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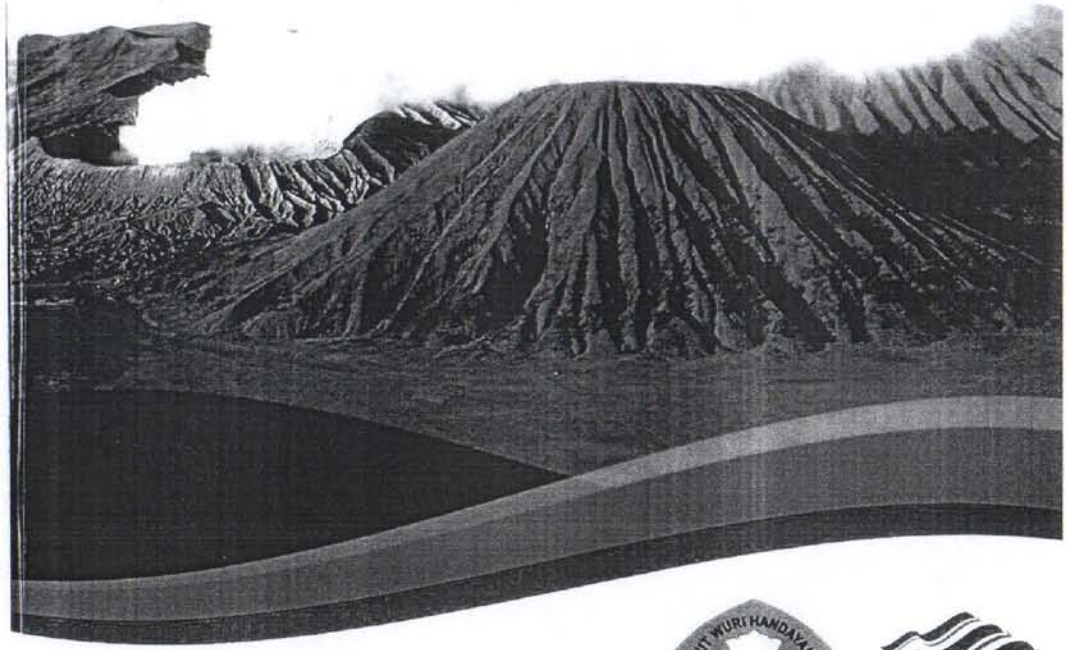

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FOREWORD

The First International Conference on Natural Sciences, July 9-11, 2011 in Batu, East Java, Indonesia, brought together scientists from nine countries from South-East Asia, Germany and Japan. South-East Asia is extremely rich in natural resources, many of them still untapped, but has also extremely densely populated areas that have to cope with the ensuing problems including infrastructure measures, intensive agri- and aquaculture, waste management, and nature preservation. Study, use and development of existing resources and coping with the aforementioned problems, requires interdisciplinary cooperation. Based on a network of Alexander von Humboldt alumni, the conference aimed at linking the wide professional expertise, at making the best use of existing equipment and pinpointing gaps, and at integrating basic and applied research.

This book is a mosaic of the impressive oral and poster presentations of the conference. It reflects the scientific diversity, existing contacts, and areas of promising new joint ventures. Editing such a wide scope of subjects was fascinating and challenging, allowing at the same time to reflect the many discussions during the meeting that encompassed a world of science. We trust that the book may serve a similar function among the participants, as well as for a wider scope of readers.

Thanks to all who contributed: Irfan Tri Raharjo as coordinator, our co-editors helping to review the submissions, the Alexander von Humboldt Foundation who gave financial and logistic support, and, last but not least, the Rector, Leenawaty Limantara, and the staff of Ma Chung University who had already organized the meeting so well and now relieved us of many formal and administrative tasks involved in making the book.

May this seed grow and bear rich fruit!

Malang, 15 March 2012

Hugo Scheer
Editor-in-Chief
Ludgwig Maximilians University, Germany

Sequence analysis shows a conserved $CX_2CX_2CX_{5,7}C$ motif which has been known as a conserved [illegible] motif for iron 4Fe-4S sulfur cluster [6; 13]. Although crystal structures of Isf from *M. thermophila* and *Archaeoglobus fulgidus* have been resolved, no FMN binding motif is concluded. In *M. thermophila* FMN in M. thermophila is surrounded by positively charged amino acid residues, while in *A. fulgidus* surrounded by hydrophobic amino acid residues. The FMN binding motif in *M. acetivorans* cannot derived from both crystal structures because the 3D folding of the protein is unknown and no satisfa computational method is available for predicting 3D structure.

