Food Oils and Fats: Chemistry and Technology

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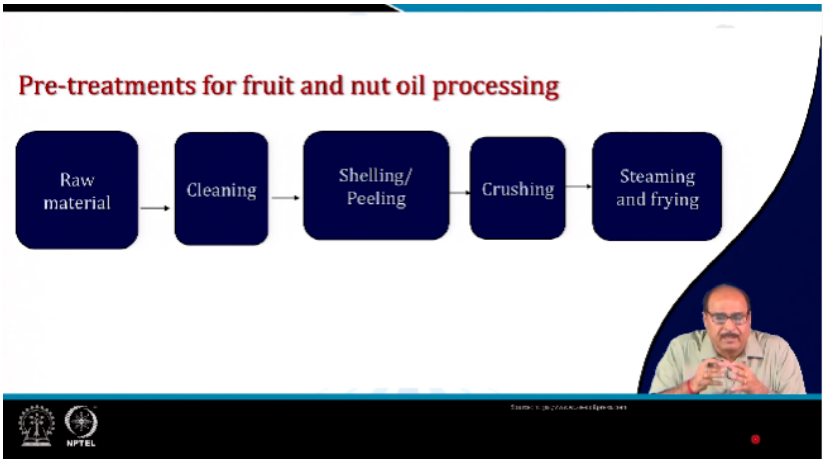
Module 09: Commercial Cooking & Frying Oils

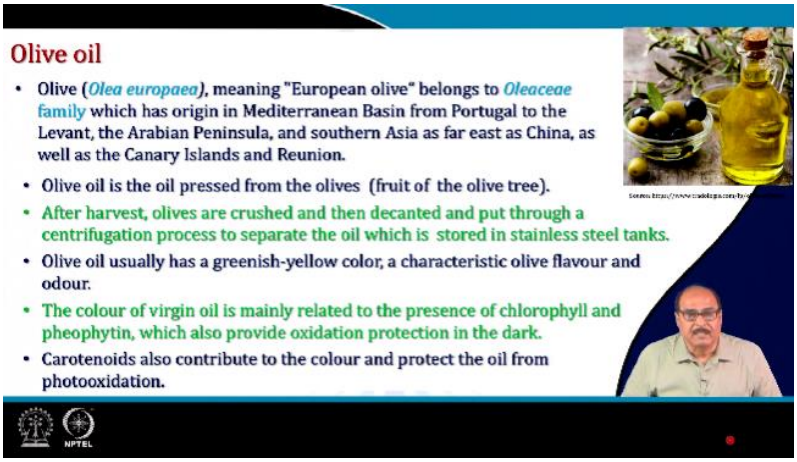
Lecture 44: Fruit and Nut Oils

Hello everyone, Namaskar. Now, in this 44th lecture, we will talk about fruit and nut oils.

We will discuss major fruits and nut oils particularly olive oil, palm oil and coconut oil and quality characteristics of these oils and their health benefits and also we will talk about what are the various pretreatments and their manufacturing process operations.

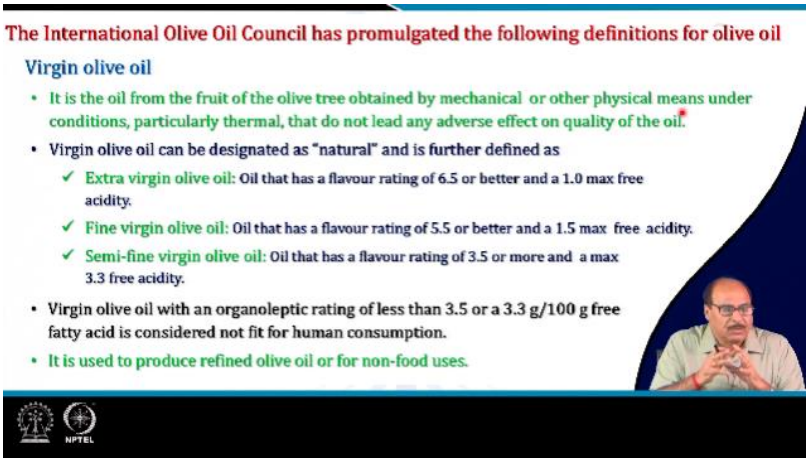


So, the pretreatments for fruit and nut oil processing normally include as in any plant material, they are required, they are taken the raw material that is the olive fruit or palm fruit palm kernel or coconut, then they are cleaned, they are harvested from the plant, they are cleaned and then they require selling or peeling, crushing and then sometime even steaming and frying because of their specific characteristics and nature like particularly palm and coconut. They require specific operations, specific treatment to remove the hull to deshell it and to obtain in their extractable forms and these are again there are standard post-harvest operations and techniques. I am not going to have details in these operations, I will directly come to the oil related that is extraction of oil-related matters in these cases. So, obviously that before being subjected to the oil extraction process, these materials are subjected to proper post-harvest operations, and the material that is a clean, radiated, sold, sealed, peeled, crushed, and steamed or fried as the case may be and it is obtained in the extractable conditions.

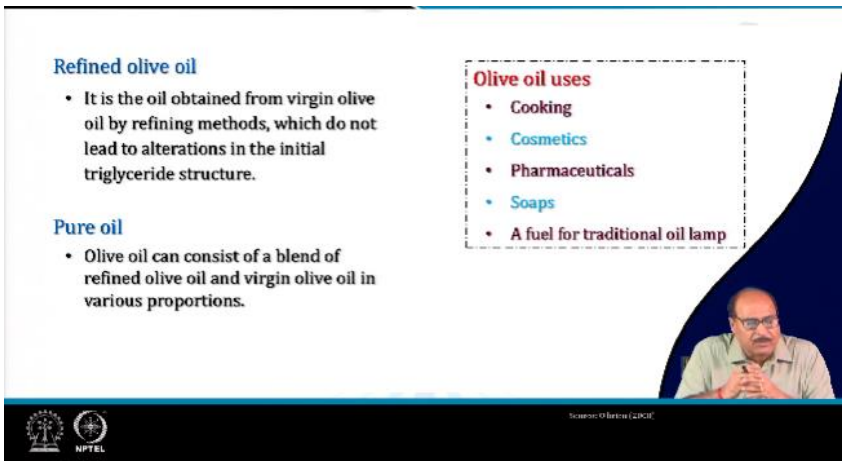


Then let us start now one by one we will take first the olive oil you know olive botanical name is *Olea Europaea* meaning European olive. It belongs to the *Oleaceae* family which has origin in the Mediterranean basin from Portugal to Levant, the Arabian Peninsula and South Asia as far as far east as China as well as the Canary, Iceland and

