SHEA TECH CERTIFICATION

ONLINE COURSE
MODULE 2

Processing and Storage of Shea Butter and Shea based Products

METHODS OF EXTRACTION

How is Shea Butter made?

There are three methods to extract Shea Butter from the Shea nut/seed:

1. Traditional Method
2. Cold Press Method
3. Hexane/Chemical Method

METHODS OF EXTRACTION

1. Traditional Method

In this method the fine Pulverized powder is mixed with an appropriate amount of water until a white bloom appears. Formation of the white bloom is an important enzymatic step. Followed by heating the mixture as required.

Proper heating coagulates proteinaceous materials and solubolizes various glycans. Stirring facilitates both of the proteinaceous coagulation and glycan solublization while simultaneously promoting the development of three phases. Namely, the particulate phase in the bottom of the pot and the oil and water layers. Finally the oily layer is harvested from atop of the water layer leaving behind the water layer and particulate matter in the bottom of the pot. Finally the collected oily layer is allowed to cool, which is what is known as Shea Butter.

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2. Cold Press Method

This method makes use of a press for applying a great deal of pressure to the fine Pulverized powder obtained from the grinding/milling steps. The material is first heated to liquefy the oil and then the oil is forced out or expressed by applying great pressure to the warmed material. When the expressed oil is collected and allowed to cool it forms a solid cream known as Shea Butter.

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3. Hexane/Chemical Method

Hexane has many of the chemical properties of gasoline. Therefore, hexane or chemical extraction of Shea Butter requires a well-trained chemist and a well-equipped chemical laboratory. In hexane extraction, the pulverized seed is mixed with hexane. This mixing process allows all the oily and fatty constituents of the seed to dissolve in the hexane.

The resulting oily –hexane mixture is later separated from the seed residue. The oily –hexane mixture is then treated to remove the hexane to yield the crude Shea Butter. The crude Shea Butter is then degummed to remove phospholipids; neutralized with (lye) sodium hydroxide; centrifuged and hot water washed to remove free fatty acids; bleached and treated with adsorbents to remove pigments and trace metals; sometimes the Butter is steamed, distilled or heated to very high temperatures to remove volatile components. Leaving behind a product with the color and consistency of cooking lard and known in the industry as refined Shea Butter. The natural integrity of unrefined shea is interrupted or changed during the chemical extraction process. For safety reasons, Shea Butter prepared by the chemical method, must be refined before it is permitted on the market. Additionally, Hexane extraction removes most if not all of the healing properties from shea butter.

METHODS OF EXTRACTION

The three methods have similar steps in common. The common steps for extraction are summarized below from a) to e). Until the seeds are pulverized, the steps of extraction for either method are the same. After the grinding/milling step, the extraction steps differ for each method. Below is a summary of each step involved in extraction of Shea Butter:

a) Harvest time: April to August each year;

b) Method of harvest: Collect fruit from the ground around the tree;

c) De-pulping: Pulp is removed by a number of methods. For example, some will collect the fruit then bury in the ground for several weeks to ferment and putrefy. Others are collected and simply allowed to decay. In a few cases, the fruit is fed to farm animals and the remains are then collected to recover the nuts. Few pickers will eat the fruit saving the nut for later use. After the nuts are collected from the de-pulped fruit, the nut is often boiled to remove any remaining and undesirable residue.

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d) Drying: Usually sun drying, roasting or other methods of drying the nut might be considered after de-pulping. The process of nut drying varies considerably throughout the Shea Belt. Sun drying, fire drying, even boiling are all practiced in one or more regions. The objective in drying is to reduce the moist content of the seed to some point between 5 – 15 %.

e) Grinding/Milling: In this step the cleaned seed is crushed to a course meal, then grind or milled to a fine Pulverized powder. Both crushing and grinding can be performed manually or by mechanical means. For the traditional method grinding/milling may be done mechanically or manually using a mortar and pestle and a stone hammer. While the cold press and the chemical methods employ mechanical means almost exclusively for grinding/milling.

QUALITY ISSUES

A. Mold in Shea Butter

Shea Butter made from unclean nuts is the source of moldy Shea Butter. Molds can be found growing on the surface of Shea Butter. The growth appears as very fine, thin dark or black filamentous structures rising from the surface of the Shea Butter. The use of moldy Shea Butter places persons with skin wounds at an increase risk to infection or allergic reactions.

