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Research article

66 CHECK FRAUD SESAME (*SESAMUS INDICUM*) OIL USING DIFFERENTIAL SCANNING CALORIMETRY (DSC) ANALYSIS

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ABSTRACT: Food fraud is done in various forms. The most common adulteration in sesame oil, sunflower oil, corn oil and hazelnut oil is done. This study examines the pure sesame oil using Differential Scanning Calorimetry (DSC) analysis deals. Samples of pure sesame oil, 5%, 10% and 15% corn oil and sunflower oil was mixed with sesame oil. With the increase of corn oil and sunflower oil, sesame oil, peak displaced towards lower temperatures and the temperatures start, maximum and end of both large and small melting peak was reduced. According to the triglycerides of saturated fatty acids at higher temperatures than triglycerides with unsaturated fatty acids are melted.The peak shift toward lower temperatures can be increased by addition of unsaturated lipid components of corn and sunflower oils Tamym said.
Keywords: Differential Scanning Calorimetry (DSC) analysis, Fraud, Sesame oil, Corn oil, Sunflower oil.

INTRODUCTION

Sesamus indicum Sesame scientific name of the family is Pedaliacea. Sesame seeds contain protein, vitamins F, E, D, B and Lecithin is [1].Sesame seed oil is one of the oldest the man known by Sesame History for 5000 years ago. Sesame native India.At present, China is the world's largest producer of sesame. Also, be produced in some sesame oil and sesame produced is consumed most of it [2].The oil content of the plant is about 50%. Sesame oil is composed of approximately 70% unsaturated fatty acidssuch as Linoleic acid, Oleic acid and saturated fatty acids such as Palmitic acid and Arachidic acid. Sesame oil, and polyunsaturated and beneficial for the body and large quantities are consumed in North America and Canada andthe reason is that the oil does not raise cholesterol levels, but it just reduces.To prepare the sesame seeds are usually colored, wash it away the grain mill and watershed its skin to the light. Let it fall in the water.After drying and boiling the seeds and pulp are coming,the dough is pressed to remove the oil. The oil is cold-pressed oils are called the first and the remaining residue oil obtained by pressure and heat called that hot oil pressure is known that the nutritional value of the oil is cold. The remaining pulp is usually forage for livestock use.Specifically, the residue of a protein is a good food for dairy cows.Note that if you want to use sesame oil, first cold pressing, which is known as First cold pressedbecause heated sesame oil loses its properties [1]. Mild odor and taste characteristic of sesame oil is desired, then a natural salad oil that has little or no freezing is not frozen.This oil as cooking oil, confectionery and margarine, as a fat slider for medicinal purposes and as a matter of insecticide used.The report proposed that the plant phytosterols, sesame has been shown that phytosterols are the richest food.Sesame oil is also a good source of copper, calcium, magnesium and zinc.This oil as a cooking oil is very popular in Asian countries and is more expensive than other edible oils.So it's a fraud by the inexpensive or low quality mixing it with oil from an economic standpoint, there are significant benefits [2]. Food fraud is done in various forms. Like mixing food with cheaper, hide quality, selling spoiled food, replace or modify the original materials with other materials, affix labels or stickers to replace bitch, and adding toxic substances (some forms of cheating is harmful to health, such as the use of colors in food industry) but in most cases of cheating in oral health care are more than economic loss.Every where there is the possibility of fraud, but those who do not have food hygiene licenses and I Dnot originally a product, they are more vulnerable to fraud [3 and 4].

The most common adulteration in sesame oil, sunflower oil, corn oil and hazelnut oil is done, soconstant vigilanceinthe counterfeit control of sesame oil and protect the interests of consumers, asan industry, is completely necessary [2].

