



Conference Member of
**International Joint Conference on
Science and Technology**
IJCST



Proceeding

**INTERNATIONAL CONFERENCE ON
SCIENCE AND TECHNOLOGY
ICST 2018**

Bali Nusa Dua Convention Center
October 18-19, 2018

Theme

**Science, Technology, Innovation and
Education for Sustainable Development
to Support Community Empowerment**

Members of Consortium



ICST Proceedings

[Current](#) [Archives](#) [About](#)

[Home](#) / [Archives](#) / Vol 1 (2018): Proceedings of ICST 2018



ISBN 978-602-0951-23-2

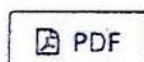
Published: 2018-12-03

Articles

Adsorption of Heavy Metals of Activities Disposal in Laboratory Using Active Carbon and Bentonite

Nuniek Herdyastuti, Rusmini Rusmini, Sari Edi Cahyaningrum

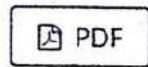
1-4



Subcloning, Expression of Gene Encoding Rophtry 1 (Rop1) Toxoplasma Gondii Local Isolate

Purwaningtyas Kusumaningsih

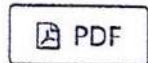
5-7



Implementation of Value Engineering for Refining Waste Palm Oil

Sumiati Sumiati, Minto Waluyo

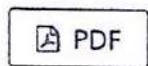
8-10



The Effectiveness of Guided Inquiry-Based Students Practicum Worksheet to Promote Science Process Skills In Reaction Rate

Rusly Hidayah, Liya Anggraeni

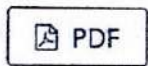
11-13



Designing Concept Marriage Law Application Based on Android

Firza Prima Aditiawan, Teddy Prima Anggriawan

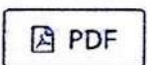
14-17



Implementation of Ergonomy on Parking Management Training Increases Parking User Satisfaction in Plaza Renon Denpasar

I Ketut Sutapa, I Made Sudiarsa, I Wayan Suasira, I Nengah Darma Susila

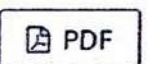
18-20



Addition of Anchovy Flour and Sodium Bicarbonate to Characteristics of High Calcium

Fesdila Putri Nurani, Jariyah Jariyah, Rosida Rosida, Risma Ayu Susanti

21-24



Addition of Anchovy Flour and Sodium Bicarbonate to Characteristics of High Calcium

Fesdila Putri Nurani¹, Jariyah, Rosida², Risma Ayu Susanti³

Department of Food Technology
Universitas Pembangunan Nasional "Veteran" Jawa Timur
Surabaya, Indonesia
¹fesdila.tp@upnjatim.ac.id

Abstract— Cracker is one biscuit made from flour, fat and salt, which is fermented with yeast, and the dough is made in layers, then cut and roasted. A cracker is generally made from flour and salt or sugar. Addition other ingredient is one of the effort to do some diversification of product to improve the taste or to improve the value of product. Anchovy is one of the marine products that is easy to find and its known has high calcium content. Anchovy should be processed into fish flour before its being used as ingredient in making crackers. The addition of anchovy flour is improving calcium content in crackers. In another side, the addition of Sodium Bicarbonate (NaHCO_3) as proofer will improve the texture and make the cracker crunchier. The aim of the study is to determine the combination of addition of anchovy flour (9, 18, and 27%) and the concentration of sodium bicarbonate (NaHCO_3) (0.3, 0.5, and 0.7%) on the characteristics and content of calcium crackers. The results obtained by adding anchovy flour showed an increased in calcium contents in crackers, while NaHCO_3 increased the crunchiness of the crackers.

Keywords— crackers; anchovy; anchovy flour; calciu; broken power.

I. INTRODUCTION

Cracker is one of snack that can be found in many places. Most of people generally enjoy crackers anytime. Cracker is one of the biscuits made from flour, fat and salt, which are fermented with yeast, and the dough is made in layers, then cut and roasted [1]. Crackers are similar as other biscuits, but crackers don't use too much sugar (even for certain types of crackers don't use sugar) and without addition of milk or eggs at all. Crackers making requires some of wheat flour, because wheat flour has glutenin and gliadin of protein which affects the elasticity of the dough. The flour makes the dough can be made into sheets, ground and can hold the air due to fermentation so that the dough expanding. The main ingredient of crackers is wheat flour that contains high carbohydrates and simple sugars but low in calcium. Usually, the calcium content of various types of crackers on the market is very low, which can only meet 5% - 8% calcium per serving.