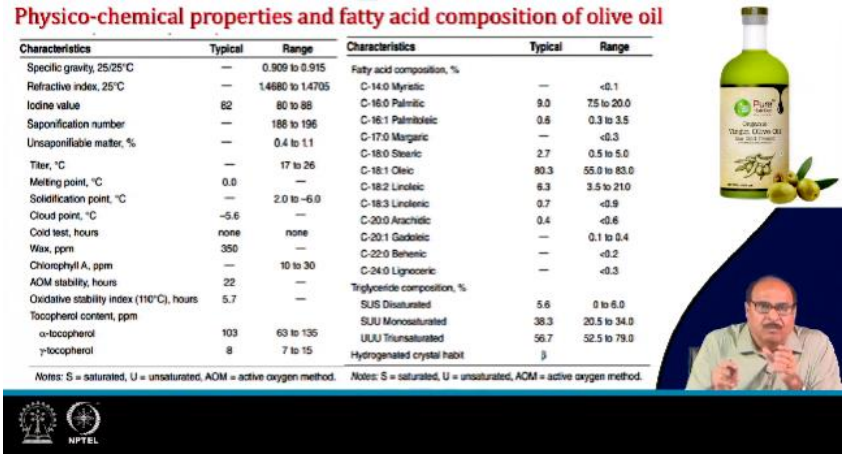
Reunion. Olive oil is the oil pressed from the olive which is the basically fruit of olive tree. Even olive fruit is also eaten as such in this every item. So, after harvest olives are crushed and then decanted and put through a centrifugation process to separate the oil which is stored in stainless steel tanks. Olive oil usually has a greenish-yellow colour, a characteristic olive flavor and udder. The udder of virgin oil is mainly related to the presence of chlorophyll and pheophytin which also provide oxidation protection in the dark. Carotenoids which are present in the olive oil contribute to the colour and they protect the oil from photooxidation.



The International Olive Oil Council has promulgated the following definition for the olive oil that is the virgin olive oil virgin olive oil is obtained in the market in various forms. So, it is the oil from the fruit of the olive tree which is obtained by mechanical or other physical means under conditions particularly the thermal condition, minimal thermal condition that is that they do not lead any adverse effect on the quality of the oil particularly the strong characteristic flavour of the oil and other components held by the virgin olive oil can further be designated as a natural and oil natural olive oil and it is categorized into three forms like extra virgin olive oil which has a strong flavouring rating, flavour rating of 6.5 or better and a maximum free acidity of 1. The fine virgin olive oil it has a flavour rating of 5.5 or better and it is a 1.5 free acidity maximum. Semi-fine virgin olive oil that is the oil that has a flavour rating of 3.5 or more and it has a maximum free acidity 3.3. So, virgin olive oil with an organoleptic rating of less than 3. 5 or you can say to be specifically less than 3.3 gram per 100 gram free fatty acid is considered to be not to fit it is considered not fit or unfit for human consumption. So, this oil is used to produce refined olive oil or for non-food usage. Because the otherwise the virgin olive oil is used as a particularly for food purposes.

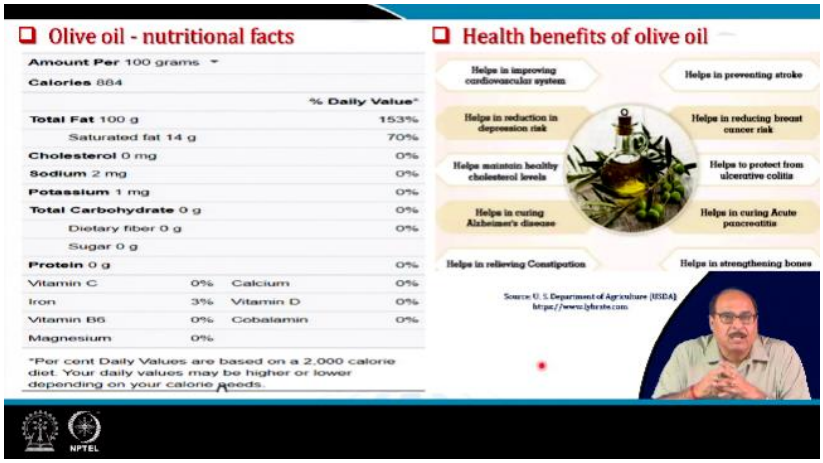


So, refined olive oil is the oil obtained from virgin oil by refining methods which do not lead to the alterations in the initial triglyceride structure. And the pure oil is the oil that can consist of a blend of refined olive oil and virgin olive oil in various proportions that is also. So, olive oil is sold in the market in different forms. So, olive oil is used for cooking, it is used in cosmetics, pharmaceuticals, in soap manufacturing industry and also it is used as a fuel for traditional oil lamps.

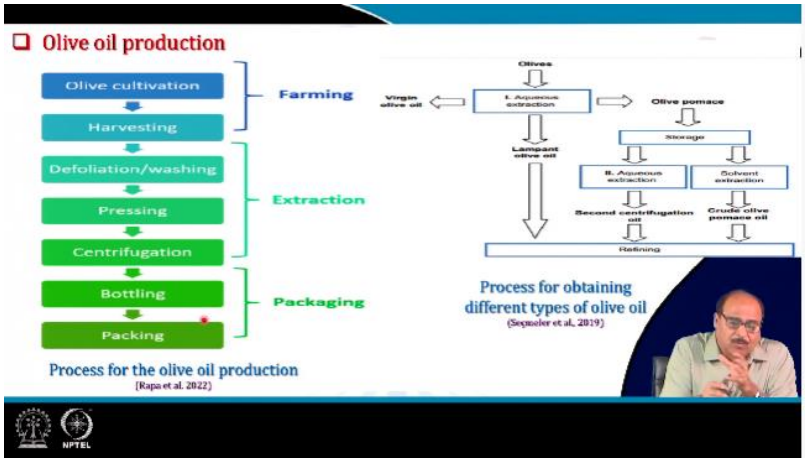


This table taken from the literature to give the physicochemical and other important characteristic fatty acid composition of olive oil. The first characteristic fatty acid composition of olive oil is the It has a specific gravity at 25°C in the range of 0.909 to 0.915. Refractive index at 25°C is in the range of 1.4680 to 1.4705. Iodine value is 80 in the range of 80 to 88. Similarly, saponification value lies in the range of 188 to 196. It has around 0.4 to 1.1 percent unsaponifiable matter and tighter value 17 to 26°C. And then it is a solidification point is 2 to 6°C, cloud point minus 5.6°C. It has a chlorophyll a about 10 to 30 ppm. It has oxidative stability index at 110°C about 5.7 hours and it has a good amount of tocopherol that is I mean alpha tocopherol 103, gamma tocopherol 8 that is the its range is 63 to 135. As far as the fatty acid composition is concerned you say that it has a permeative fatty acid around 9 percent. Then oleic acid about at the name

