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ASAM LEMAK SAWIT DISTILAT SEBAGAI BAHAN BAKU PEMBUATAN SABUN TRANSPARAN

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ABSTRAK

Di samping minyak sawit mentah digunakan sebagai bahan baku utama untuk industri sabun, asam lemak sawit distilat yang merupakan hasil samping industri minyak goreng juga dapat digunakan sebagai bahan baku pembuatan sabun. Pada penelitian ini, sabun transparan dibuat dengan menggunakan bahan baku dari asam lemak sawit distilat. Asam lemak sawit ditilat dan minyak inti sawit yang telah dipucatkan serta asam stearat yang dicampur dengan larutan NaOH 20'C pada suhu 100'C, dan campuran tersebut disebut stok sabun. Gliserin, alkohol, sukrosa, dan dietanolamin ditambahkan ke dalam stok sabun. Proses pencampuran dilakukan selama 30 menit di dalam refluk. Kemudian sabun tansparan dicetak dan didinginkan pada suhu ruangan. Sifat-sifat kimia dari sabun transparan meliputi 0,12-0,15% kadar basa bebas, 4,18-5,71% gliserin bebas, 18,27-22,13% total kandungan lemak, dan bilangan iod penyabunan sebesar 3,41-17,69. Dari sifat-sifat kimia tersebut dapat disimpulkan bahwa asam lemak sawit distilat berpotensi untuk digunakan sebagai bahan baku pembuatan sabun transparan. Sifat fisik dan kimia sabun transparan yang berasal dari asam lemak sawit distilat tidak jauh berbeda dibandingkan dengan sabun transparan komersial.

Kata kunci: minyak sawit mentah, asam lemak sawit distilat, sabun transparan

PENDAHULUAN

Produksi sabun di Indonesia meningkat sekitar 13,65% per tahun pada periode 1992 - 1997 (6). Hal ini disebabkan karena konsumsi sabun dan pertumbuhan penduduk yang semakin meningkat. Menurut Departemen Perindustrian dan Perdagangan, Indonesia mempunyai 35 unit industri sabun mandi dengan total kapasitas sebesar 187.570 ton per tahun. Pada 1997 total konsumsi minyak sawit mentah (MSM) di Indonesia mencapai sekitar 2,4 juta ton dan sekitar 15,44% digunakan untuk bahan baku industri sabun (6).

Pada umumnya bahan baku yang digunakan untuk membuat sabun adalah lemak sapi dan minyak kelapa. Lemak sapi merupakan sumber asam lemak dengan rantai karbon C16-C18, sedangkan minyak kelapa merupakan sumber asam lemak dengan rantai karbon C12-C14 (4). Asam lemak C16-C18 berperan terhadap kekerasan dan sifat deterjensinya, sedangkan asam lemak C12-C14 berperan terhadap pembusaan (2). Sabun mandi tersusun dari 80-85% lemak sapi dan 15-20% minyak kelapa (4, 6).

Asam lemak sawit distilat (ALSD) merupakan hasil samping dari industri minyak goreng yang jumlahnya sekitar 2,5-3,5% dari MSM yang diolah. Jika in-

dustri sabun mempunyai kapasitas total rata-rata sebesar 6.249 ton MSM per hari, maka akan dihasilkan ALSD sekitar 156,2-218,7 ton per hari (6). Menurut hasil penelitian, ALSD dapat digunakan sebagai bahan baku pembuatan surfaktan non ionik (5), metil ester (11) dan sabun mandi (2). Hal ini disebabkan karena ALSD dan minyak inti sawit (MIS) juga mengandung asam lemak dengan rantai karbon C16-C18 dan C12-C14. ALSD mengandung C16 sekitar 55,34% dan C18:1 sekitar 37,5% (8). MIS mengandung C12 sekitar 49,6% dan C14 sekitar 16%, sedangkan minyak kelapa mengandung C12 sekitar 48% dan C14 sekitar 16,5% (8).