Analysis of materials with different methods, including: Atomic Absorption Spectrometry (AAS), Optical Absorption Spectroscopy (OAS), Flame Emission Spectroscopy (FES),Gas Discharge Spectroscopy (GDS), Infrared Spectroscopy (IRS), Mass Spectrometry (MS), Nuclear Magnetic Resonance (NMR), Spark Excitation Spectroscopy (SES), X RayDiffraction (XRD), X-Ray Fluorescence (XRF), Wavelength Dispersive Spectroscopy (WDS), Energy Dispersive X-ray Spectroscopy (EDS), Thermo Gravimetric Analysis (TGA), Thermal Gravimetric Analysis (DTG), Differential Scanning Calorimetry (DSC), Thermal Dilatometer (TD), X-ray Photoelectron Spectroscopy (XPS), Auger Electron Spectroscopy (AES), Alpha Epsilon Delta(AED), Secondary Ion Mass Spectrometry (SIMS), Atomic Force Microscopy(AFM), Scanning Electron Microscope (SEM), Transmission Electron Microscopy (TEM), Through an Optical Microscope (TOM), Reflection Optical Microscopy (ROM), Lateral Force Microscopy (LFM), MagneticForce Microscopy (MFM), Scanning Tunneling Microscope (STM), Near-field Scanning Optical Microscopy (NSOM), Cathode Luminescence (CL) occurs. DSC technique was used in this study. Analysis of Differential Scanning Calorimetry or DSC, unknownand control samples storedat the same temperature difference between theenergy required tomaintain the desiredtemperatureis plottedversustemperature change.In other words, different amounts of energy are unknown sample and control its temperature always stays the same.Under control and passive electrical heaters which are supplied separately.Two thermocouples, the temperature of the sample is determined. An electrical unit called a differential calorimetry control circuit, upon receiving the symbols of both the sample temperature, the amount of energy required to equalize the temperature set and runs and thus the energy difference between the unknown and control samples are plotted versus temperature by the Registrar. DSC measuring device for the accurate calculation of the energy and heat capacity is considered. Differential Scanning Calorimetry method, the heating of samples, if the unknown sample,a thermal event occurs, such as melting, because some energy is melting, the temperature of the unknown sample relative to the control sample found and so the device to supply electrical energy required, the temperature dropped to the same unknown sample with the control sample. Thus, if the energy difference between the two samples is shown with ΔQ, the amount of heat during the event, suddenly changed and the emergence of equilibrium goes back to the previous value. The result of it, the emergence of a peak in the temperature curve in terms of ΔQ. Due to the difference in heat capacity and thermal conductivity, even when they are not accepted as a thermal event, the amount ΔQ is zero and thus there is the expected deviation from the baseline. Differential Thermal Analysis and Differential Scanning Calorimetry Analyzer Today, devices are equipped with computers and can correct the deviation from the baseline and straight lines into curves ensured.DSC method, the energy required to change the temperature of the unknown sample is measured, can be directly related to the temperature needed change, or rather, the heat of reaction achieved [5]. DSC thermal analysis applications are typically designed to hold the sample temperature change is a linear function of time.Reference sample should have a well-marked heat capacity over the temperature range that is to be scanned. This technique in 1960 by ES Watson and M.J. O'Neill was developed and in the 1963 Pittsburghconference on applied spectroscopy for chemical analysis was introduced commercially.A trial DSC curve of heat flux or the temperature or time, there are two different kinds of temperatures: exothermic and endothermic exothermic: Result in a positive or negative peak is shown in the chart are based on the device usedthis curve is used for the enthalpy of phase change.It does this by integrating the peak corresponding to the transfer and use of the following formula takes place. ΔH is the enthalpy change $\Delta H = KA$ phase constant k and A is the area under the curve. K number of different devices, different [6]. This analysis can be used to measure some characteristic properties of a sample to be used.This technique for calculating heat or freezing temperatures, and the temperature of the glass to be used crystallization.When the glass transition temperature of an amorphous solid increase, as a first step in the DSC curve is evident. This peak is due to a rise in body temperature is affected by a change in heat capacity (no phase change) temperatures in some parts of the molecule may be sufficient freedom to move toward spontaneous arrangement to achieve a crystalline structure which is known as the temperature crystallization. The transition from amorphous solid to crystalline solid is an exothermic process and a peak appears and increases when the temperature reaches the melting temperature of the sample. Endothermic peak in the DSC curve is the result of a melting process. Ability to determine the transition temperature and enthalpy of the DSC an invaluable tool in producing a phase diagram is constructed for different chemical substances [6]. In this regard, this study will investigate fraud sesame oil using DSC analysis.