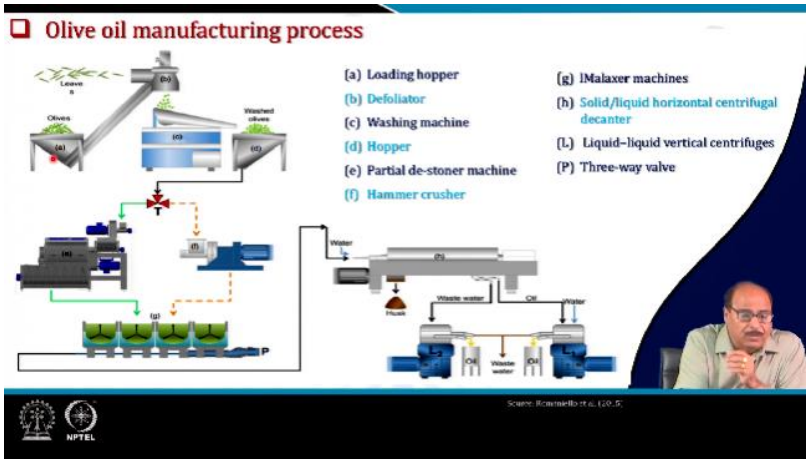
oleboile, oleic acid 80 percent its range may be 55 to 83 percent, linoleic around 6 percent. It has also triglyceride composition if you see that is SUS dye saturated is around 5.5 that is range is 0 to 6 percent. Then SUU monosaturated it is around 38, range may be 20 to 30, 4 or 20 to 30, 40. Then UUU triunsaturated fatty acids are about 56 percent and its hydrogenated crystal habit is beta. So, these are the physicochemical and characterized properties and fatty acid composition of olive oil.



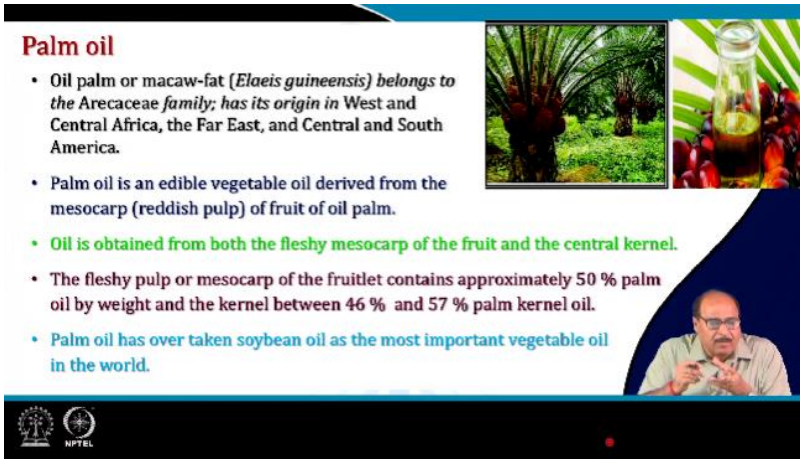
About a nutritional fat of olive oil per 100 gram it gives 884 calories and if you take total fat 100 gram of olive oil its daily value percent daily value becomes 153, saturated fat will be 70 percent of the per daily value it will give and it has no cholesterol and other components are not there here. Of course, iron 3 percent of the daily value is provided by this oleboile and health benefits I told that is the olive oil is helps in improving cardiovascular system, helps in reduction in depression risk, helps maintain healthy cholesterol levels and helps in curing Alzheimer disease. It helps in curing acute that is pancreatis helps to protect the ulcerative colitis, it helps in reducing breast cancer risk, helps in preventing stroke. So, it is a very good and health very good quality oil has a lot of health benefits.



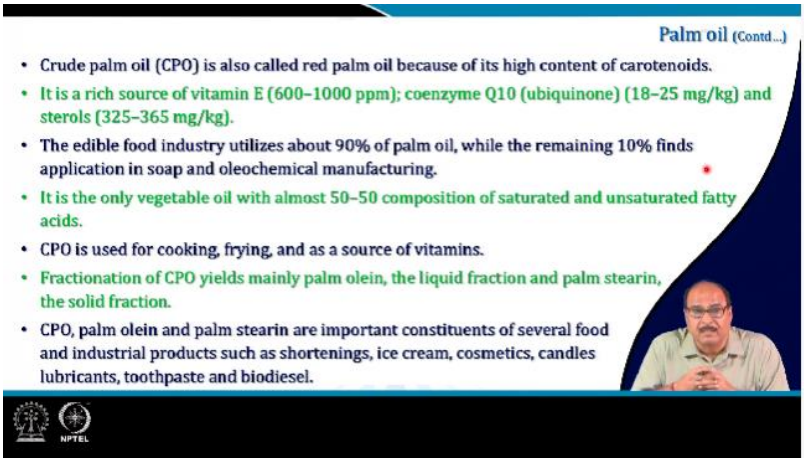
As far as the production of olive oil is concerned, I told you there are three major issues like farming that is from the plant tree that is olive is harvested, then this is the defoliation, washing, pressing and, centrifugation. So, this is the extraction and then finally, the virgin olive oil that is after extraction it is bottling and packaging. So, this is so farming extraction and packaging these are the major steps in the olive oil extraction process, olive oil production and also that is there are various step like for getting different types of olive oil by just changing the conditions and one after the other process mainly it is the pressing, but just pressing operator etc can be changed like you see olive first aqua extraction you get the virgin olive oil, then after that olive pomace is obtained. And then after aqua extraction whatever is the lime and olive oil you can get then olive pomace it is stored and then subjected to second extraction and the solvent extraction. So, second concentration of olive oil and crude olive oil etcetera this is also just by changing the extraction conditions different types of olive oils can be obtained.



