Some Functional Properties of *Blondo*-Calcium Mix

Hani Putranto and Slamet Sudarmadji
Faculty of Agriculture Technology, Gadjah Mada University,
Yogyakarta, Indonesia

ABSTRACT

Blondo *is a solid residue of the wet coconut milk oil extraction process. The oil extraction from coconut milk, which is facilitated by adding* Ca_2SO_4*, produced* ***blondo****-calcium mix residue. This residue was studied for its stability as a high protein food ingredient.* ***Blondo****-calcium mix contains 77.6% protein with water retention capacity of 2 ml water/g (less than skim milk powder but greater than casein) and oil retention similar to those of skim milk powder or casein. The emulsion capacity of* ***blondo****-calcium mix was slightly lower (70%) than that of skim milk powder or casein at pH 6 and 8 but slightly higher at pH 2 and 10. The emulsion stability of* ***blondo****-calcium was lowest at pH 4 and 6, but highest at pH 2.* ***Blondo****-calcium mix is probably best to be used in a low pH food emulsion system (such as in non-dairy yogurt).*

INTRODUCTION

The water based processing of coconut (in contrast to the dried or copra processing) into coconut milk, followed by separation of the oil from the skim, has been developed by Hagenmaier (1980). After the milk has been obtained, there are several ways to separate the oil. One way is by evaporation to get more concentrated coconut milk (cream) and then by centrifugation to separate the oil. The solid residue (*blondo*) can be mixed with the spent shredded coconut meat (after pressing the milk) and the process is repeated again to recover the remaining oil in the residue. Another method to recover natural coconut oil is by adding calcium ions into the coconut cream. After mixing and settling overnight, the oil is easily separated by centrifugation (Setiadji, 1989). The residue, a sludge-like solid which still contains oil, could be defatted furthermore by petroleum-ether extraction. Yuliani (1987) has tried successfully to produce dried residue into *blondo*-calcium powder.

The *blondo*-calcium residue in wet coconut oil extraction is quantitatively significant and may have commercial value as a food ingredient.

The objective of this study was to evaluate functional properties of *blondo*-calcium mix including water and oil retention capacity, oil emulsion capacity and emulsion stability.

MATERIALS AND METHODS

Blondo-calcium Complex Preparation

Coconut meat of Mapanget variety was obtained from the Local Estate Plant Experiment Station. The coconut was selected on its maturity (naturally dried skin). The coconut meat was then shredded by a mechanical shredder and water was added to it, one liter for every 400 g shredded coconut. The moist shredded coconut was pressed by a mechanical press to obtain coconut milk. The coconut milk was separated into cream and skim by a cream separator (de Laval, model GYROTEST with outlet screw 15.5 mm). The coconut cream obtained was mixed with a saturated solution of $CaSO_4$ in the ratio v/v of 1:1. The cream – $CaSO_4$ mixture was allowed to settle overnight. The bottom layer was separated and the remaining mixture of oil and other solid was centrifuged (Kokusan centrifuge model H-107) at 3,500 rpm for 10 minutes. The separated oil was collected and the remaining residue was centrifuged once more. The final oily residue (*blondo*-calcium complex) was extracted ten times with petroleum-ether (ratio 1 ml petroleum ether to 1 g residue). The extraction was done by mixing petroleum ether solvent and the oily residue in an Erlenmeyer flask by magnetic stirrer for 5 minutes and then settled for 30 minutes at room temperature. The defatted *blondo*-calcium complex was dried through a minispray dryer

(Buchi, model 190) with air inlet temperature 154°C and outlet temperature kept not higher than 70°C. The *blondo* powder obtained was used for further analyses.

Chemical Analysis

Moisture content was determined according to AOAC procedure (AOAC, 1970). Fat content was determined according to Woodman (1941), and protein by semi-micro Kjeldahl method.

Functional Properties

Commercially available casein and skim milk powder were used for comparison. Water and oil retention were determined according to Sathe and Salunke (1981) with slight a modification.

Water and Oil Retention Capacity

Samples of 250 mg each were thoroughly mixed in a conical graduated centrifuge tube with 5 ml distilled water (for water retention) and Mazola™ corn oil (for oil retention). The samples were then allowed to stand at room temperature for 30 minutes and centrifuged at 5,000 × G for 10 minutes. The volume of free oil or water was observed directly from the graduated centrifuge tube. The volume of absorbed oil or water (total volume minus free volume) was multiplied by its respective specific density (0.88 g/ml and 1.0 g/ml) for conversion to grams. The determination was done in triplicate.