MATERIALS AND METHODS

This test GR Oil Factory in 1392 and has been located in Tehran province. Samples of pure sesame oil, 5%, 10% and 15% corn oil and sunflower mixed with pure sesame oil.The DSC instrument was calibrated with indium (m.p. 156.6°C, ΔH_f = 28.45 J/g) and n-dodecane (m.p.–9.65°C, ΔH_f = 216.73 J/g).

Weighed about 12.6 mg of sesame oil and corn oil and sunflower oil was mixed in the ratio.Samples in Group 1 were subjected to the following temperature program: 50°Cisotherm for 5 min, cooled at 5°C/min to –50°C and held for 5min. The same sample was then heated from –50 to 50°C at thesame rate. Samples in Groups 2 and 3 were subjected to the followingtemperature program: sample was melted at 50°C andheld for 5 min before cooling to –100°C at the rate of 5°C/min. The samples were again held at this temperature for 5 min beforeheating to 50°C at the rate of 5°C/min.Thermal DSC is melting and crystallization characteristics of each sample with different temperatures indicated by the scan [9].

RESULTS

Differential Scanning Calorimetry DSC analysis test is a simple, fast and straight to evaluate the quality of the oil. This study was designed to test the oil comprising triglycerides and fusion properties and crystal using thermal behavior and calculate the amount of energy released or absorbed is [7]. During cooling (crystallization) mixtures exothermic were a phenomenon that was not clear, because oil is a complex phenomenon polymorphism during crystallization (Figures 2-7). Jafari-Valdani *et al* [8] the results saw the solidification curve of peak oil Tuesday in −14.5, −42, −74°C was observed and the main peak at −74°C, triglycerides simultaneous crystallization of LLL, OLL, OOL that a significant amount of this oil accounted for.In this experiment, as can be seen in Figure 8, the crystal melting phenomenon in sesame oil at a temperature of about −39.94°C begins and ends approximately −12.85°C. During heating (melting) sesame oil endothermic two phenomena was found in sesame oil.The small peak on large peak −34.92°C and the temperature has reached its maximum −19.75°C. Researchers small peak melting triacylglycerol crystals of large melting peak UUU and SUU and SSU have linked crystals [9]. As can be deduced from the graphs by increasing the percentage of corn oil and sunflower oil, sesame oil, peak displaced towards lower temperatures and the temperatures start, maximum and end of both large and small melting peaks was reduced (Tables 1 to 4) however, changes in the peak height of the specified process did not comply. The peak shift towards lower temperatures increase the risk of unsaturated lipid components of corn oil and sunflower.Add mixture of corn and sunflower oil, sesame oil and reduce the melting point than the other peaks, which is indicative of triglycerides containing unsaturated fatty acids is higher (Tables 1 to 4). Tan and Cheman [9] the relation of triglycerides containing saturated fatty acids and triglycerides were related to temperature (SSS) at temperatures higher than the melting triglycerides with unsaturated fatty acids are and melting point triglycerides SUU and SSU are in the range of fusion between the two groups.There is a double bond in the fatty acid, carbon chain causes a certain difficulty arise because, unlike the chain is free to rotate around the C-C-Simple Syndication is possible,such a rotation around the double bond is not possible. If a cis double bond is created in the chain causes the difficulty to achieve the lowest energy level of 30 to 40 degrees in a bent chain arise. Naturally, in such a case, the density of the carbon chain is not good, hydrophobic bonds between the chains is smaller or weaker than the desired melting point of unsaturated fatty acids is below [10]. Tan and Cheman [9] reported that the combination of two or more melting triglycerides in a specific temperature range can be combined at one time been in the DSC curve of the composite peak is observed. Tan and Cheman [9] the reason was stated that when the sample is heated with oil,triglycerides, which have little resistance to temperature, melts at a lower temperature, and the rest of the triacylglycerol oil, configuration changes and new crystals are created. In this experiment, the increase in unsaturated lipid components in corn oil and sunflower oil, sesame oil, resulting in more than crystalline melting temperature is lower. According to the results of pure sesame oil contains unsaturated fatty acid triglycerides with less than mix it with corn oil and sunflower and this indicates that the lower the quality sesame oil is mixed with corn and sunflower oils.