So, this is a schematic of the even equipment and system for the extraction of the olive oil. So, it is you see that is a loading hopper olive is given then this is a it comes to the defoliator from where it goes to the washing machine alright and from washing the washed olives are sent to the hopper. And from where it comes to the partial de stroller machine where there are the stones of the olives are there removed and from where it is then sent to the that is the I Malaxer machine that is here ok that it causes crushing etcetera. And then this is also it comes through that hammer crusher that is de stroller and hammer crushing and from this the pulp is obtained crush is removed and pulp is obtained then it goes to the solid liquid horizontal centrifuge decanter. And then liquid liquid vertical centrifuges and three way valves etc are provided to get the oil olive oil. So, this is a schematic process flow for the manufacture of olive oil.

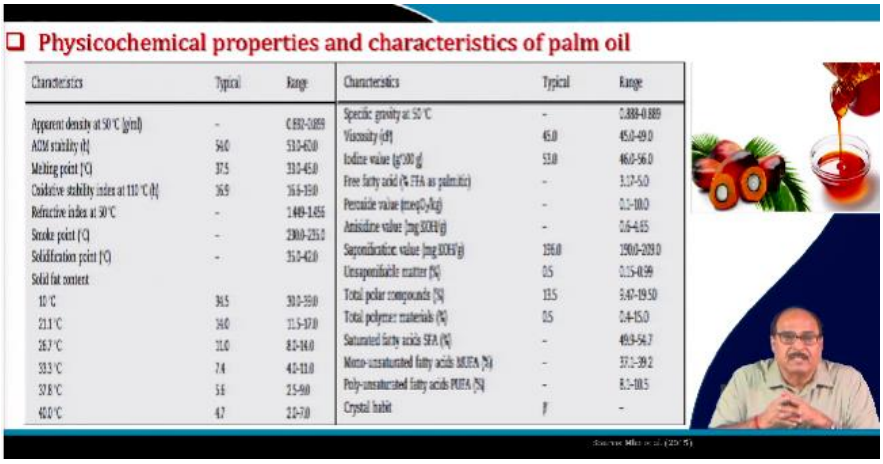


Then we come to the palm oil palm oil palm or macrophage that is allys genuineness it belongs to the Aracaceae family it has its origin in West and Central Africa the Far East and Central and South America. Palm oil is an edible vegetable oil which is derived from the mesocarp that is the reddish pulp of the fruit of oil palm because see that oil tree that. Oil is obtained from both the fleshy mesocarp of the fruit and also the central kernel. The fleshy pulp or mesocarp of the fruit plate contains approximately 50% palm oil by weight and the kernel it contains around 50%, 46% to 57% palm kernel oil. Palm oil has oil has overtaken soybean oil as the most important well vegetable oil in the world and even its use that is in the cooking operations etc is increasing.

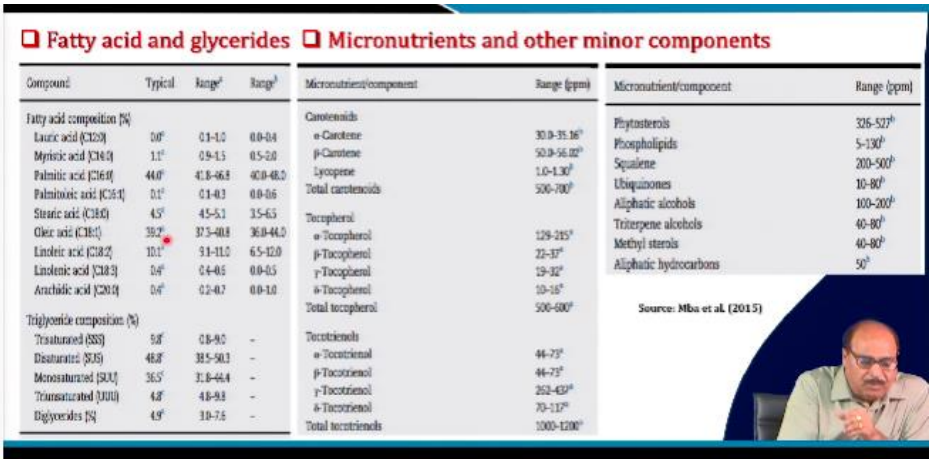


The crude oil palm oil is also called the red palm oil because of its high content of carotenoids. It is a resource of vitamin E that contains around 600 to 1000 ppm, its coenzyme Q10 that is ubiquinone around 18 to 25 mg per kg and sterols are around 325 to 365 milligram per kg. The edible food industry utilizes about 90 percent of the palm oil while the remaining 10 percent finds application in the soap and oleochemical manufacturing. It is the only vegetable oil with almost 50-50 composition of saturated and unsaturated fatty acids. Crude palm oil is used for cooking, frying and as a source of vitamins. Fractionation of crude palm oil yields mainly palm olein the liquid fraction and

the palm is here in the solid fraction. Crude palm oil, then palm olein and palm stearin are important constituents of several food and industrial products such as sardines, ice creams, cosmetics, candles, lubricant, toothpaste, biodiesel and so on.