The organism Aspergillus is frequently the culprit when mold is present in Shea Butter. Aspergillus is a very dark, often black growth on the surface of Shea Butter. This particular Aspergillus organism produces a group of metabolic products that are highly toxic poisons known as aflatoxins. When individuals with small skin wounds and minor skin injuries use moldy Shea Aspergillus and its metabolic products may gain access to deeper ports in the body at the site of the skin wounds and injuries. Caution must be taken to avoid moldy Shea Butter at all cost.

Those that are allergic to mold are at additional risk with moldy Shea Butter. When a container of moldy Shea is opened in your home or office the mold present can spread to other places in the home or office.

QUALITY ISSUES

A. Mold in Shea Butter (continued)

Molds are microscopic, plant-like organisms, composed of long filaments called hyphea. Mold or hyphea grows over the surface of Shea Butter in a container that has been tightly closed for several weeks or more. Because of their filamentous construction and consistent lack of chlorophyll, this mold is considered by most biologists to be fungi and not really included in the Plant Kingdom. They are related to the familiar mushrooms and toadstools. Molds reproduce by spores. Spores are like seeds; they germinate to produce a new mold colony when they're maintained in a suitable place and environment for a period of time.

Mold is the best example to demonstrate that heating during processing of Shea does not destroy all microorganisms. Other spore reproducing microorganisms are also likely to survive the heating step during preparation. For this reason, the American Shea Butter Institute does not recommend oral consumption of Shea Butter without the proper analytical analysis and governmental approval.

QUALITY ISSUES

A. Mold in Shea Butter (continued)

We place great emphasis on the age-old observation that heat destroys bacteria. This is absolutely true. However, the same level of emphasis is not placed on the well-known finding that spores may survive heating. To that end, organisms that reproduce by spores are more likely to survive the heat during processing. It is the spore that actually survives the heating step. When the post preparation environment is suitable, the surviving spore will germinate to contaminate the final Shea Butter product. One may ask how molds get into Shea Butter in the first place. When moist nuts are allowed to remain in warm, moist areas for prolonged periods of time, mold spores will germinate to produce moldy nuts. Moldy nuts are the source of mold found in Shea Butter.

The certificate of analysis denoting the quality of your butter should always state results of laboratory tests for mold.

QUALITY ISSUES

B. What Lab Tests evaluates the moisturizing fraction?

The quality of the moisturizing fraction can be determined by review the content of free fatty acid and peroxide. When free fatty acids are greater than 2% significant damage has occurred. Likewise, when peroxide levels are greater than 2 meq per kg significant damage has occurred. Whenever you see a damaged moisturizing fraction you can be assured the healing fraction has been damaged as well.

There are four-laboratory tests that evaluate the quality of the moisturizing fraction.

- **Free Fatty Acid ;**
- **Peroxide ;**
- **Iron content; and,**
- **Moisture content.**

QUALITY ISSUES

C. Fatty Acid Profile

The fatty has profile has two components to study.

(1). List of fatty acids present

(2). the percent of each acid

The list of fatty acids tends to remain rather constant throughout most analysis. What does change from batch to batch and country to country is the concentration (%) of a given fatty acid in a given batch of shea butter.

Fatty Acids	CHAD	Nigeria	Burkina Faso
Oleic	51.30	43.47	43.99
Stearic	36.47	43.89	43.42
Linoleic	5.77	6.01	5.96
Palmitic	3.93	3.83	3.20
Vaccenic	0.59	0.53	0.51
Arachidic	1.22	1.40	1.51
Eicosenoic	0.27	0.24	0.33
Alpha Linolenic	0.13	0.15	0.17
Behenic	0.14	o.16	0.14
Lignoceric	0.10	0.11	0.10
unknown	0.08	0.21	0.60
C-2 thru C-15 acids	Not detected	Not detected	Not detected
Adulteration	Not detected	Not detected	Not detected

QUALITY ISSUES

C. Fatty Acid Profile (continued)

In high quality shea butter the above fatty acids do not exist as stand alone free fatty acids. They are actually bound up in the form of triglycerides. However, when the butter is degraded or destroyed by heat, moisture, microbial, etc, any one or more of the above acids are liberated from the triglyceride complex to exist as free fatty acids, and thus more easily reacts with oxygen to form peroxides and undesirable odors.