Table 1: characterized by a large peak melt mixed with sesame oil and sunflower oil

Treatments / Characteristic	Sesame oil	Sesame oil + 5% sunflower	Sesame oil + 10% sunflower	Sesame oil + 15% sunflower
Initial temperature (°C)	−26.78	−27.17	−27.43	−27.98
Maximum temperature (°C)	−19.75	−20.17	−20.25	−21
The final temperature (°C)	−12.85	−13.35	−12.87	−14.2

Table 2: characterized by a small peak melt mixed with sesame oil and sunflower oil

Treatments / Characteristic	Sesame oil	Sesame oil + 5% sunflower	Sesame oil + 10% sunflower	Sesame oil + 15% sunflower
Initial temperature (°C)	−39.94	−40.13	−40.23	−40.72
Maximum temperature (°C)	−34.92	−35.17	−35.25	−35.75
The final temperature (°C)	−30.87	−31.21	−31.26	−31.78

Table 3: characterized by a large peak melting sesame oil and mix it with corn oil

Treatments / Characteristic	Sesame oil	Sesame oil + 5% corn	Sesame oil + 10% corn	Sesame oil + 15% corn
Initial temperature (°C)	−26.78	−27.08	−27.28	−27.46
Maximum temperature (°C)	−19.75	−20	−20.33	−20.58
The final temperature (°C)	−12.85	−13.03	−13.36	−13.64

Table 4: Characteristics of small melting peak sesame oil and mix it with corn oil

Treatments / Characteristic	Sesame oil	Sesame oil + 5% corn	Sesame oil + 10% corn	Sesame oil + 15% corn
Initial temperature (°C)	−39.94	−40.12	−40.23	−40.38
Maximum temperature (°C)	−34.92	−35.08	−35.25	−35.42
The final temperature (°C)	−30.87	−31.06	−31.21	−31.32

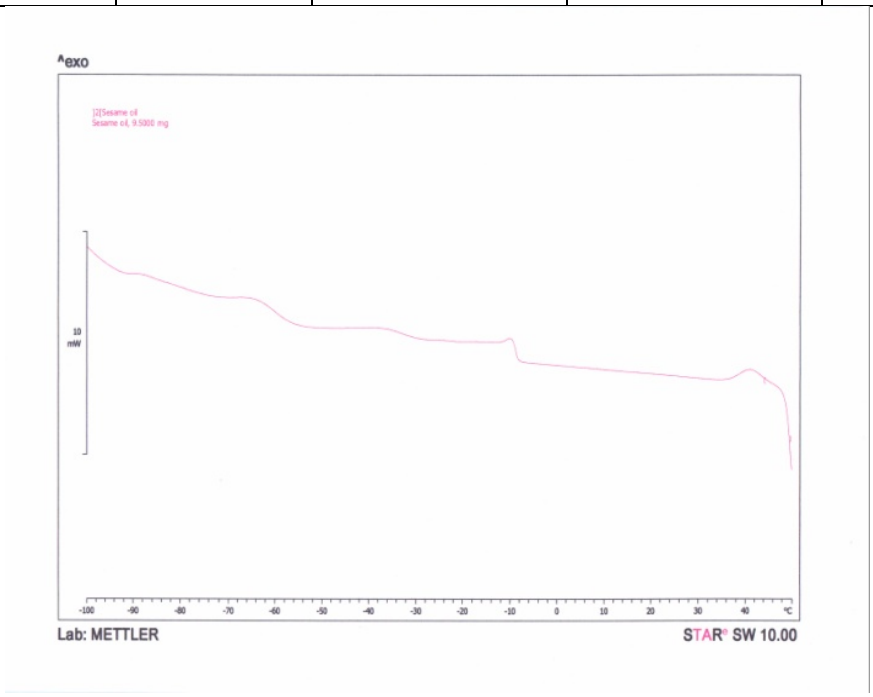

Figure 1: DSC crystallization curves of pure sesame oil.