Isf1 was succesfully overexpressed in *E.coli* and and purified into homogeneity using a one purification procedure. SDS-PAGE gives an apparent Isf1 molcular mass of 22 ± 0.5 kDa which is close Isf theoretical molecular mass of 21 kDa (Figure 3A). The Slight difference between apparent and theore molecular mass presumably is due to charge differences between Isf1 and standard proteins. In orde maximise iron-sulfur and flavin incorporation into Isf one, the purified protein was reconstituted UV spectrum of reconstituted Isf1 shows a typical of iron-sulfur flavoprotein with peaks around 380 and 4 (Figure 3B). This spectra is different compared to those of flavin containing proteins or iron flavoproteins alone. Isf UV-Vis spectrum is a sum of iron sulfur anf flavin spectra.

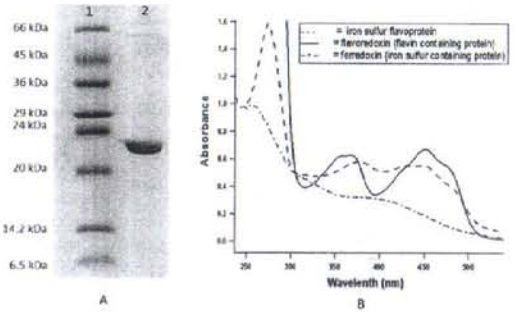

Figure 3. SDS-PAGE (A) and UV-Vis spectra of purified Isf1 (B)

Qualitative analysis using Thin Layer Chromatography showed Isf1 contains a flavin with retention time similar to Flavin mononucleotide (FMN) which concluded that Isf contains FM Furthermore, Iron sulfur determination of reconstituted protein showed Fe:S:FMN ratio of 3.9:3.6:0.94 wh suggested that Isf contains one of 4Fe-4S cluster and one FMN.

Based on the results, a novel operon is proposed to encode enzymes which might function in a n organic compund conversion such as antibiotic biosynthesis. Isf as a part of this operon is an iron sulfu flavoprotein containing one 4Fe-4S cluster and one FMN molecule. The structue of the iron sulfur needs be furthur confirmed with other methods such as Electron Paramagnetic Resonance or Circular Dicrhoism

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CHARACTERIZATION FUNCTIONAL PROPERTIES OF OKARA FLOUR

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ABSTRACT - *Okara is a solid by product of soymilk and tofu processing with highly water content, so it is very perishable. Conversion wet okara to okara flour is one of best strategies to overcome those problems. The dietary fiber and insoluble protein content of okara still high enough so it could can be used in many processed food. Okara has been used in many products, especially bakery products (e.g. pizza, biscuit, bread) for increasing its dietary fiber and protein contents, but it will decrease the specific volume and may give impact to the properties of product. That is why to optimize the utilization of okara. Its functional properties necessary to be characterized. The functional properties of okara that analyzed are solubility, water and oil absorption capacity, foam capacity and stability, and also emulsion capacity and stability. The characteristic observation replicate 4 times and the coefficient of variant set ≤ 10% to be accepted as homogen. Emulsion capacity of okara flour was 4.7867 ± 0.01 mL oil/g sample with its stability after 24 hours storage was 1.90 ± 0.04 mL water/g sample and the water absorption capacity was 5.9349 ± 0.10 mL water/g sample. Those made okara potential to be applied in emulsion based food or be added in any food system with higher water retention, such as restructured meat. Substitution 20% okara flour made the batter emulsion better and the product specific weight lower than the control. Thereby, okara dietary fiber contributed much than protein in order to characterize its functional properties.*

Keywords: *okara, protein, dietary fiber, functional properties*

1. INTRODUCTION

Okara is a solid by product of soymilk and tofu processing with less utilization [1]. High water content of okara makes it deteriorated easily and therefore needs strategies to utilize it. Conversion to okara flour is one of the best strategies to overcome those problems. As okara consist of dietary fiber and protein which was still high enough so it could be applied in many processed food. Soluble, insoluble, and total dietary fiber of okara is 4.46, 40.44, and 44.91 mg/100 g dry basis [2]. Its protein was about 24.00–37.00% dry basis and dietary fiber was about 42.50–55.48% dry basis [3], [4],[5],[6]. Although its protein only 17% of soy protein, the quality higher than other soy products, i.e. tofu, soymilk, and soy whey [7].

Okara has been used in many products, especially bakery products (e.g. pizza, biscuit, and bread) only for increasing its dietary fiber and protein contents [3],[8]. Those made the specific volume decreased, then may give negative impact to the acceptability of products. To optimize the use of okara in food products, the functional properties of okara is necessary to be observed and it can be used as the guidelines for its utilization.