Anchovy is one of the best sources of calcium to prevent osteoporosis. Anchovy is a source of calcium that is

resistant and not easily dissolved in water. Anchovy known as one of fish that contains high protein, some minerals, and vitamin that has beneficially for human health. Anchovy is one of the material of fish flour that known as anchovy flour. Anchovy flour is resulting of grinding and shieving process after the anchovy was dried for about 24 hr. Calcium content of the anchovy flour is 2000mg/100g [2].

Proximate analysis of anchovy flour showed the moisture content is 4.44%, ash content is 7.33%, protein is 80.94%, fat is 4.75% and carbohydrates are 2.54%. Furthermore, [3] explained that the addition of 5% anchovy flour in making biscuits is the best treatment in both of chemically and organoleptically. Biscuits with adding 5% anchovy flour has moisture content 2.95%, protein content 13.05%, ash content 1.55%, fat content 15.21%, carbohydrate content 67.24%. Sulistyowati *et al.* [4] stated that the effect of substitution of soy flour to 10% anchovy flour showed increasing calcium in crackers by 7.52%. Fish flour generally added as one of food ingredients. Protein content of fish flour is high. This is the reasons some people consume fish flour in their diet.

Crunchiness is an important physical characteristic of crackers. The protein and starch forms matrix by mixing two or more types of flour which are have different characteristics. It will form a compact structure and may cause hardness of the product [5]. The aim of NaHCO_3 addition is to prevent the hardness of the product. NaHCO_3 is a improver that helps to improve the volume of dough. If the improver is added to the mixture, carbon dioxide gas will be formed; this gas will be trapped inside the gluten so that the mixture will expand because the increasing of the gas produced [6].

The addition of anchovy flour is expected to produce calcium-rich crackers. Besides, crackers with the addition of anchovy can be called as one of the diversified products that have high calcium contents.

II. MATERIALS AND METHODS

II.1 Materials

The ingredients used in making crackers are dried anchovy obtained from the Pabean Market Surabaya, wheat flour, margarine, NaHCO_3 , instant yeast brand (Fermipan),

salt. Materials for analysis include petroleum ether, methyl red indicator, kjeldahl tablet, water, sodium oxide.

III. METHODS

II.2.1. Anchovy Flour

The ingredients used in making crackers are dried anchovy obtained from the Pabean Market Surabaya, wheat flour, margarine, NaHCO₃, instant yeast brand (Fermipan), salt. Materials for analysis include petroleum ether, methyl red indicator, kjeldahl tablet, water, sodium oxide.

II.2.2. Crackers

Ingredients like margarine 25 g, salt 1.5g, water 55ml, instant yeast 1.5g, wheat flour 35g, NaHCO₃ and anchovy flour was prepared before the mixing. Margarine and salt were mixed and poured into wheat flour which has been given instant yeast, stirred evenly then added anchovy flour with a concentration of 9%, 18%, 27% and 0.3% NaHCO₃, 0.5%, 0, 7%. Water is added little by little until the dough is smooth. The dough was fermented for 30 minutes until the mixture expands and then laminated with flour and then made into sheet. Baking was carried out at 175 ° C for the first 5 minutes and 125 ° C for the next 8 minutes.

The analysis was carried out included: protein contents [7], moisture and ash content [7], fat content [7], calcium contents with AAS method [7], broken power/crunchiness [8].

IV. RESULTS AND DISCUSSION

TABLE I. CHARACTERISTIC OF ANCHOVY FLOUR

Properties	Results	References
Moisture contents (%)	5,21	4,44 ^[3]
Ash (%)	10,25	7,33 ^[3]
Total Proteins (%)	64,38	80,94 ^[3]
Total Lipids (%)	1,5	4,75 ^[3]
Calcium (mg)	645,37	972 ^[4]

[3]: Asmoro(2012); [4]:Sulistyowati (2015)

The results showed that moisture content of anchovy flour was 5.21%, ash content of 10.25%, protein content of 64.38%, fat content of 1.5%, and calcium content of 645.37 mg / 100g. The anchovy flour contains showed that anchovy flour contained water content of 5.21%, ash content of 10.25%, protein content of 64.38%, fat content of 1.5%, and calcium content of 645.37 mg / 100g. The differences that occur can be caused by the raw materials used are different, drying processes and the water content contained in flour where the lower the water content, the higher the nutrient component than the water content contained therein. Desrosier [9] stated that during the drying, some materials will lose water content which can result in increased concentration of nutrients per dry weight.