Sabun mandi terdiri dari *cold-made*, *opaque* dan sabun transparan. Sabun transparan mempunyai beberapa kelebihan jika dibandingkan dengan jenis sabun yang lain. Sabun mandi *cold-made* kurang terkenal, tetapi sabun tersebut mempunyai kemampuan dapat berbusa baik di dalam air garam. Sabun cold-made banyak digunakan oleh pelaut. Sabun *opaque* adalah jenis sabun mandi yang biasa digunakan sehari-hari. Sementara itu sabun transparan atau juga disebut juga sabun gliserin adalah jenis sabun mandi yang dapat menghasilkan busa lebih lembut di kulit dan penampakannya berkilau jika dibandingkan dengan jenis sabun yang lain. Sabun jenis ini mempunyai harga sangat mahal dan hanya dapat dikonsumsi oleh kalangan menengah ke atas (7).

Komposisi sabun transparan komersial terdiri dari sodium tallowate, sodium cocoate, air, gliserin, sukrosa, alkohol, sodium stearat, parfum, madu, pentasodium pentatrat, dan EDTA. Karena komposisi asam lemak antara *tallow* dan ALSD, minyak kelapa dan MIS tidak jauh berbeda, maka sabun transparan dapat dibuat dengan menggunakan ALSD dan MIS.

BAHAN DAN METODE

Bahan baku yang digunakan dalam penelitian ini adalah asam lemak sawit distilat (ALSD), dan minyak inti sawit (MIS), asam stearat, natrium hidroksida, alkohol absolut, sukrosa, dietanolamin, gliserin, dan air. ALSD dan MIS yang digunakan sebagai bahan baku sabun transparan harus dipucatkan lebih dahulu dengan menggunakan tanah pemucat. Tanah pemucat yang digunakan untuk memucatkan MIS sebanyak 3% (b/b), sedangkan untuk ALSD sebanyak 6% (b/b) dan 8% (b/b). Proses pemucatan dilakukan selama 60 menit.

Stok sabun dibuat dari 100 g campuran ALSD dan MIS yang telah dipucatkan serta asam stearat (80:15:5 b/b) dan dicampur dengan 88 ml sodium hidroksida 20°Be (7, 9) pada suhu 100°C. Formulasi sabun transparan dilakukan dengan cara mencampur stok sabun dengan gliserin, alkohol, sukrosa, dan dietanolamin pada suhu 150°C selama 30 menit di dalam refluks. Selanjutnya sabun transparan dicetak dan didinginkan pada suhu kamar. Formulasi sabun transparan dapat dilihat pada Tabel 1.

Sifat-sifat kimia yang diamati adalah asam lemak/basa bebas (AOCS Da4a-48), gliserin bebas (AOCS Da23-56), total kandungan lemak (10), bilangan iod (AOCS Da15-48), dan bilangan penyabunan (AOCS Da16-48). Sedangkan tingkat transparansi dan kekerasan sabun diukur secara organoleptik.

Tabel 1. Formulasi pembuatan sabun transparan*

Contoh	Stok sabun	Gliserin	Alkohol	Sukrosa	Dietanolamie
F1.0	2	1,5	1,0	0,5	-
F2.0	2	1,5	1,0	0,5	0,5
F3.0	2	1,5	1,5	1,0	0,5
F4.0	2	1,0	1,5	0,5	0,5

* Dihitung sebagai perbandingan berat (b/b)

HASIL DAN PEMBAHASAN

Pada proses pemucatan diperoleh hasil bahwa intensitas warna ALSD berubah dari 4,4Y 24,6R 3B menjadi 23Y 3,8R dan intensitas warna MIS berubah dari 18,74Y 3,7R menjadi 10Y 1R.