Free Fatty Acids tell us the integrity of the moisturizing fraction; therefore, low free fatty acids is consistent with high quality shea butter. The acceptable limit of free fatty acids is 2%. Shea butter with free fatty acids higher than 2% should trigger concern and caution in buying and selling. ***The Higher the free fatty acids the more damage has occurred within the moisturizing fraction.***

QUALITY ISSUES

C. Free Fatty Acids and Peroxide Value

The Free fatty acid liberated from triglyceride breakdown that most easily react with oxygen to produce peroxides and undesirables odors are listed below:

1). Alpha Linolenic omega-3
2). Linoleic omega-6
3). Eicosenoic omega-9
4). Vaccenic acid omega-7
5). Oleic

A peroxide test tells us the amount of peroxides have been produced by oxygen, while the amount of free fatty acids present in a given batch of Shea Butter tells us the degree destruction and digestion has occurred in the butter.
Therefore two quality tests are the peroxide valve and the free fatty acid value. In both cases high values are seen with poor quality.

QUALITY ISSUES

C. Free Fatty Acids and Peroxide Value

Free fatty acids value above 2%, is indicative of significant destruction and breakdown of important ingredients, especially the triglycerides. While a peroxide value grater than 2 meq is indicative of significant oxidative destruction.

For this reason the highest quality rating is awarded to those butters with the least amount of free fatty acids, and the lowest peroxide value.

QUALITY ISSUES

D. Bioactive Fraction and Quality

Bioactive fraction, formerly called the Nonsaponifiable fraction, or the healing fraction poses the defining value for shea butter. The bioactive fraction gives shea butter its unparalleled value in the cosmetic industry. In the great majority of oils derived from fruits, vegetables and nuts the bioactive fraction is very small, often in the range of 1-2% (see chart on next page). However, the bioactive fraction in a good preparation of shea butter can be as high as 4 -6% or greater. It is this exceptionally large bioactive fraction that separates and distinguishes shea butter from all other oils. Likewise, it is this exceptionally large bioactive fraction that makes shea butter superior to petroleum based skin care products such as baby oil, mineral oil, and petroleum jelly, etc. For example petroleum based oils such as mineral oil, baby oil, petroleum jelly, etc., have absolutely no bioactive ingredients.

QUALITY ISSUES

D. Bioactive Fraction and Quality (continued)

It is important to understand that the bioactive fraction has the healing ingredients (Vitamins A, F, E, cinnamic acid, sterols, and triterpenes) for various skin ailments. The size of the bioactive fraction is one of the parameters used to determine the quality grade of a given batch of shea butter. Those butters with large bioactive fraction earn more quality points than those with a smaller bioactive fraction.

Oil	Size Range
Baby Oil	0.00–0.00%
Mineral Oil	0.00–0.00%
Olive Oil	0.6 –1.5 %
Sesame Oil	1.0 –1.5 %
Soy Oil	0.5 –1.5 %
Maize Germ Oil	0.8 –2.9 %
Refined Shea Butter	1.0–2.2%
Argan oil	1.5 –3.5%
Avocado	2.0 –6.0%
Low Quality Unrefined Shea Butter	3.0–9.0%
Wheat Germ Oil	3.5 –4.7%
Higher Quality Unrefined	4.0–9.0%
Certified Premium Grade A	4.0–9.0%

SHELF LIFE

A. The question, “What is the shelf life of shea butter?” is an inappropriate question…

The question should be, what is the shelf life of a specific or given batch of shea butter. The shelf life of Shea Butter is dependent on two important variables.

1).The conditions during its extraction.

2). Its post extraction management.

These variables differ from one preparation to the next, from person to person, from region to region, from country to country. Because of this variation, the shelf life varies from one batch to another. As a broker or manufacturer you should now understand why it is unreliable to use the shelf life of one batch as the shelf life for another batch.