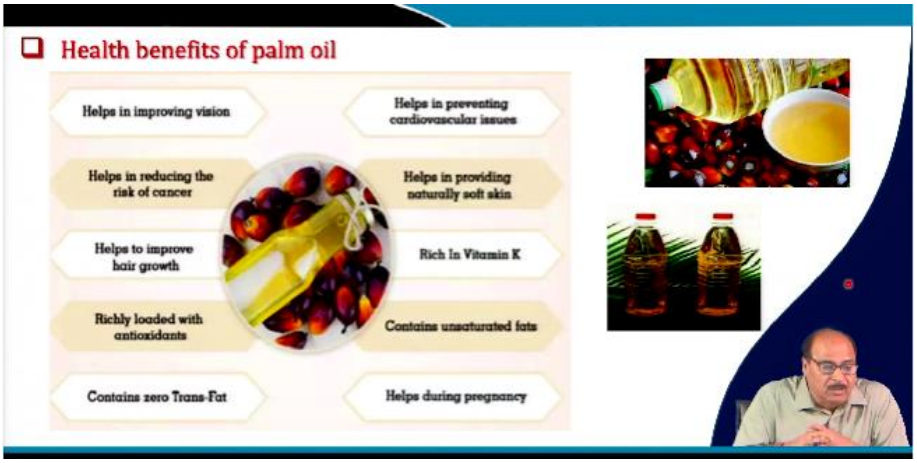
So, here this slide I have taken from the literature that physicochemical properties and characteristics of the palm oil its apparent density that is a gram per ml is around 0.8922 0.99, AOM stability that is the 54 hours melting point around 37.5 you can see that is it is a good melting characteristic, oxidative stability index at 110°C around 16.9 hours ok. And its solid fat content is here 10°C it is 34.5 and at 40°C it is 4. 7. Its specific gravity is 0.888 at 50°C, viscosity is around 45, iodine value is around 53 and it has sub verification value that is 196 which is indicative of the chain length. It has total polar compounds around 13.5 percent, total polymer 0.5 percent and its crystal habit is it forms beta dash crystal on crystallization.



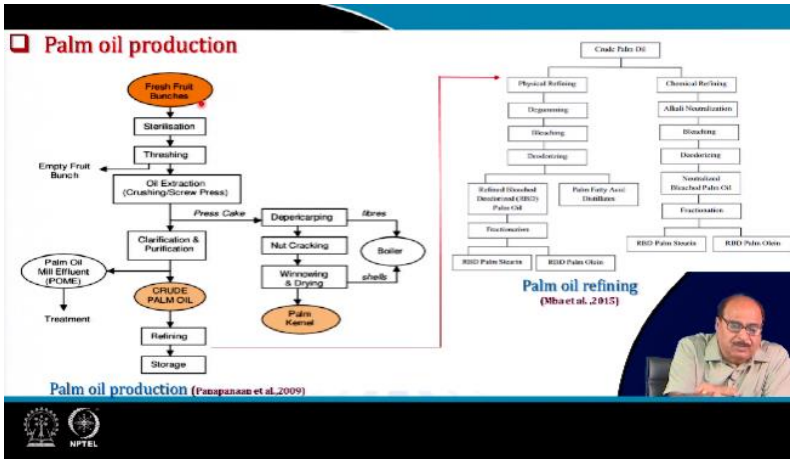
Fatty acids composition and glycerides or micronutrient and other minor components in the palm oil are provided in this table as you can see that it has oleic acid around 39 percent, linoleic 10 percent and it has palmitic acid around 44 percent that is a saturated fatty acid, stearic acid also around 4.5 percent. Triglyceride composition Tri-saturated

9.8, desaturated 48.8 or 49, monounsaturated 36 percent and Tri-unsaturated around 5 percent. Diglycerides they may contain around 4.9 percent depending upon the conditions of extraction. Micronutrient it has good amount of alpha carotene, beta carotene even total carotenoids present in the palm oil may be around 500 to 700 that is a ppm ok. Similarly it also has contain good vitamin A like alpha tocopherol 129 to 215 ppm. The total tocopherols may be 500 to 600 ppm even also it contains good tocotrienols about total tocotrienols it contains around 1000 to 1200 ppm and maximum is gamma tocotrienol which is 262 ppm, delta tocopherol is also 70 to 217 ppm. As far as the micronutrient present in the palm oil include it has phytosterols around 326 to 527 ppm, it has good amount of phospholipid ok, squalene, ubiquinone and then aliphatic alcohols, tripe in alphatic alcohol, methyl sterols and aliphatic hydrocarbons are also present in significant amount in the palm oil.

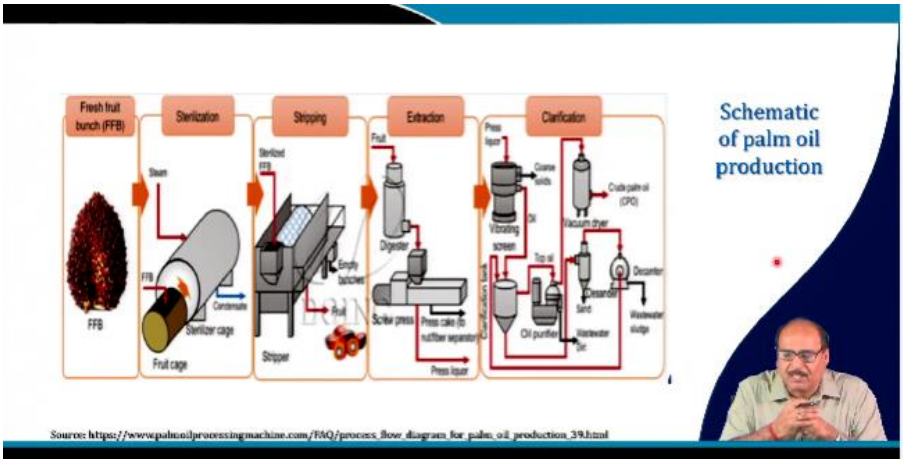
So, these are the different uses of the palm oil that is it is used in food manufacturing, in making beauty products, it is making beverages, making cookies, candy and ice creams, it is also used for making cleaning products even personal care or cosmetic products.



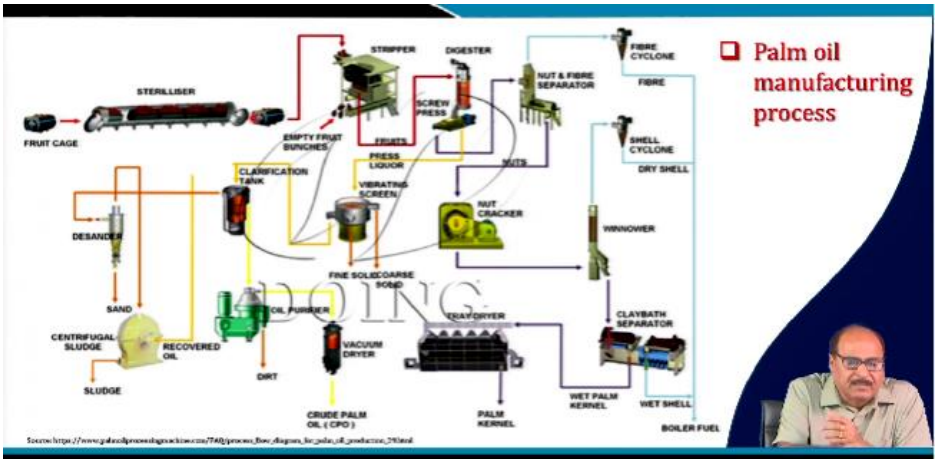
Health benefits of palm oil include, improving the vision, helps in reducing the risk of cancer, helps in improve hair growth, rich landed with landed with the antioxidant it is decreased. So, all these it is a very good health oil ok, it contains zero transfat, it helps during pregnancy, it contains more amount of unsaturated fats, rich in it is rich in vitamin K, helps in providing naturally soft skins, it helps in preventing cardiovascular usage etcetera ok. So, this is considered to be a healthy oil.