Table 2 shows that the higher addition of anchovy flour is not significantly different from the water content of crackers. It's because the anchovy flour contains high protein (64.38%) where the hydrophilic protein binds water to the crackers. Mulyana [10] stated that differences in moisture content are

influenced by protein contents in crackers. Protein molecules could bind the water because a number of side chain amino acids contain hydrocarbon chains. The higher the protein content in a substance, the harder it is to release water at a high temperature. The moisture content of crackers increases with the addition of NaHCO₃ concentration. Increasing of moisture content is due to NaHCO₃ ionizing and binding to water. According to Winarno [11], NaHCO₃ will split up into Na⁺⁺ and HCO₃⁻ in the high temperature and it able to produce CO₂ and H₂O.

TABLE II. MOISTURE CONTENT OF CRACKERS

Anchovy Flour (%)	NaHCO ₃ (%)	Moisture contents (%)
9	0,3	5,84
	0,5	5,86
	0,7	6,62
18	0,3	5,79
	0,5	5,94
	0,7	6,60
27	0,3	6,36
	0,5	6,48
	0,7	6,67

TABLE III. ASH CONTENT OF CRACKERS

Anchovy Flour (%)	NaHCO ₃ (%)	Ash (%)
9	0,3	2,51
	0,5	2,76
	0,7	2,80
18	0,3	2,60
	0,5	2,73
	0,7	3,03
27	0,3	3,07
	0,5	3,29
	0,7	3,18

Table 3 showed that ash content of crackers increased as the addition of anchovy flour increases. It's because anchovy flour contains 10.25% ash, Nugroho [12] stated that the ash content of crackers with the addition of pepetek flour was 2.72%. The higher concentration of NaHCO₃ concentration the higher ash content in crackers. NaHCO₃ is included in the salt-mineral group, the higher concentrations of NaHCO₃ in a substance, the higher the minerals contained in it because NaHCO₃ has a high Na Na content [11].

TABLE IV. TOTAL PROTEIN OF CRACKERS

Anchovy Flour (%)	NaHCO ₃ (%)	Total protein (%)
9	0,3	12,15
	0,5	12,32
	0,7	12,40
18	0,3	13,16
	0,5	14,00
	0,7	14,11
27	0,3	13,99
	0,5	14,09
	0,7	14,48

Total protein value in crackers linear with concentration of anchovy flour that showed in Table 4. Increasing of total protein were directly proportional to the addition of anchovy flour, the tendency of increasing total protein in accordance with the experiments of Asmoro. [3] which stated that crackers that were substituted with anchovy flour provide higher protein content. Addition of anchovy flour with 1.5% fat content did not give a significant difference to the fat content of crackers as shown as Table 5. SNI number 01-2973-1992 states that the minimum fat content in crackers is 9.5% while crackers with the addition of anchovy flour with a concentration of 9, 18 and 27% are in the range of 12%.

TABLE V. FAT CONTENT OF CRACKERS

Anchovy Flour (%)	NaHCO3 (%)	Fat Content (%)
9	0,3	12,40
	0,5	12,54
	0,7	12,59
18	0,3	12,31
	0,5	12,61
	0,7	12,69
27	0,3	12,47
	0,5	12,70
	0,7	12,83

TABLE VI. CALCIUM OF CRACKERS

Anchovy Flour (%)	NaHCO3 (%)	Calcium (mg)
9	0,3	36,93
	0,5	37,46
	0,7	38,51
18	0,3	37,26
	0,5	38,34
	0,7	40,40
27	0,3	39,88
	0,5	40,32
	0,7	40,12

Anchovy flour concentration linear with the calcium content of the crackers. Aryati and Damayanti [13] stated that fish is one source of protein and calcium, both of fresh and dried anchovy has the highest protein and calcium content. Calcium in crackers with the addition of soy flour and 10% anchovy flour has the highest calcium content is 37.60 mg [4]. The concentration of NaHCO3 did not correlate with the total protein, fat content and calcium of crackers. Apriyantono [6] stated that sodium bicarbonate has function to help the dough become more porous and greater volume by producing CO2.