Oil Emulsion Capacity

A portion of 25 mg of each sample was dissolved in 16 ml buffers of pH 2, 4, 6, 8 and 10. Approximately 18 ml of Mazola™ oil was added, mixed well and homogenized by a hand homogenizer. Then, 10 ml of emulsion was taken from the emulsion and transferred into a conical graduated centrifuge tube. A duplicate of this was prepared. The tubes were then centrifuged at 3500 rpm for 10 min to allow free oil and water to separate from the emulsion. The emulsion capacity was determined by the oil retained in the emulsion (total oil added minus oil separated) in term of grams of oil retained by one gram of sample. The test was done in triplicate.

Emulsion Stability

The separated oil, water and emulsion from the emulsion capacity determination were mixed and homogenized again to determine its stability. The resulting emulsion was allowed to stand in a graduated cylinder at room temperature for 30 minutes. The separated aqueous phase was read directly from the graduated cylinder. The result was expressed in percent stability.

RESULTS AND DISCUSSION

Yield of *Blondo*-calcium Powder

The yield of *blondo*-calcium powder and oil are shown in Table 1. The yield of oil was similar to a previous study (Syahrizal, 1990). But the yield of powdered residue was lower due to unknown reasons.

Table 1. **Yield of oil and *blondo*-calcium in the wet process**

Product	Yield
Oil (centrifugation)	209.7 ml/kg coconut meat
Total oil (centrifugation + solvent extraction)	239,0 m/kg coconut meat
Blondo-calcium mix	11.7 g/1000 ml oil

Composition of *Blondo*-calcium Mix

The proximate composition of blondo-calcium residue powder is shown in Table 2. The protein content of blondo residue was quite high (77.60% wet basis or 82,80% dry basis). With major component of protein and low in fats and carbohydrates, *blondo*-calcium mix is nutritionally a superior product. Calcium-sulfate used to facilitate the separation of oil is safe for consumption as this component is always used for protein coagulation in soybean tofu production.

This coconut oil by-product is probably suitable as an ingredient in the formulation of sausages, non-dairy creamer, protein enrichment of cookies or at least for animal feed.

Table 2. **Proximate composition of *blondo*-calcium mix residue**

Component	Percentage
Protein (N × 6.25)	77.60
Fat	7.58
Moisture	6.28
Ash	3.19
Calcium (part of the ash)	0.74
Carbohydrates (by difference)	5.35
	100.00

Water and Oil Retention

Water and oil retention capacity of *blondo*-calcium mix is shown in Figure 1. The water retention of *blondo*-calcium powder was much lower than skim milk powder (2 ml/g vs 7.9 ml/g) but higher than casein (0.93 ml/g). This result indicate, that *blondo*-calcium mix is a poor substitute for skim milk powder or non-dairy creamer. The coconut residue is probably more suitable to be used in solid or semi-solid food formulation such as cookies or sausages. The fact the oil retention of *blondo*-calcium mix is comparable to that of skim milk and casein, this coconut residue by-product is probably suitable for oil-water emulsion product such as sausages.

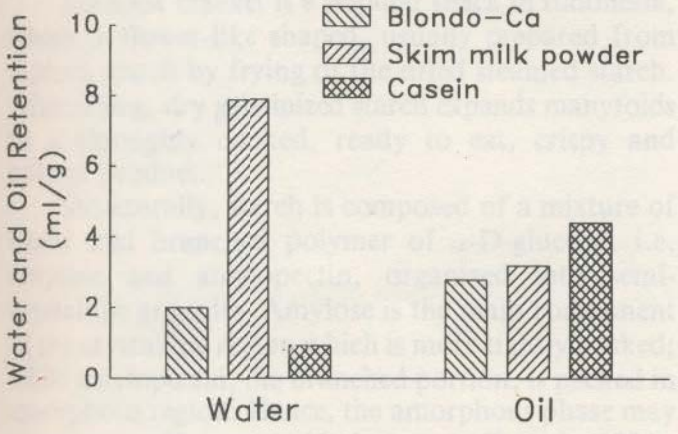

Figure 1. **Water and oil retention of *blondo*-Ca, skim milk powder, and casein**

Emulsion Capacity

The emulsion capacity of skim milk powder, casein and *blondo*-calcium mix are shown in Figure 2. Although the value of emulsion capacity of *blondo*-calcium at different pH did not differ significantly, but still showed its best emulsion capacity at pH 10 and 2. Overall, emulsion capacity of *blondo*-calcium mix is comparable to those of skim milk powder and casein. At the pH common for food (6) the emulsion capacity of *blondo*-calcium was slightly lower (70% of that of casein). According to Kito (1987) emulsion capacity of soy protein was about 50% of that of casein at pH 7. Therefore the emulsion capacity of *blondo*-calcium mix is still significantly higher than that of soy protein. All samples showed no emulsion capacity at pH 4, this phenomenon probably has some connection with the isoelectric point of the proteins.