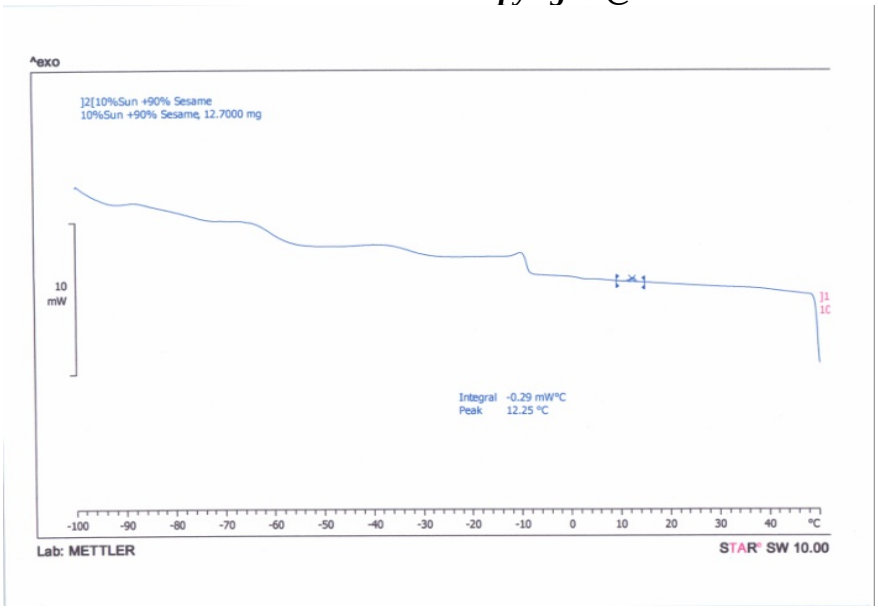

Figure 2: DSC crystallization curves of mix sesame oil with 10% sunflower oil.

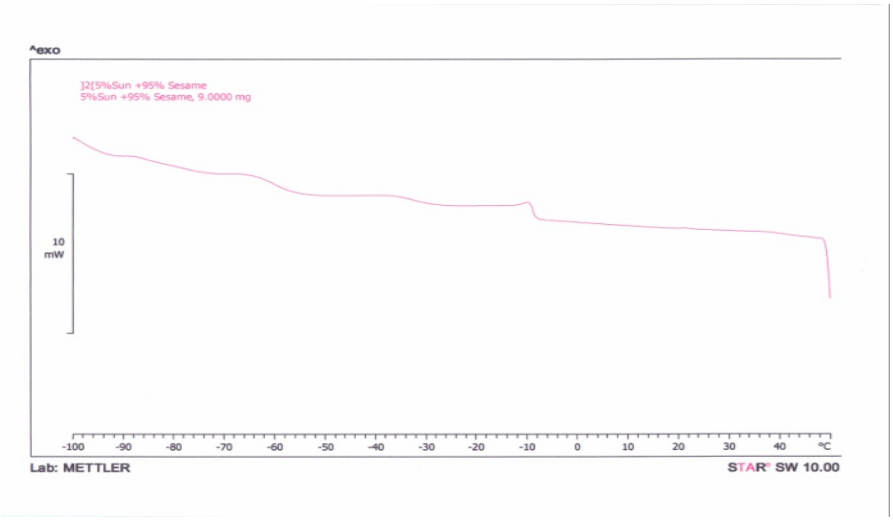

Figure 3: DSC crystallization curves of mix ses oil with 5% sun oil.