As far as the palm oil production is concerned, then this fresh fruit bunches there it is sterilized and where the appropriate threshing technology, in fruit bunches are thrown and there is this kernel is used for the oil extraction and the oil extraction is done by either by crushing or screw pressing. So, after crushing or screw pressing, the oil which is obtained it is sent for the clarification and purification and you get a palm oil, POME treatment and the crude palm oil. This is crude palm oil subjected to refining and storage. The cake is then deeppericarping, nut cracking and winnowing and drying and it gives palm kernel. And the crude palm oil which is refined and it is sent for the crude palm oil either physical refining or chemical refining using the standard like degumming, bleaching, deodorizing. Then refined and bleached is a oil palm oil and the palm fatty acid fractionation refined and bleached palm olein or refined and bleached palm olein is obtained. So, either by chemical refining process and other by physical refining process these are the steps which are obtained.

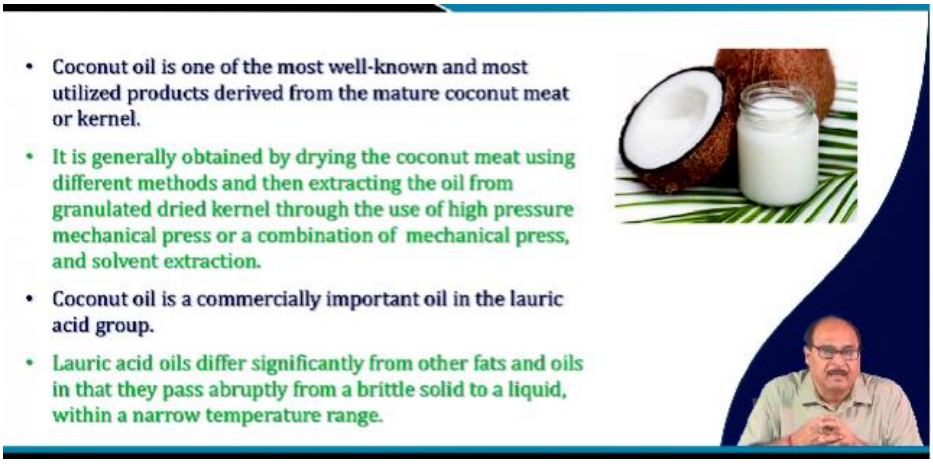


So, this is again schematic of the palm oil production it has shown showing with that little to make it little understand that using the equipment etc that is your is the fresh fruit bunches is obtained, then it is part sterilizer, fruit cage, where it is bunches are removed, washed and you get that is and it is stripped striping treatment and then you get by stripping that is the kernels etc alright. And then it is subjected to extraction machinery that is the resistor and then extraction is repressing or fresh oil is obtained, then fresh liquor is sent to the clarification, oil purifier and then you get the oil clarified palm oil crude palm oil.

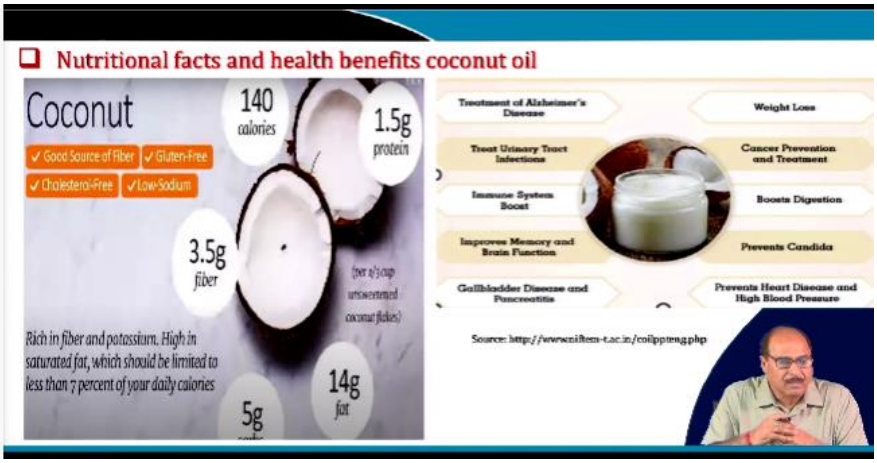


This is also again a similar that is where the different oil palm oil manufacturing process that is fruit cage, sterilizer from here it is stripper, from the stripper it is good there is a fruit it is go to the screw press ok. And then different stages that is the yellow line it is going to the press liquor that is oil line which is clarified oil that is oil purifier, clarified oil and the cake filter line. So, different there is drying etcetera. So, it keeps palm kernel that is the cake which is obtained fibre for the use for boiler fuel, then crude palm oil is obtained, then recovered palm oil. So, different product are after the crude palm oil or palm kernel or boiler fuel all these things are its fibres.