The Functional properties that observed are solubility, water and oil absorption capacity, foam capacity and stability, and also emulsion capacity and stability. Those properties were important in

order to determine the right application of okara in food products. Functional properties could be affected by processing treatment, such as heating, drying, pressing, and freezing. Converting wet okara as solid by product of soymilk and tofu processing to okara flour, can change the functional properties that caused by its protein and fiber. The objective of this study was to characterize the functional properties of okara flour and determine the relationship of protein and dietary fiber components.

2. MATERIALS AND METHODS

2.1 *Material*

Okara were obtained from local tofu industry in Bogor. Okara dried in cabinet dryer (± 50°C) for 9 hour, ground, and screened through a 150μm sieve (100 mesh).

2.2 *Methods*

Okara were determined its proximate chemical and functional properties. Functional properties cover solubility, Water Absorption Capacity (WAC), Oil Absorption Capacity (OAC), Gel Formation, Foaming Capacity (FC) and Foaming Stability (FS), Emulsion Capacity (EC) and Emulsion Stability (ES). Each property used 4 replication samples. Variant coefficient defined maximum 10% to obtain data uniformity.

2.2.1 *Proximate Chemical Composition of Okara*

Proximate chemical analysis was according to [9]. Carbohydrate content was calculated as by difference.

2.2.2 *Solubility*

Solubility was determined according to [10]. An aqueous solution (1 g/100 ml) of sample was stirred for 10 min, with either 1M HCl or 1M NaOH to adjust the various pH values ranging from 2 to 12. The sample solution was then centrifuged at 8.000 × g for 10 minutes. After appropriate dilution, the protein content of the supernatant was determined by the Bradford method [11,12], and the solubility was express as grams of soluble protein/100 g protein in the sample.

2.2.3 *Water Absorption Capacity (WAC)*

WAC was determined according to [13] with some modification. Sample (0.1 g) add aquadest (1 mL) and stirred for 5 minutes. The suspension was centrifuged at 5000 × g for 30 minutes and the supernatant was measured in a 10 mL graduated cylinder. Water absorbed was calculated as the difference between the initial volume of water added to the sample and the volume of the supernatant. Water absorption capacity was calculated as milliliters absorb water volume per gram sample.

2.2.4 *Oil Absorption Capacity (OAC)*

OAC was determined according to [13] with some modification. Sample (0.1 g) was mixed with 1 mL soybean oil in a centrifuge tube and allowed to stand at room temperature for 1 hour. It was then centrifuged at 15.000 × g for 15 minutes. The volume of oil on the sediment was measured. OAC was calculated as milliliters of oil absorbed per gram sample.

2.2.5 *Gel Formation*

Gelation was investigated according to [13]. Suspensions of 2–20 g sample/100 mL distilled water were prepared. Ten mL of each dispersion was transferred into a test tube. It was heated in a boiling water bath for 1 hour, followed by rapid cooling in a cold water bath. The tubes were further cooled at 4°C for 2 hour. The least gel concentration (LGC) was determined as the concentration when the sample from the inverted test tube did not slip or fall.

2.2.6 *Foaming Capacity (FC) and Foaming Stability (FS)*

FC and FS were determined according to [13] with some modification. Two grams of meal sample were blended with 100 mL water in a hand mixer. The suspension was whipped at high speed scale for 5 minutes. The mixture was poured into a 250 mL measuring cylinder, and the volume was recorded after 30 second. FC (%) was calculated as [(vol. after whipping – vol. before whipping)/ (vol. before whipping)] × 100. Foam capacity (FC) was expressed as percent of increaseding volume. The foam volume was recorded at 5, 10, 20, 30, 45, 60, 90, and 120 minutes after whipping to determine foam

stability (FS). FS (%) was calculated as (foam volume after time t/initial foam volume) × 100. Foam stability (FS) was expressed as percent of stable foam in certain time (t).

2.2.7 *Emulsion Capacity (EC) and Emulsion Stability (ES)*

EC and ES were determined according to [13]. A four gram meal sample was blended with 46 mL water for 30 second in an electric blender at the maximum speed. Refined soybean oil was added continuously from a volumetric pipette and blending continued until a phase separation was observed visually. EC is expressed as milliliters of oil emulsified by gram of sample. The prepared emulsion was allowed to stand in a graduated cylinder and the volume of water separated recorded every 30 minutes until 5 hours and after 24 hour mL/g sample as ES.

2.2.8 *Restructured Meat Application*

Restructured meat was made by mix chicken nugget (100%), tapioca (10%), salt(1%), sugar (2%), pepper (0.5%) and water ice (20%), then chopped (10 minutes), steamed for 25 minutes and finally cutted 3 × 3 × 1 cm. Steam restructured meat was representative of meatball and sausage products.