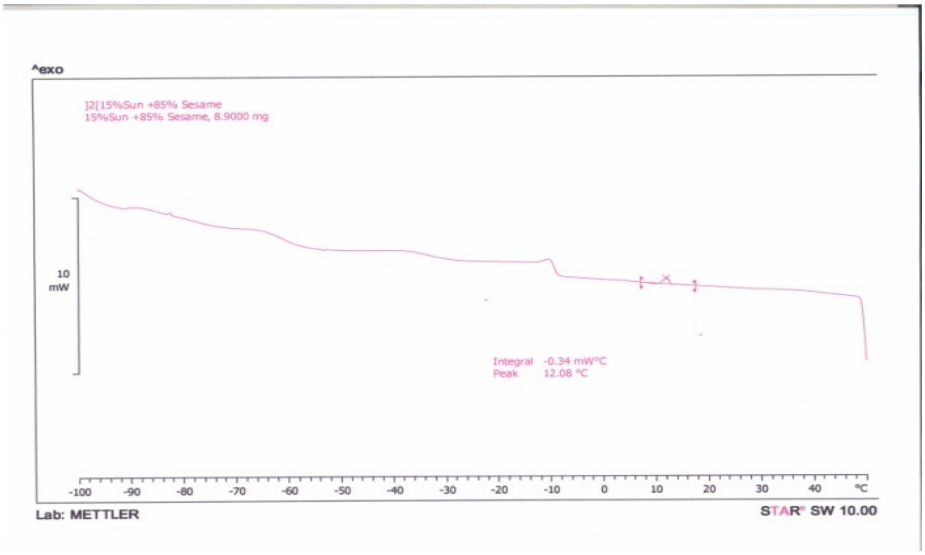

Figure 4: DSC crystallization curves of mix ses oil with 15% sun oil.

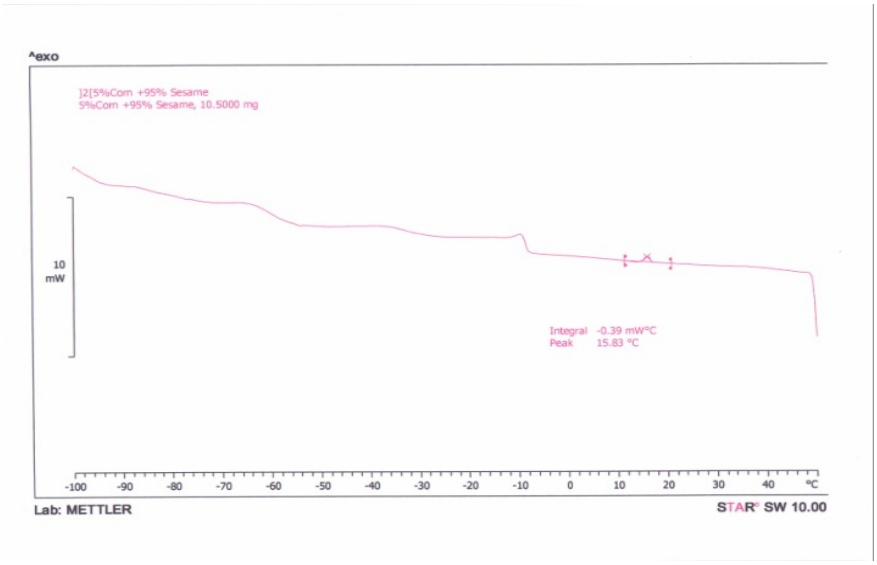

Figure 5: DSC crystallization curves of mix ses oil with 5% cornoil.

