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Research Article

Novel Method for up-cycle of used Salad Oil by Minimal Catalyst Water

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Abstract

Oil is essentials for cooking and meal in daily life. Dairy farming seems difficult in the world wide because of climate change, decreasing of pasture, animals, feed, and workers. Furthermore, human develop residential lands using natural agricultural land, field, and forest. Peoples make oils from crops, and result in increasement the wasted materials after processing. We can upcycle not recycle it.

The method is very easy to use water technology which is always needed and helpful in daily life. The water possesses deoxidizing energy and reduce the substance meaning upcycle. We found the technology to change the new oil form the used oil, and make it new oil employing at restaurant for several years.

Keyword: reuse; deoxidation; cooking oil; pico-sized water; functional group

Introduction

We can tremendously survey many organic compounds relating to oils only, so we must limit the contents even the chemical structures. Furthermore, we focus on the chemical bond strength of each structure, in which we choose three kinds like linoleic acid, oleic acid, and palmitic acid in the salad oils. We pay attention to a saturated, and an unsaturated fatty acid, of which have one double bond and two double bonds. According to these chemical bonds, characteristics are remarkably different like melting point, liquidity, etc.

The three kinds of fatty acids dealt with here are typical fatty acids. The organic compounds are contained in an ingredient we commonly use and popular in the textbook. Here is simple explanation of three kinds of oils, and we notify shortly the information associating with human body.

Salad oil consists of linoleic acid (two double bonds), oleic acid (a double bond), and palmitic acid (saturated fatty acid). Firstly, Linoleic acid is shown in chemical formula, $C_{18}H_{32}O_2$, an essential fatty acid. Furthermore, we depict other method of schematic way showing functional group, $CH_3(CH_2)_4(CH{=}CHCH_2)_2(CH_2)_6COOH$. We can realize the functions of the fatty acid to some extent. The boiling point is 229°C (melting point; -5°C). The linoleic acid is essential fatty acid not synthesized in a human body. There are contained in Safflower oil (52~58%), soy beans (52~58%) in vegetable oil.

Secondly, we show oleic fatty acid, $C_{18}H_{34}O_2$, and functional group indicates $CH_3(CH_2)_7CH{=}CH(CH_2)_7COOH$. The group possesses a double bond which can be oxidized as compared with the following fatty acid. The boiling point is 360°C and melting point is 13.4°C.

Then, we introduce the third fatty acid, palmitic acid, $C_{16}H_{32}O_2$, $CH_3(CH_2)_{14}COOH$. The boiling point is 62.9°C and melting point is 351°C. According to organism, palmitic acid makes cell membrane, and secrete as sebum from sebaceous glands.

Palmitic acid is required for circulation of nutrition in the body, which occupy the amount of 20 to 30 % of fatty acid [1]. The purposes of the article are report how we change the reused salad oil to a new one and its mechanism in terms of chemical bonding of these constituents in the oils.

Methods

First, we use computer simulation of molecular orbital method as the basic science of water. Here, we abbreviate it because of frequent introduction of the method of MICA water [2]. The water contains certain information after higher elementary particle. The particle, <H^+~e^-> oscillates between proton and electron which is neither hydrogen atom nor their ions. This idea is an important idea when we consider and treat water.

Here other essential property of MICA water is transmittance of information from the water like chemical reduction (deoxidization) to other substance. A can (20 L) for the used oil can contain information of deoxidation treated with MICA water. The owner of the restaurant surprised to say “this is a bran-new oil”.

Results and Discussion

Linoleic fatty acid

We preciously introduce chemical structure of three fatty acids. First, linoleic acid, the functional group of $C_{18}H_{32}O_2$ is $CH_3(CH_2)_4(CH{=}CH{-}CH_2)_2(CH_2)_6COOH$ [3]. We can realize the two double bonds placed at 9th and 12th in Fig. 1. So, linoleic fatty acid is an unsaturated substance which is easily oxidized. The red, 6 means the palace from the methyl radical end bond (CH_3-).