Bahan tambahan yang digunakan untuk membuat sabun transparan adalah gliserin, sukrosa, dietanolamin, dan alkohol. Penambahan gliserin memberi kecenderungan membentuk fase gel pada sabun. Sukrosa yang ditambahkan membantu perkembangan kristal, sedangkan perkebangan serabut-serabut kristal yang dapat menyebabkan sabun menjadi *opaque* dihambat oleh gliserin (7). Menurut Shipp (12) dietanolamin berfungsi untuk menstabilkan busa dan membuat sabun menjadi lembut. Transparansi dan kekerasan sabun transparan diukur secara organoleptik. Hasil penelitian menunjukkan bahwa transparansi, kekerasan, dan kadar asam lemak bebas pada setiap formulasi berbeda (Tabel 2).

Tabel 2. Sifat kimia dan fisik formulasi sabun transparan*

Contoh	Asam lemak bebas (%)	Hasil
F1.0	3,69	lunak, kuning muda, tidak transparan pH 9-10
F2.0	2,74	keras, krem, transparan + +, pH 9-10
F3.0	1,48	keras, kuning, transparan+ + +, pH 9-10
F4.0	1,55	keras, kuning muda, transparan + pH 9-10

Keterangan: + : kurang, ++ : lebih, +++ : paling

Menurut Jungermann (7) sabun transparan mempunyai alkalinitas yang relatif tinggi (pH < 9,6). Secara umum alkalinitas sabun transparan dari ALSD telah sesuai dengan standard (Tabel 2). Contoh F3.0 mempunyai tingkat transparansi yang paling tinggi dan kadar asam lemak bebas paling rendah. Sabun transparan harus memenuhi standard kadar asam lemak bebasnya maksimal sebesar 0,5% atau kadar basa bebasnya sebesar 0,05 - 0,1%. (1). Dengan demikian formulasi F3.0 harus diformulasi kembali agar sampai diperoleh kadar asam lemak bebas atau basa bebas yang sesuai dengan standard (7). Variasi formulasi F3.0 dilakukan dengan penambahan dietanolamin, yaitu 1,0% (b/b) untuk contoh F3.1 dan 1,5% untuk contoh F3.2. Setelah dilakukan penambahan dietanolamin 1,0%(b/b) atau 1,5% (b/b), sabun transparan tidak mengandung asam lemak bebas. Tetapi F3.1 dan F3.2 mengandung sejumlah basa bebas masing-masing sebesar 0,15% dan 0,12%. Kadar asam lemak bebas sabun transparan

komersial lebih tinggi (5,83%) dari standar yang telah ditentukan (0,5% maks.). Sifat-sifat kimia sabun transparan dari ALSD dan komersial disajikan pada Tabel 3.

Tabel 3. Sifat-sifat kimia sabun transparan

Contoh	Gliserin bebas (%)	TKL* (%)	BIP** factor
F3.0	5,71	21,81	4,75
F3.1	4,18	18,27	3,41
F3.2	4,65	22,13	17,69
X***	2,43	56,26	61,46

Keterangan :
* TKL : total kandungan lemak
** BIP : bilangan iod penyabunan
*** X : sabun transparan komersial

Kandungan gliserin bebas

Kandungan gliserin bebas berpengaruh terhadap kekerasan suatu sabun. Jika sabun mempunyai kandungan gli-serin bebas yang relatif tinggi, maka sabun menjadi bersifat lunak. Sabun transparan dari ALSD mempunyai kandungan gliserin bebas yang lebih tinggi (4,18-5,71%) daripada sabun transparan komersial (2,43%).

Total kandungan lemak

Total kandungan lemak (TKL) dari sabun adalah total lemak atau minyak yang akan bereaksi dengan basa. Semakin tinggi TKL, semakin banyak asam lemak yang bereaksi dengan basa, dan sabun yang dihasilkan semakin ba-nyak. Sabun transparan dari ALSD mempunyai TKL yang lebih rendah (18,27-22,13%) daripada sabun transparan komersial (56,26%). Hal ini berarti bahwa sabun transparan dari ALSD lebih banyak menggunakan bahan tambahan.