The addition of anchovy flour and bigger concentration of NaHCO3 resulting in crunchiness of crackers. Generally, the amount of anchovy flour causing the hardness of crackers. In another side, addition of NaHCO3 will help to obtain the better broken power on crackers. This might be cause of heating NaHCO3 resulting CO2 and it will lead greater

volume of dough. The crackers that produced with this kind of dough will have crunchier texture. Crunchiness and broken power of crackers depends on the type of flour. Higher protein content of the flour will decrease crunchiness and broken power of the crackers. Whitely [14] stated that flour with small amount of protein is the best flour in making crackers.

TABLE VII. BROKEN POWER OF CRACKERS

Anchovy Flour (%)	NaHCO3 (%)	Fat Content (%)
9	0,3	12,40
	0,5	12,54
	0,7	12,59
18	0,3	12,31
	0,5	12,61
	0,7	12,69
27	0,3	12,47
	0,5	12,70
	0,7	12,83

The best combination to obtain high calcium crackers is addition of 9% anchovy flour and 0.5% NaHCO3. This combination resulting 2.76% ash, 5.86% moisture content, 12.32% total protein, 12.54% total lipid, and 37.46 mg calcium. Compare to the control, SNI 01-2973-1992, crackers should contain at least 9% total protein, 9.5% fat content, and shouldn't have more than 5% moisture content and 1.5% ash. The bigger amount of anchovy flour added to the dough, the greater calcium content of the crackers, and 9% anchovy was fulfill the requirement as high calcium crackers.

V. CONCLUSION

Addition of anchovy flour showed increasing calcium content of the crackers. Total protein and fat content did not influence by the addition of anchovy flour. Concentration of NaHCO3 affects moisture content and ash content. The greater of NaHCO3 added into the dough, the greater moisture and ash content of the crackers. Anchovy flour did not give any differences in crunchiness, but it's still increased the porosity of the dough that responsibility the crunchiness of the crackers.

REFERENCES

- [1] Manley, D.J.R. 1983. Technology of biscuit, Crackers and Cookies. Ellis Horwood Limited, England. J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.
- [2] Iwansyah, A.C., Heminati, A, dan Setyoningrum, F. 2008. The Effect of Fish Bone Flour Addition as Calcium Resource to Chemical Properties of Fish. Universitas Lampung.
- [3] Asmoro, L.C. 2012. Organoleptic Characteristic of Biscuit with Anchovy (Stolephorus sp.) Flour Addition. Thesis. Agriculture Industrial Technology Dept, Agriculture Technology Faculty. Universitas Brawijaya.
- [4] Sulistyowati, E., Wijaningsih, W., dan Mintarsih, S.N. 2015. The Effect of Soybean Flour and Anchovy Flour to Total Protein Value and Calcium Crackers. Jurnal Riset Kesehatan vol 4 No 3.
- [5] Purnamasari, I.W dan Putri, Widya, R. 2015. Taro Flakes Characteristic. Jurnal Pangan dan Agroindustri. 3(4) : 1375 – 1385

- [6] Apriyantono, A. 2006. Food Analysis. Bogor: Pusat Antar Universitas. Pangan dan Gizi. IPB.
- [7] AOAC, 2005. Official Methods of Analysis of The Association of Analytical Chemist, Wasington, D.C.
- [8] Yuwono, S. S, dan T.Susanto, 1998. Measurement of Food's Physics. Food Science and Technology Department. Agriculture Technology Faculty. Universitas Brawijaya. Malang.
- [9] Desrosier, N.W. 1988. Food Preservation Technology. UI Press, Jakarta
- [10] Mulyana, Susanto, W.H., dan Purwatiningrum, I. 2014. The Effect of Proportion (Tempe Semangit Flour : Tapioca) and Water Addition to Characteristic of Tempe Semangit Crackers. Jurnal Pangan dan Agroindustri, 2(4): 113- 120.
- [11] Winarno, F.G. 2002. Food Chemistry and Nutrition. Gramedia Pustaka Utama. Jakarta.
- [12] Nugroho. 2006. Optimation Pepetek Fish and White Yam for Partial Substitution of Wheat Flour on Crackers. Thesis. Departemen Teknologi Hasil Perairan, Fakultas Perikanan dan Ilmu Kelautan Institut Pertanian Bogor. Bogor
- [13] Aryati, E.E ., dan A.W.S Dharmayanti. 2014. Advantages of Fresh Anchovy (*Stolephorus* sp) For Bones and Teeth. ODONTO Dental Jurnal, 1(12) : 52-56.
- [14] Whiteley, P.R. 1971. Biscuit Manufacture : fundamental of in-line production.