We can compare the bond strength between atoms in the unit of electron volt (eV) [4];

1) C = O; 8.3, 2) C = C; 6.3, 3) O-H; 4.6, 4) C-H; 4.3, 5) C-OH; 3.7, 6) C - C; 3.6.

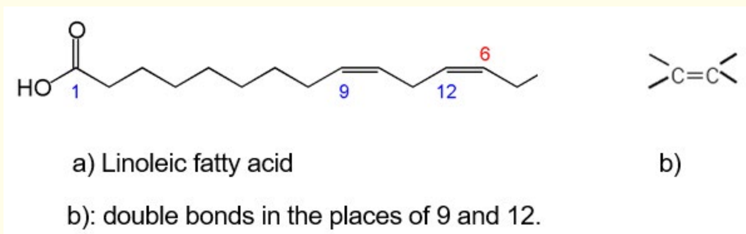

Figure 1: a) Linoleic fatty acid, and b) double bonds in the places of 9 and 12.

The double bond is stronger (6.3), but the near bond, C-H; 4.3 eV which is easily attacked by an electron from oxygen. The boiling point is 229°C which is the lowest temperature among three fatty acids.

The oils are necessary for a row substance of physiological activity in an animal and human body, and there exists as lipid in cell membrane.

The linoleic fatty acid functions lowering cholesterol value and neutral lipid in blood temporarily.

Oleic fatty acid

The oleic acid ($C_{18}H_{34}O_2$) does not solve in water and solves in chloroform, acetone, and diethyl ether. This fatty acid is difficult to oxidize because of a double bond, although less than linoleic acid. Formation of saturated fatty acid proceeds through Acetyl-CoA when extra glucose and protein exist in human body. The synthesis of fatty acid stops at the palmitic fatty acid in the following item.

Oleic acid contains around 50% fat lard in pig's body fat, and in cattle's tallow. Furthermore, oleic acid exists one-third of the mother's milk, and vegetable oil. And oleic acid is refined from flesh meat and seeds of pulp like palm, soybean, and rapeseed.

Rational formula of oleic acid is $CH_3(CH_2)_7CH=CH(CH_2)_7COOH$ [5, 6], and we can realize existence of one double bond at the 9th position. Lin TK et al. reviewed and discussed the oleic acid on the therapeutic benefits of these plant oils according to their anti-inflammatory and antioxidant effects on the skin, promotion of wound healing and repair of skin barrier [7].

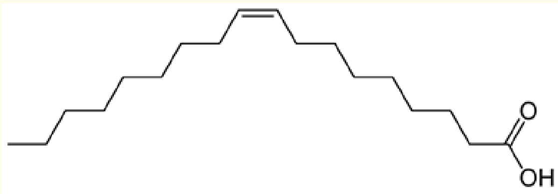

Figure 2: The structure of oleic acid (ref. Wikipedia).

Palmitic fatty acid

Palmitic acid, $C_{16}H_{32}O_2$, is depicted in Fig 3., and primary constituent of palm oil, Palmitic acid [8].

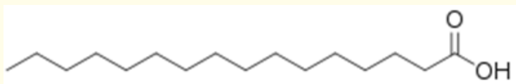

Figure 3: The structure of palmitic acid.

Palmitic fat is a main ingredient of depot fat which is the most efficient energy storage in our body and not need water. Palmitic fat accumulates in plant seeds and subcutaneous, mesentery, and muscle resulting in adipose tissue.

Food additives and cosmetics are employed because of anti-oxidative function leads to stability of amino acids [9], and the melting point, 351°C is the highest among three fatty acids.

Certain tree in Africa grows thickly with fruits, bark, and leaves. Oils from the plant contains oleic acid, 69% and palmitic acid, 15%. People and animals moisturize with the oils, and coating on the skin indicates increasing water content in the skin leading to moisturization [10].