3. RESULTS AND DISCUSSION

3.1 *Proximate Chemical Composition of Okara*

Proximate chemical compositions of investigated meals are shown in Table I. Carbohydrate was the main component (54.44 ± 1.46%) of okara flour. Protein content of okara flour was 26.51 ± 1.34% show that about half of soybean protein (48.56 ± 0.03%) was still unextracted during soymilk and tofu processing.

Table I. Proximate chemical composition* (% dry basis) of investigated Okara flour

ash	2.89 ± 0.10
protein	26.51 ± 1.34
fat	16.16 ± 0.87
carbohydrate	54.44 ± 1.46

*Means ± standard deviation (SD)

3.2 *Functional Properties of Okara*

3.2.1 *Solubility*

Among the functional properties, solubilityty is probably the most critical as it affects other properties such as emulsification, foaming and gelation. Solubility okara flour in various pH were as shown in Figure 1. Minimal solubility was occured in pH 4 that indicate its isoelectric point of okara flour. Various pH made polar, cationic, anionic, and non-ionic side chain distribution change in protein molecules [14]. Curve plot of okara solubility was U-like. This result has similar to the solubility of okara protein isolate [15]. Solubility okara flour in various pH were small and lower than its isolate. It shown that okara protein contain predominantly was insoluble protein. The presence of other macromolecules (i.e. fat and carbohydrate) also affects the solubility.

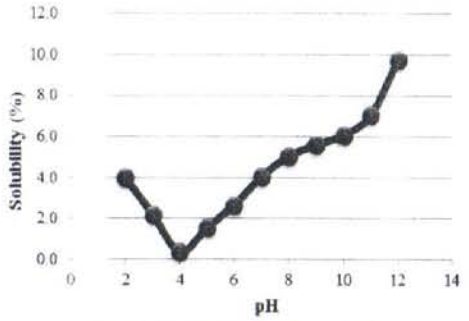

Figure I. Okara Solubility in Various pH

3.2.2 *Water Absorption Capacity (WAC)*

Water Absorption Capacity (WAC) of okara flour was 5.93 ± 0.10 mL water/g sample and indicated that okara flour had ability to absorbb much water. This result was higher than okara protein isolate which isolated at 25°C (4.3 mL water/g) and 80°C (5.1 mL water/g) [15]. Reference [16] indicated that WAC soy protein isolate was ranging from 1.85 to 6.30 mL water/g protein. It showed that WAC okara flour still higher. This condition was affected by the presence of denaturated protein in okara. Likewise, the present of dietary fiber also contributed to absorbb water because water retention capacity of okara fibber was 8.33 g/g sample [2].

3.2.3 *Oil Absorption Capacity (OAC)*

Oil Absorption Capacity (OAC) of okara flour was 2.7733 ± 0.03 mL oil/g sample. This result slightly lower than okara protein isolate (2.9–3.0 mL oil/g) [15] and much higher than soy isolate (0.87–1.95 mL oil/g protein) [16]. Dietary fiber with its oil retention capacity (0.27g/g sample) also contributed to the high WAC of okara.

Water-oil absorption index (WOAI), ratio of WAC and OAC, show proportion between hydrophilic and lipophilic of protein. WOAI of okara flour (2.14 mL water/mL oil) indicated that hydrophilic part much than the other in okara protein. As compare to okara protein isolate which isolated at 25°C (1.482 mL water/mL oil) and 80°C (1.7 mL water/mL oil) [15], okara has higher WOAI. This means that there was not only influence by the okara protein, but also clarifies the contribution of dietary fiber.

3.2.4 *Gel Formation*

Okara flour could not form a gel although all water had absorbed and appear could form a gel. Okara suspension with 10% concentration appeared could form a gel but had not the characteristics of gel (when test tube was inverted and it did not slip or fall). It was related to fact that most okara protein was insoluble protein and the presence of fiber.

3.2.5 *Foaming Capacity (FC) and Foaming Stability (FS)*

Okara flour could not form foam because of its small solubility and support by the contribution of okara fibber and lipid (fat). The presence of lipid and other water insoluble corrupt the foam and made protein film collapse [17].

3.2.6 *Emulsion Capacity (EC) and Emulsion Stability (ES)*

Emulsion Capacity (EC) was calculated by determined the maximal amount of oil which could make the stabile emulsion of okara flour. EC okara was 4.79 ± 0.01 mL oil/g sample. This result was much lower than okara protein isolate and soy protein isolate. Okara protein isolate's EC was 41.0 mL oil/g sample (isolated at 25°C) and 44.7 mL oil/g sample (isolated at 80°C) [15] and soy protein isolate's EC was 117–200 mL oil/g protein [16]. Small amount of oil which was needed clarify that there was interaction between protein and fibber to make a good emulsion.