Bilangan iod penyabunan

Bilangan iod penyabunan (BIP) merupakan indikator kekerasan suatu sabun (1). Semakin tinggi BIP-nya, sabun menjadi semakin keras. Hasil penelitian menunjukkan bahwa sabun transparan dari ALSD mempunyai BIP lebih rendah (3,41-17,69) daripada sabun transparan komersial (61,46). Oleh karena itu, sabun transparan dari ALSD bersifat lebih lunak. Hal ini disebabkan karena sabun transparan dari ALSD mempunyai kandungan gliserin bebas yang lebih tinggi daripada sabun transparan komersial. Selain itu juga, sabun transparan dari ALSD mempunyai TKL yang lebih rendah daripada sabun transparan komersial.

KESIMPULAN

Komposisi asam lemak antara lemak sapi dengan asam lemak sawit distilat dan minyak kelapa dengan minyak inti sawit hampir sama, oleh karena itu asam lemak sawit distilat dan minyak inti sawit dapat digunakan sebagai bahan baku pembuatan sabun transparan.

Hasil penelitian memperlihatkan bahwa sabun transparan yang terbuat dari campuran asam lemak sawit distilat, minyak inti sawit dan bahan-bahan tambahan dengan komposisi stok sabun : gliserin : alkohol : sukrosa : dietanolamin = 2 : 1,5 : 1,5 : 1,0 : 1,5 mempunyai 0,12% kadar basa bebas, 4,65% kandungan gliserin bebas, 22,13% total kandungan lemak, dan bilangan iod penyabunan sebesar 17,69.

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Production of transparent soap using palm fatty acid distillate as raw material

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Abstract

Besides crude palm oil conventionally used as a main raw material in soap making industry, palm fatty acid distillate which is a by-products from cooking oil industry can also be used as a raw material for soap making. In this research, transparent soap was made from palm fatty acid distillate. Bleached palm fatty acid distillate and palm kernel oil, and stearic acid were mixed with sodium hydroxide of 20°Be at 100°C and the mixture was named as soap stock. Glycerin, alcohol, sucrose, and diethanolamine were added into the soap stock and mixed at the temperature of 150°C for 30 minutes in the reflux. Transparent soap was then molded and cooled at room temperature. The chemical properties of transparent soap made from palm fatty acid distillate were free alkali of 0.12-0.23%, free glycerin of 4.18-5.71%, total fatty matter of 18.27-21.81%, and iodine number saponification of 3.41 - 17.69. These characteristics were confirmed that palm fatty acid distillate was potential to be used as a raw material for transparent soap making. Transparent soap made from palm fatty acid distillate had no different in physical and chemical properties compared with that of commercial transparent soap.

Key words: crude palm oil, palm fatty acid distillate, transparent soap

Introduction

Soap making industries in Indonesia increased about 13.65% per year during 1992 - 1997, due to the increase in the toilet soap consumption and the increase of growth population. According to Department of Industry and Trade, there were 35 unit toilet soap industries having total capacity of about 187,570 tons per year. At 1997, the total consumption of crude palm oil (CPO) in Indonesia was about 2.4 ton millions and about 15.4% of it were used as a raw material in soap making industry (6).

The conventional raw materials used for soap making are tallow and coconut oil. Tallow is a source of C16-C18 fatty acid, while coconut oil is a source of C12-C14 fatty acid (4). C16-C18 fatty acid contribute to the hardness and detergency properties, while C12-C14 fatty acid contribute to the lathering (2). Toilet soap may consist of 80-85% tallow and 15-20% coconut oil (4, 6).