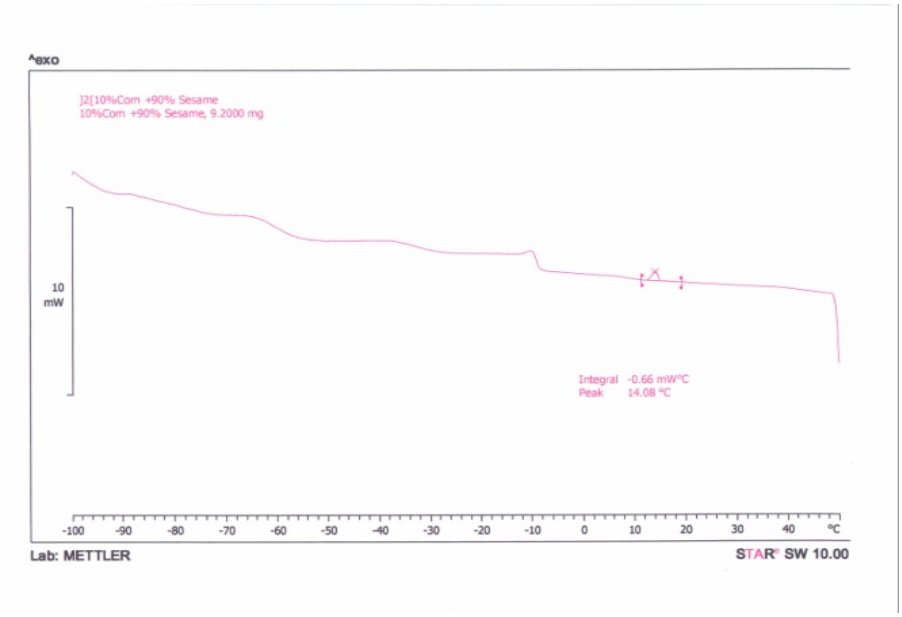

Figure 6: DSC crystallization curves of mix ses oil with 10% cornoil.

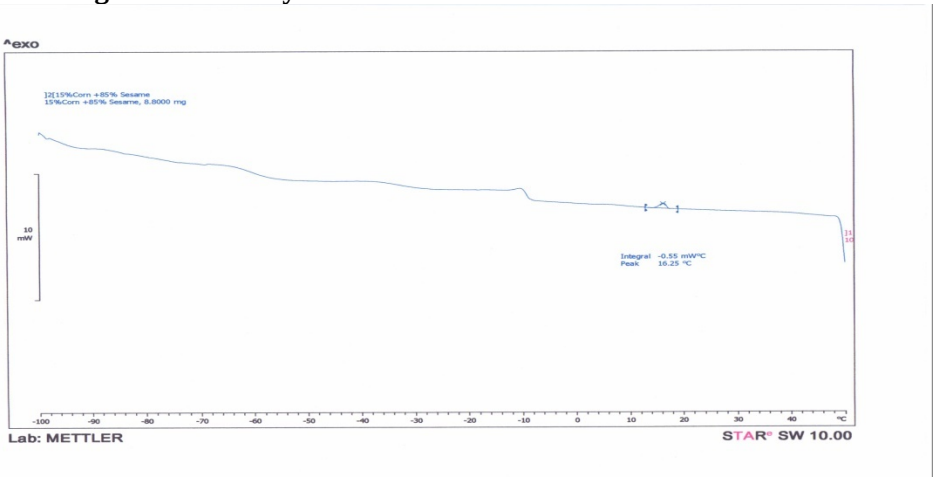

Figure 7: DSC crystallization curves of mix ses oil with 15% cornoil.

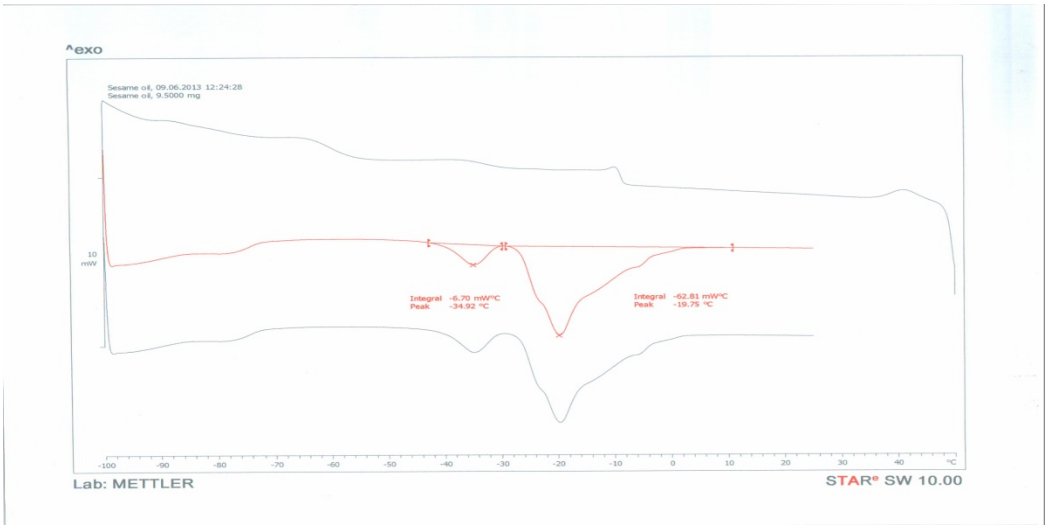

Figure 8: DSC melting curves of pure sesame oil.

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