ES of okara flour emulsion until 5 hour storage shown in Figure II and after 24 hour was 1.90 ± 0.04 mL water/g sample. This result indicated that the emulsion was stabile, much better than okara protein isolates (11.7% and 6.2% when isolated at 25°C and 80°C) [15].

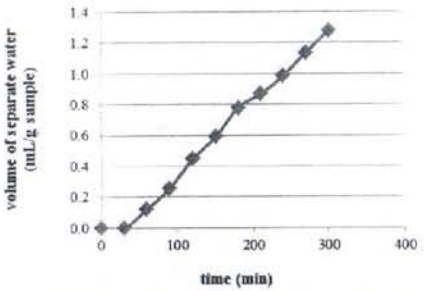

Figure II Okara Emulsion Stability Until 5 Hour Storage

3.3 *Potential Application of Okara Appropriate to Its Functional Properties*

Potential functional properties of okara were the emulsion capacity and stability and also the water absorption capacity, therefore the appropriate food product was products which need good emulsion characteristics and stability and also good water absorption. One of products that suit through those characteristics was restructured meat.

Application of 20% okara flour to substitute the amount of chicken meat made the batter emulsion better. Product specific weight was 0.92 ± 0.01g/mL. That was lower than the control (without substitution) which its product specific weight was 1.02 ± 0.02 g/mL. Lower specific weight showed that okara flour increased volume of the product because its fibber has ability to absorp water. Okara fibber has swelling capacity 9.44 mL/g sample (Aparicio *et al.*, 2010)

4. CONCLUSION

Potential functional properties of okara were the emulsion capacity and stability and also the water absorption capacity. Application of okara in restructured meat with 20% okara flour substitution made the batter emulsion better and the product specific weight lower than the control. Okara dietary fiber had more contribution than protein in order to characterize its functional properties.

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PARTIAL SLIP SURFACE: POTENTIAL APPLICATION IN LUBRICATED MEMS

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ABSTRACT - *Superhydrophobic surfaces were originally inspired by the unique water-repellent properties of the lotus leaf. Implementing the slip property (hydrophobicity) on a surface in a wide range of applications for the mechanical components is a challenge for numerous authors. Slip reduces drag friction at the contacting surfaces and thereby reducing energy consumption, increasing component's life time and reducing economic and environmental costs. Lubrication that exists in the micro-electro-mechanical systems (MEMS) need to be improved its performance, i.e. reducing friction and increasing load support, by applying slip (hydrophobic) on one or both of the opposing surfaces. However, the choice of the slip area on certain surface must be taken carefully in relation to the friction. In the present work, numerical simulation is conducted to investigate how slip can be beneficial to achieve a lower friction and higher load support. The result shows that if one of the surfaces is designed as full slip (slip applied everywhere on surface), the load support will decrease about 50% compared to no-slip surfaces. However, on the other hand the advantage of full slip surface in accordance with the friction reduction can be achieved. Therefore, by introducing the partial slip surface instead of the full slip, it is shown that such surface can generate the combined positive effect, i.e. high load support but low friction. The slip surface chosen is designed to move relative to the converging zone so as to entrain fluid effectively between the sliding faces.*

Keywords: *lubrication, hydrophobic, micro-electro-mechanical system, slip*

1. INTRODUCTION

For the last years, there has been a tremendous effort towards the development of Micro-Electro-Mechanical System (MEMS) for a wide variety of applications in aerospace, automotive, biomedical, computer, and agricultural industries. As microengineering technology continues to advance, driven by increasingly complex and capable microfabrication and materials technologies, the need for more and more sophistication in MEMS design will increase. Many MEMS devices include moving (sliding/rolling) surfaces and thus it is necessary to apply a lubricant between the contacting surfaces to reduce friction and wear. A significant barrier to the development of MEMS lubrication is the problem of achieving effective performance of their moving parts. This is because the lubricant behavior is different at micro-scale compared to macro-scale. At the macroscopic level, it is well accepted that the boundary condition for a viscous fluid at a solid wall is no-slip, i.e., the fluid velocity matches the velocity of the solid boundary. While the no-slip boundary condition has been proven experimentally to be accurate for a number of macroscopic flows, it remains an assumption that is not based on physicals principles. At micro-scale level, certain phenomena must be taken into account when analyzing liquid flows such as slip condition at solid wall boundaries. With the progress in micro- and nano-scale