Palm fatty acid distillate (PFAD) is a by-product of cooking oil industry that is about 2.5 - 3.5% of CPO processed. If total capacity of cooking oil industry is about 6,249 ton CPO per day, PFAD will be produced at about 156.2 - 218.7 tons per day (6). According to the previous research, PFAD can be used as a raw material for surfactant non-ionic (5), methyl ester (11), and toilet soap (2), because PFAD and palm kernel oil (PKO) also contain C16-C18 and C12-C14 fatty acid, respectively. PFAD contains C16 fatty acid about 55.34% and C18:1 fatty acid about 31.76% (5), while CPO contains C16 fatty acid about 47% and C18: 1 fatty acid about 37.5% (8). PKO contains C12 fatty acid about 49.6% and C14 fatty acid about 16%, while coconut oil contains C12 fatty acid about 48% and C14 fatty acid about 16.5% (8).

The toilet soaps can be catagorized as opaque, cold-made, and transparent soaps. Opaque soap is daily used. Among other toilet soaps, cold-made soap is less popular, but it has an ability to lather in salt water. Sailors extensively use cold-made toilet soap. Transparent soap has something more attractive than other soaps. The transparent soap sometime called glycerin soap is a kind of toilet soap that has more mild foam and glossy than other types of toilet soaps. However, the transparent soap is very expensive and generally consumed by upper class society (7).

Compositions of the commercial transparent soap are sodium tallowate, sodium cocoate, water, glycerin, sucrose, alcohol, sodium stearic, perfume, honey, pentasodium pentatrate, and EDTA. Since there are similarity of the fatty acid compositions between tallow and PFAD, coconut oil and PKO, the transparent soap can be possibly derived from PFAD and PKO.

Materials and Methods

Materials used in this research were palm fatty acid distillate (PFAD), palm kernel oil (PKO), stearic acid, sodium hydroxide, alcohol absolute, sucrose, diethanolamine, glycerin, and water respectively. PFAD and PKO were bleached with bleaching earth. Bleaching earth used to bleach PKO was 3% (w/w), while

PFAD was bleached with 6% (w/w) and 8% (w/w). The bleaching process had been done for 60 minutes.

The soap stock was made from 100 g bleached PFAD and PKO, and stearic acid with the mixture ratio of 80:15:5 (w/w) and mixed with 88 ml sodium hydroxide of 20°Be (7, 9) at temperature of 100°C. Transparent soap formulation had been made from soap stock and mixed with glycerin, alcohol, sucrose, and diethanolamine at temperature of 150°C for 30 minutes in the reflux. Furthermore, the transparent soap was molded and cooled in the room temperature. The formulation of the transparent soap making is presented in Table 1.

Free alkali (AOCS Da4a-48), free glycerin (AOCS Da23-56), total fatty matter (10), iodine value (AOCS Da15-48), and saponification value (AOCS Da16-48) of the transparent soap were determined to characterize their chemical properties. Meanwhile, the transpa-rency and hardness of soap were measured by organoleptic.

Table 1. Formulations of the transparent soap making*

Sample	Soap stock	Glycerin	Alcohol	Sucrose	Diethanolamine
F1.0	2	1.5	1.0	0.5	-
F2.0	2	1.5	1.0	0.5	0.5
F3.0	2	1.5	1.5	1.0	0.5
F4.0	2	1.0	1.5	0.5	0.5

* Calculated based on ratio of weight (w/w)

Results and Discussion

As mentioned in the materials and method, the purpose of bleaching pro-cess is to reduce the color intensity in order to the transparent soap has a good color (1). After bleaching process, color intensity of PFAD changed from 4.4Y 24.6R 3B to 23Y 3.8R and color intensity of PKO changed from 18.74Y 3.7R to 10Y 1R.

Additives used for the transparent soap making were glycerin, sucrose, di-ethanolamine and alcohol. Glycerin addition tended to produce phase of gel in the soap. Sucrose is added to help the establishment of the crystals, while the development of fibrous crystals that caused opaqueness is depressed by glycerin (7). According to Shipp (12) diethanolamine is used as foam stabilizers and to make sodium soap soft. The transparency and hardness of the soaps were measured by organoleptic test. Results revealed that the transparency, hardness, and free fatty acid of the transparent soap produced were different due to the different in the formulation (Table 2).