Dielectric constant and electrical resistivity

Water's dielectric constant is usually approx. 80. On the other hand, oil is approx.4.7. A dielectric constant is a material with a poor electrical conductivity; the higher the value, the higher an electrical charge is stored. Therefore, oil can easily transfer electricity to water.

Another reason palmetic oil has higher melting point seems to balance polarity, i.e., water is polar molecule. Generally, water and oil do not solve each other because of higher interface tension; the surface tension becomes smaller even droplets meet together, and separated mutually in final stage.

Amphiphilic molecule and quasi pico-particle water

Two structures solve in a different medium (i.e., disperse system). When an amphiphilic molecule accesses the disperse system, the molecule orients to one another and completely covers the interface. This is an amphiphilic molecule.

We discuss the mechanism based on the pico-sized water as the behavior of basic water sciences after hydrogen bond dissociation [11]. We add QPP water to oil, in which QPP water, including <H^+~e^->, covers the oil molecules. We can get emulsion and not separate after that because QPP can provide electron to the oil and proceed reduction.

We show the results in the next section and discuss reduction of stearic acid shown in Fig. 4.

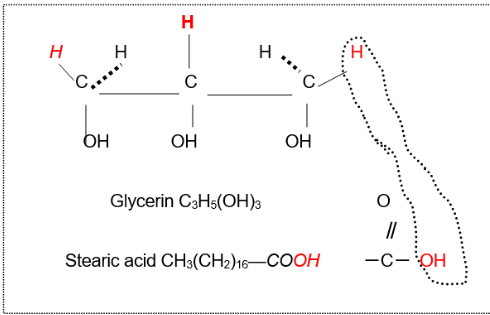

Figure 4: Hydrogens (H) depicted with red color in glycerin are cut, and bind the OH bond dissociated in stearic acid, then water generates, i.e., glycerol (CH_2OH-CHOH-CH_2OH).

Oxidation and reduction of fat and oil

We explain Fig. 4 relating to oxidized stearic acid. Fat and oil form binding of one glycerin, $C_3H_5(OH)_3$, and three fatty acids like stearic acid, $C_{18}H_{36}COOH$, $CH_3(CH_2)_{16}COOH$ which is saturated acid (M.P.69.6°C, B.P. 383°C), The bonds in glycerin (dotted lines) cut with heat, and electron vacancy generates in carbon atom, and means free fatty acid. This is the oxidation of fat and oil. The electron from quasi pico-particle, <H^+~e^->, moves to the carbon leading to reduction.

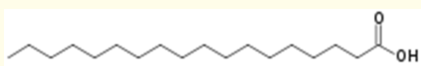

Figure 5: Stearic acid structure.

Interface surfactant (detergent) like shampoo or soap takes out oil from skin etc. resulting in skin hardness, drying, irritation or itching possibly. The fatty acid like stearic acid or palmitic acid are necessary onto the skin, and we can help to improve skin barrier functions [12]. The mechanism may depend on water (approx. 58%) in the skin from epidermis through dermis (about 2mm from the surface). Water protects bacteria, viruses, toxin, and ultraviolet light besides skin.

We reported CO_2 reduction from the automobile exhausted gases [13], the kind of reduction in terms of keeping foods fresh employing Minimal Catalyst (MICA) water [14], and we introduced the function on the plants and seeds with the weak energy of water [15]. The electron in QPP plays a role for effects like catalyst and growth of seeds as the results of reduction. So, we found to understand macroscopic water properties from the pico-sized water analysis [16].

Terahertz absorption spectrographs

Novoa et al., reported a proton-transfer mechanism in the H_3O_2 and H_3O system in the THz region [17]. Furthermore, THz waves were generated by stimulated polariton scattering in a lithium niobate ($LiNbO_3$) crystal as the result of the action of the laser [18]. Kojima et al., introduced the parametric oscillation (0.3~2.5 THz) also generated by using $LiNbO_3$ crystal [19]. There was the report of THz surface plasmon on the metal sheet [20]. We can understand the THz electromagnetic wave shows the interesting characteristics, although there will be more research theme.