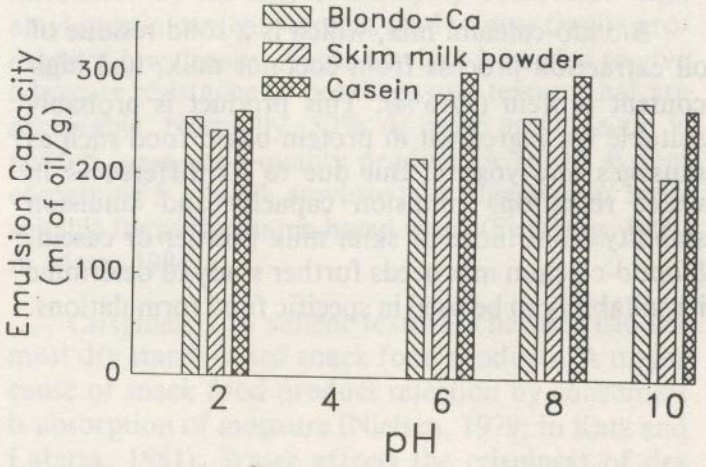

Figure 2. **Emulsion capacity of *blondo*-Ca, skim milk powder, and casein**

Emulsion Stability

The emulsion stability blondo, skim-milk powder and casein is shown in Figure 3. The emulsion stability of *blondo* is lowest at pH 4.

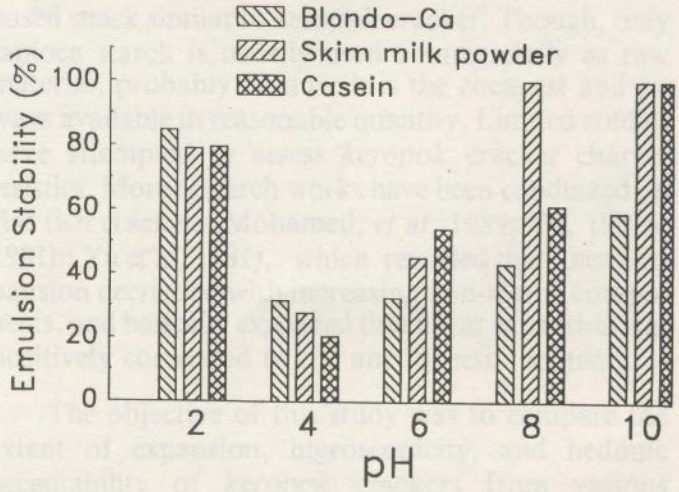

Figure 3. **Emulsion stability of *blondo*-Ca, skim milk powder, and casein**

At pH 6, the emulsion stability of *blondo* is lower than those of skim milk powder and casein but at pH 2, *blondo* has the highest emulsion stability, even higher than those of skim milk powder and casein. At pH common in food, the emulsion stability of *blondo* is inferior to those of skim milk powder and casein. Based on its emulsion capacity, *blondo*-calcium mix is probably best to be used in acid food emulsion system such as non-dairy-yogurt.

CONCLUSION

Blondo-calcium mix, which is a solid residue of oil extraction process from coconut milk, had high content protein (77.6%). This product is probably suitable for ingredient in protein based food such as sausages and yogurt. But due to its differences in water retention, emulsion capacity and emulsion stability from those of skim milk powder or casein, *blondo*-calcium mix needs further study to determine its suitability to be used in specific food formulations.

REFERENCES

AOAC. 1970. Official Methods of Analysis. Official Analytical Chemists, Washington, DC.

Setiadji, B. 1989. How to recover coconut oil by addition calcium ions into coconut cream. (Personal communication).

Hagenmaier, R. 1980. Coconut Aquaous Processing. 2nd ed. San Carlos Publications, Cebu City, Philipines.

Hagenmaier, R., Mattil, K.F. and Cater, C.M. 1974. Dehydrated coconut skim milk as a food product: composition and functionality. Journal of Food Science. 39: 196-199.

Syahrizal, M. 1990. Pengaruh penambahan $CaC1_2$ pada krim santan. Faculty of Agricultural Technology, Gadjah Mada University, Yogyakarta, Indonesia.

Kito, M. 1987. Chemical and lyophilization of proteins. Journal of American Oil Chemists Society. 64: 1676-1681.

Sathe, S.K. and Salunkhe, D.K. 1981. Functional properties of Great Nothern Bean (*Phaseolus Vulgaris* L+) proteins, foaming, viscocity, and gelation properties. Journal of Food Science. 46: 71-74.

Woodman, A.G. 1941. Food analysis. 4th ed. Mc Graw Hill Book Company, Inc. New York.

Yuliani. 1988. Analisis mineral dalam blondo santan kelapa yang diendapkan dengan $CaSO_4.2H_2O$. Faculty of Mathematic and Natural Science, Gadjah Mada University, Yogyakarta, Indonesia.