,25	1,50	2,50	5,00	7,50
1	0,077 ^c	0,070 ^b	0,059 ^a	0,076 ^c	0,069 ^b	0,062 ^a
2	0,097 ^c	0,080 ^b	0,058 ^a	0,087 ^c	0,079 ^b	0,069 ^a
3	0,324 ^c	0,240 ^b	0,215 ^a	0,291 ^c	0,264 ^b	0,232 ^a
4	0,673 ^c	0,609 ^b	0,357 ^a	0,592 ^c	0,544 ^b	0,503 ^a
5	1,411 ^c	0,994 ^b	0,634 ^a	1,109 ^c	1,006 ^b	0,875 ^a
6	1,952 ^c	1,336 ^b	0,769 ^a	1,467 ^c	1,332 ^b	1,259 ^a
7	2,542 ^c	1,729 ^b	1,209 ^a	1,968 ^c	1,812 ^b	1,700 ^a

Different manuscript letter in a row indicate significant differences between samples ($\alpha = 5\%$)

Sensory Characteristic

Hedonic score of panna cotta can be seen in Table 2. The results showed that increasing concentration of gelatin and sugar caused increasing in preference of panelists to gel firmness up to gelatin concentration levels of 1,25% and 5% sugar. Increasing concentration of gelatin above 1,25% with various concentration of sugar caused decrease in preference of gel firmness. The most preferred treatment was concentration of gelatin 1,25% and 5% sugar. This produce gel that were firm enough. Gelatin concentration above 1,25% in various concentration of sugar has a lower score. This treatment produced a rigid gel because the higher concentration of gelatin gave more intense intermolecular contacts and stronger protein-protein interaction. The use of gelatin concentration below 1,25% at various concentration of sugar also gave a lower score because it produced a very soft gel.

Score of ease to melt and ease to swallow were increased due to decrease in concentration of gelatin and increase in concentration of sugar. The highest score was obtained in 1% gelatin and 7,5% sugar. This treatment produced panna cotta that was melt easily inside the mouth. Cross-link formation of gelatin chains were not intense in low concentration of gelatin. It only formed a little entangled points of polypeptide chains, so the hydrogen bonds binding it were more easy to be break and gelatin gel were melt easily by heat in the mouth. High concentration of sugar also caused gel more easy to melt because sugar increased viscosity of the system. Cross-link formation in viscous system occurred slowly as

described before, therefore the entangled points were not intense and it caused gel more easy to melt.

Table 2. Hedonic Score of Panna Cotta

Attributes	Sample								
	A ₁ B ₁	A ₂ B ₁	A ₃ B ₁	A ₁ B ₂	A ₂ B ₂	A ₃ B ₂	A ₁ B ₃	A ₂ B ₃	A ₃ B ₃
Gel Firmness	4,34 ^a	6,23 ^{cd}	5,69 ^b	5,65 ^b	6,69 ^e	5,63 ^b	5,81 ^{bc}	6,55 ^{de}	6,08 ^{bc}
Ease to Melt	6,29 ^d	4,89 ^b	4,40 ^a	6,86 ^e	6,14 ^{cd}	5,08 ^b	7,43 ^f	6,49 ^{de}	5,78 ^c
Ease to Swallow	6,65 ^d	5,50 ^c	4,55 ^a	7,13 ^e	5,75 ^c	4,99 ^b	7,59 ^f	6,69 ^d	5,76 ^c
Total Score	17,28	16,62	14,64	19,64	18,58	15,70	20,83	19,73	17,62

A₁B₁ = 1% gelatin, 2,5% sugar; A₂B₁ = 1,25% gelatin, 2,5% sugar; A₃B₁ = 1,5% gelatin, 2,5% sugar; A₁B₂ = 1% gelatin, 5% sugar; A₂B₂ = 1,25% gelatin, 5% sugar; A₃B₂ = 1,5% gelatin, 5% sugar; A₁B₃ = 1% gelatin, 7,5% sugar; A₂B₃ = 1,25% gelatin, 7,5% sugar; A₃B₃ = 1,5% gelatin; 7,5% sugar. Different manuscript letter in a row indicate significant differences between samples ($\alpha = 5\%$)

Ease to swallow was related to gel firmness and ease to melt. Treatment of 1% gelatin and 7,5% sugar produced the softest gel therefore it was the most easy to swallow. Panna cotta with properties of the most easy to melt would undergo rapid change from solid to liquid so that it would have a tendency to flow and swallow easily in esophagus. Based on the highest score, the recommended treatment was 1% of gelatin and 7,5% of sugar.

Conclusion

Interactions between gelatin and sugar concentration provided significant effect on hardness of panna cotta. Increasing gelatin concentration caused an increased in hardness, but when sugar concentration was increased, the increasing of hardness were declined. Increasing concentration of gelatin and sugar caused a decreased in syneresis. Hedonic score of gel firmness was increased as increasing of gelatin and sugar concentration up to 1,25% gelatin and 5% sugar. Hedonic score of ease to melt and ease to swallow were increased as decreasing in gelatin concentration and increasing in sugar concentration. The treatment recommended was 1% gelatin and 7,5% sugar.

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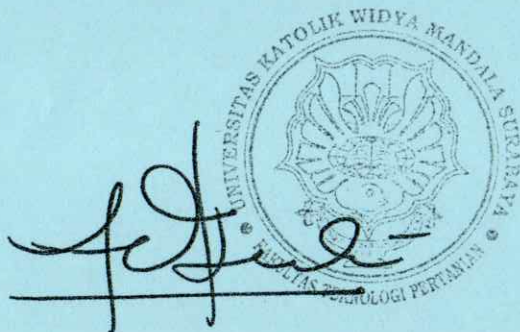
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Ir. Adrianus Rulianto Utomo, MP.
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