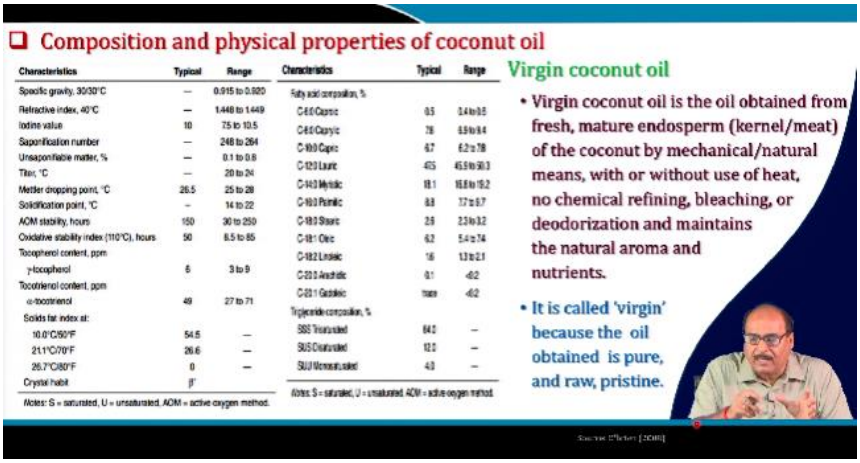
Then you go for the coconut oil, coconut oil or coconut butter is an edible oil derived from the kernels meat and milk of the coconut palm fruit. Coconut oil is a white solid fat below around 25°C and a clear thin liquid oil in warmer climates. It is an unrefined varieties have a distinct coconut aroma, coconut oil is used as a food oil and in industrial application for cosmetics and detergent production, the oil is rich in medium chain fatty acids and due to its high level of saturated fats numerous health authorities recommend limiting its consumption as a food.



Coconut oil is one of the most well known and most utilized products derived from the mature coconut meat or kernel. It is generally obtained by drying the coconut meat using different methods and then extracting the oil from the granulated dried kernel through the use of high pressure mechanical press or a combination of mechanical press and solvent extraction. Coconut oil is a commonly commercially important oil in the lauric acid group. Lauric acid oil differs significantly from other fats and oils in that they pass abruptly from a brittle solid into a liquid within a narrow temperature range.

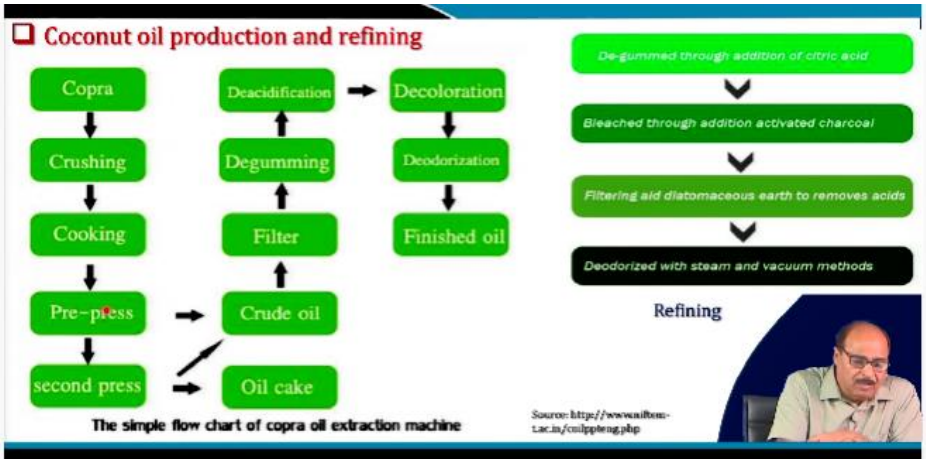


The nutritional fats of the coconut oil that is a health benefits and nutritional fat that is you see that a coconut oil it is a good source of fiber, coconut is a good source of fiber, it is gluten free, it is cholesterol free and it has a low sodium content ok. It is high in saturated fat which should be limited to less than 7 percent of your daily calories ok. It is that is a it gives around 14 gram fat, 5 gram carb ok per 1 by 3 cup unsweetened coconut flakes it gives 3.5 gram fiber, 140 calories and 105 gram of protein. As far as its health benefits are concerned it is used for the treatment of Alzheimer disease, it is treats urinary tract infections, it is immune system booster, it improves memory and brain function and gallbladder disease and pancreatitis are also improved ok. It is a results in weight loss, cancer prevention and treatment, boost digestion and prevents candida, it prevents heart diseases and high blood pressure.

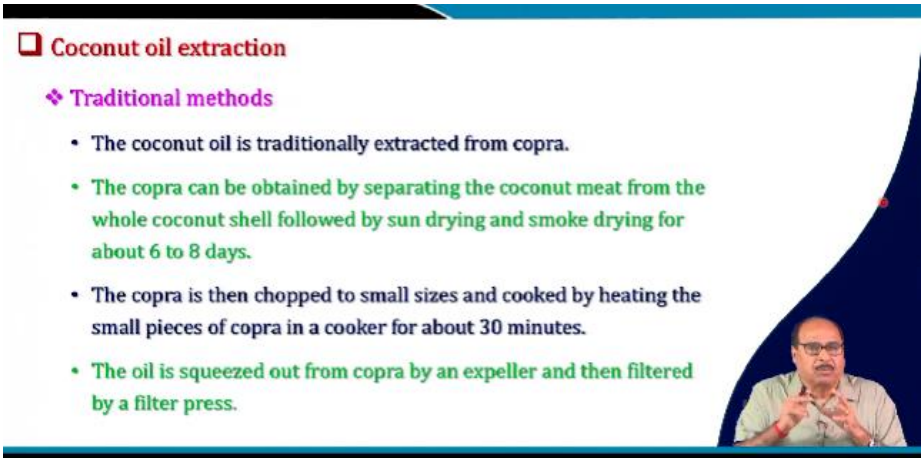


This is the composition and physical properties of coconut oil, virgin coconut oil is the oil obtained from the fresh mature endosperm like kernel or meat of the coconut by mechanical or natural means with or without the use of heat, no chemical refining, bleaching or deodorization and is used and this the oil that maintains the natural aroma and the nutrients that is the virgin coconut oil. It is called virgin because the oil obtained is pure and it is raw it is crystal clear. It had good amount as you can see specific gravity

and the refractive index the iodine value is 10 which indicates that is a highly saturated fats are there melting dropping point 36.5, oxidative stability index is 50, AOM stability is 50 hours ok. And then solid fat index that is a 10 degree Celsius it is 54, 21°C it is 26, crystal high which is beta dash crystal and as far as the fatty acid composition is concerned lauric 47. 5 maximum. And then SSS Tri-saturated fatty acids are 84 percent, disaturated 12, monounsaturated it is 4.