Here we introduce the results of the terahertz spectroscopy of salad oils in Fig. 6; Salad oil consists of linoleic fatty acid, 45 % (2 unsaturated double bonds), oleic fatty acid, 30 % (1 unsaturated double bonds) and palmitic acid, 20 % (saturated bond only). Because of MICA function, unsaturated fatty acid changes to saturated acid owing to reduction; the saturated molecule may become straight like palmitic acid. Liquid like water and oil is initially absorbed in the THz area (0~15THz corresponding to 3 mm~30μm in wavelength). The THz wave easily transfers through the MICA salad oil as a result. We reported pico-sized water information transfers at the region of THz, and the fresh meats were kept through the activated polyethylene film [14].

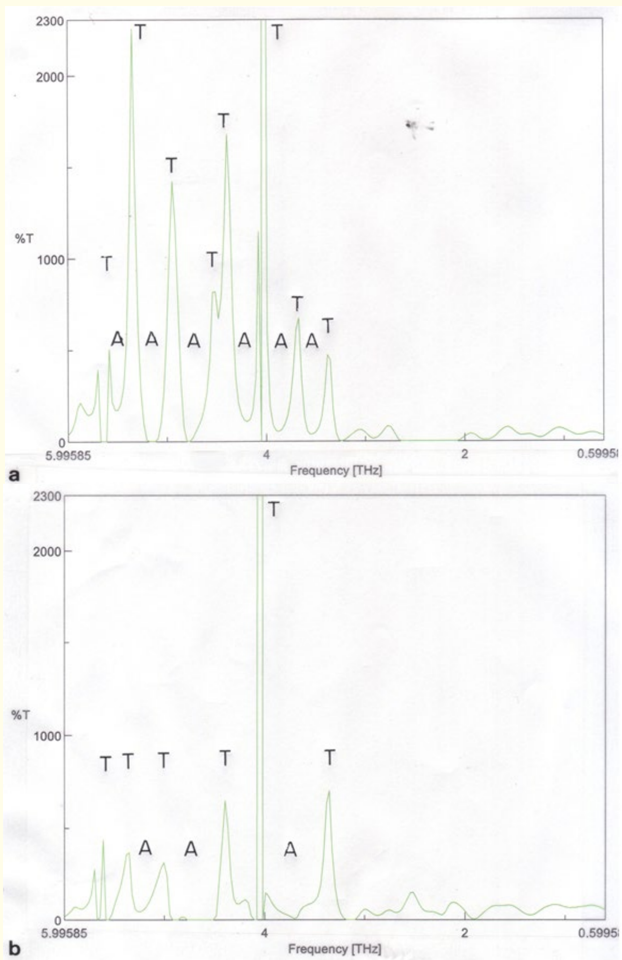

Figure 6: Terahertz absorption spectrographs from 0.6 to 6.0 THz in the longitudinal axis and relative absorption amount. A; absorption and T; transmittance of spectra. The sample is salad oil. Upper: a, MICA. Lower: b, control.

Axis and relative absorption amount. A; absorption and T; transmittance of spectra. The sample is salad oil. Upper: a, MICA. Lower: b, control.

MICA means the "activated" fatty acid describing minimal catalyst.

Conclusion

We used standard salad oil daily, including linoleic, oleic, and palmitic fatty oil and we discussed those oils contain two double bonds, one double bond as unsaturated fatty acid and saturated molecules. Furthermore, we focused on chemical bonds and the bond strength to the reduction of the oil. As the example, we reduced the used oil stored container (20L can) with the minimal catalyst (MICA) water which led to the reduction of the oxidized oil. The reduced salad oil changed to a new one as identified with terahertz spectrographs. The evidence conformed the owner's expression; "this is a new oil".

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