Table 2. Chemical and physical properties of transparent soap formulation

Sample	Free fatty acid (%)	Remarks
F1.0	3.69	Soft, light yellow, not transparent, pH 9-10
F2.0	2.74	hard, cream, transpar-ent + +, pH 9-10
F3.0	1.48	hard, yellow, transpar-ent + + +, pH 9-10
F4.0	1.55	hard, light yellow, transparent +, pH 9-10

Note: +:less, + + :more, + + + :most

According to Jungermann (7) the transparent soap has relatively high alkalinity (pH < 9.6). In general, the alkalinity of transparent soap made from PFAD was suited with standard alkalinity (Table 2). Formulation F3.0 had the highest degree transparency and lowest free fatty acid. The standard requirement of free fatty acid content in the transparent soap is 0.5% max. (7) or the free alkali is 0.05 - 0.1% max. (1). Thus, the formulation of F3.0 has to be reformulated in such away that its free fatty acid or free alkali content is in agreement with the standard requirement according to Jungermann (7). The modification of F3.0 formulation was done by varying di ethanolamine addition level, i.e. 1.0% (w/w) (F3.1 formulation) and 1.5% (w/w) (F3.2 formulation). There was no free fatty acid content in the transparent soap after addition the diethanolamine of 1.0% (w/w) or 1.5% (w/w). The new formulations of F3.1 and F3.2 contained free alkali of 0.15% and 0.12%, respectively. The free fatty acid content of the commercial transparent soap was much higher (5.85%) than that of standard requirement (0.5% max.). The other chemical properties of F3.0, F3.1, F3.2 formulations and commercial transparent soap are presented in Table 3.

Table 3. Chemical properties of transparent soap

Sample	Free Glycerin (%)	TFM* (%)	INS** factor
F3.0	5.71	21.81	4.75
F3.1	4.18	18.27	3.41
F3.2	4.65	22.13	17.69
X***	2.43	56.26	61.46

Note
* TFM : total fatty matter
** INS : iodine number saponification
*** X : commercial transparent soap

Free glycerin content of soap

A number of free glycerin influenced on the hardness of the soap. If the soap has relatively high of free glycerin content, the soap will become softer. The transparent soap made from PFAD had a free glycerin content higher (4.18-5.71%) than that of commercial transparent soap (2.43%).

Total fatty matter content

Total fatty matter (TFM) of soap is the amount of total fat or oil, which will react with alkali. The higher TFM content, the more fatty acid will react with alkali, and the more soap will be produced. The transparent soap made from PFAD had TFM content lower (18.27-22.13%) than that of commercial transparent soap (56.26%) meaning that transparent soap made from PFAD used a lot of additives.

Iodine number saponification factor

Iodine number saponification (INS) factor gave indication of the hardness of soap (1) if the INS factor is higher, the soap becomes harder. The result showed that the transparent soap made from PFAD had INS factor (3.41-17.69) lower than that of commercial transparent soap (61.46). Therefore, the transparent soap made from PFAD was softer than that of commercial transparent soap because the transparent soap made from PFAD had free glycerin content higher than that of the commercial transparent soap. Another reason was, that TFM of transparent soap

made from PFAD was lower than that of commercial transparent soap.

Conclusions

Due to the similarity in chemical properties between tallow and palm fatty acid distillate, coconut oil and palm kernel oil, and the transparent soap could be prepared using palm fatty acid distillate and palm kernel oil as a main raw materials. The results showed that transparent soap made from palm fatty acid distillate, palm kernel oil, and other additives with the composition of soap stock: glycerin : alcohol : sucrose : diethanolamine = 2 : 1.5 : 1.5 : 1.0 : 1.5 had free alkali content of 0.12%, free glycerin content of 4.65%, total fatty matter of 22.13%, and iodine number saponification factor of 17.69. The substitute of conventional raw materials such as tallow and coconut oil with the palm fatty acid distillate and palm kernel oil is expected that the production cost of transparent soap making will decrease.

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