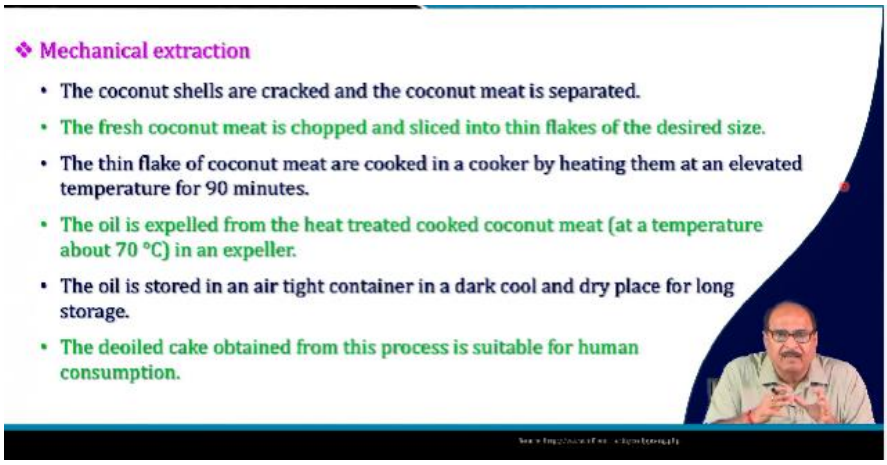


So, it gives the coconut oil production and refining that is the copra is crushed, cooked and prepressed second prepressed and then it is get oil cake, oil cake or crude oil it is filtered degum, deacidified, decolorization and finished. So, degummed that is the oil crude oil where refining the degumming is done through the action of citric acid, bleaching is done through the addition of activated charcoal, filtering aid atomize or phase two remove the acids and then finally, deodorized with the steam and vacuum method details of all these already discussed earlier.

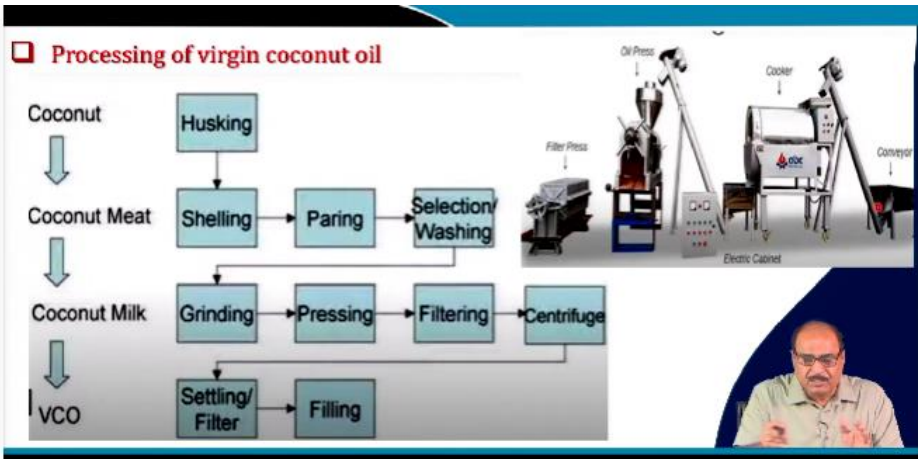


So, as far as the for the extraction of coconut oil there are various methods that is traditionally used in the crystallization method. Coconut oil is extracted from the copra traditionally copra can be obtained by separating the coconut meat from the whole

coconut shell followed by sun drying and smoke drying for around 6 to 8 days. The copra is then chopped to small sizes and cooked by heating in small pieces of copra in a cooker for about 30 minutes. The oil is then squeezed out from copra by an expeller and then filtered by a filter press.

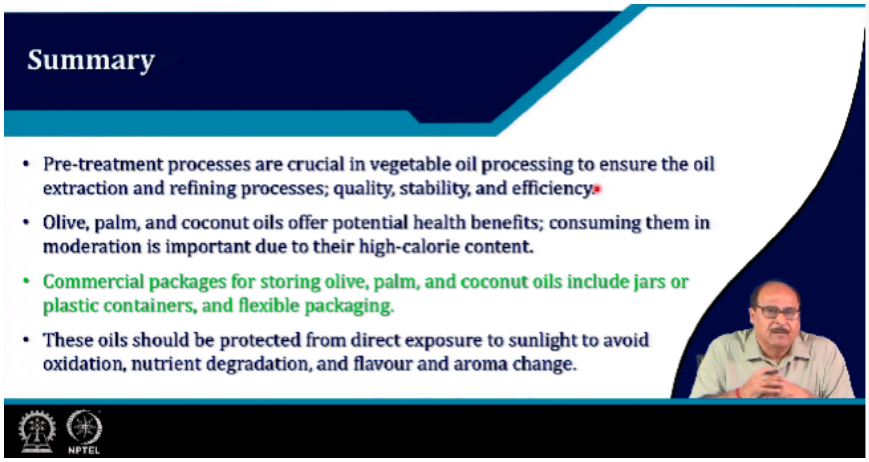


In the mechanical extraction the coconut shells are cracked and the coconut meat is separated. The fresh coconut meat is chopped and sliced into thin flakes and of the desired sizes. These thin flakes of coconut meat are cooked in a cooker by heating them at an elevated temperature of for about 90 minutes. The oil is expelled from the heat treated coconut meat and the normally at around a temperature of 70°C in an expeller. The oil is stored in an airtight container in a dark cool and dry place for long storage and the de-oiled cake obtained from this process is suitable for human consumption.



So, this is the process pressing for the virgin coconut oil you can see that coconut husking, selling ok and after selling, pearling, selection and washing. So, by this you get coconut meat and then coconut meat is the grinded, pressed, filtering, centrifugation, get coconut milk and then virgin coconut oil is obtained by settling filter pressing. So, these are the equipment how it is going? There is a coconut using a convener it comes to the

cook cooker and from cooker it goes to the oil press and it is pressed and oil is obtained which is filtered right.



So, I will summarize now this lecture by saying that yes pretreatment processes are crucial in vegetable oil refining processing to ensure the oil extraction and refining process, its quality stability and efficiency. Olive oil, palm oil and coconut oil offer potential health benefits consuming them in moderation is important due to their high calorie content. Commercial packages for the storing oil, olive oil, palm oil and coconut oils include jars or plastic containers and flexible packaging etcetera. Details of packaging we already discussed in the earlier lectures for the oils as the same is true here also ok in the case of these oils and also we will take up especially in the next its separate lecture of packaging materials and packaging of food oils. So, these oils should be protected from direct exposure to sunlight like any other oils also sunlight to avoid oxidation, nutrient degradation and flavor aroma change.

So, these are the references used this finally. Thank you very much for your patience here.