SHELF LIFE

Before mixing shea butter with other products, it is essential to first determine the batch's shelf life, if it has not been determined previously. Shelf life for a given batch of unrefined shea butter is so batch specific that, at the American Shea Butter Institute, we use the batch shelf life as one of four parameters to establish the ASBI batch fingerprint. The fingerprint allows us to identify a given unrefined shea butter at a later time even after mixing with other products. When it comes to shea butter shelf life, it is important for you to know that 60% of the butter arriving from West Africa is already rancid. While 90% of the shea butter arriving from East Africa is rancid. By the time it reaches the consumer, the rancidity percentage is even higher. This occurs unfortunately because consumers, retailers or brokers almost never request a peroxide value before buying. You should also know that the highest possible quality grade for rancid shea butter is Grade D.

SHELF LIFE

B. Peroxide Value

Shelf life is determined by increasing peroxide levels that eventually causes the butter to reach the point of rancidity. Factors responsible for rancidity are discussed in details below.

It is profoundly incorrect to consider the shelf life value for one batch shea butter is the same for all shea butters. We consider a peroxide value of 5 – 6 meq per kg as rancid.

Peroxide Value is commonly zero or close to zero the day extraction is completed. Shea butter properly prepared and maintained as recommended will require more than one year from the day of extraction to reach a peroxide value of 5 – 6 meq per kg. This rate is less than 0.5 meq per kg per month. Once extraction is completed, the rate at which peroxide in any shea butter goes from zero to 5 – 6 meq per kg is determined by the contribution of a host of factors working together.

SHELF LIFE

Shelf life is considered the amount of time before a given shea butter is rancid.

The amount of time required for a given shea butter to go rancid is dependent on a number of intrinsic and extrinsic factors. These intrinsic and extrinsic factors as listed below may promote or retard the onset of rancidity.

Shelf Life factors include, but are not limited to the following:

1. Moisture content;
2. Metal content;
3. Insoluble debris;
4. Peroxide content;
5. Free fatty acid content;
6. Light exposure;
7. Vitamin A content;
8. Vitamin E content; and,
9. Storage temperature.

SHELF LIFE

The stoichiometric relation of these factors is still unclear. However, it is clear that each of these variables plays a significant role in the butter's shelf life. Because these parameters vary within each batch, it follows that the shelf life is unique for each batch.

In many villages or communities where shea butter is prepared, the physical facilities necessary to properly maintain shea in an ideal post extraction environment are not readily available. To that end, once production is completed, we strongly recommend the buyer make every effort to have the butter shipped immediately to facilities capable of ideal post extraction management.

We recommend producers process shea butter based on new orders. Where possible, the producer should first find a buyer, and then prepare the product. Avoid preparing large volumes of shea butter before identifying a buyer.

SHELF LIFE

Finally, we strongly encourage shipping by land and sea in refrigerated trucks and/or containers to avoid exposed to heat and other undesirable environmental factors. These recommendations ensure the buyer a longer shelf life before rancidity. Shea butter is a biological product and undergoes continuous auto oxidation and auto decay.

SHELF LIFE

C. Storage

All biological materials are undergoing continuous decay even in the most ideal storage conditions. So long as oxygen is available biological material will decay. Our efforts with storage are to reduce the rate of decay as much as possible. Once the butter is rancid you have lost your investment. To that end Quality decreases with age. Post extraction management (PEM) is designed to preserve the quality over the long-term, long after extraction is completed. PEM should not be confused with quality control (QC) Quality Control is applicable during extraction. PEM on the other hand is applicable during storage and shipping.

*Those interested in more detail training in Post Extraction Management are recommended to contact Online Administrator for more information, elearning@sheainstitute.com

SHELF LIFE

D. Factors that Promote Shea Butter Decay (Rancidity)

1. Heat;
2. Light;
3. Oxygen;
4. Metal;
5. Microorganisms;
6. Rancidity;
7. Metal storage containers; and,
8. Mixing aged shea butter with freshly prepared shea butter.

SHELF LIFE

E. Storage Factors Preventing Rancidity

1. Store in dark area
2. Keep storage containers sealed tightly
3. Avoid Metal contamination
4. Avoid Microbial organisms
5. Storage Environment is defined by four parameters (HALT Humidity, Air, Light, and Temperature). HALT represents the essence of your storage environment.
6. Humidity (low humidity /dry)
7. Air: Containers should be closed airtight. Vacuum packed if possible.
8. Temperature: 70 F