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## Carboxylic acid ester properties

## Carboxylic acid esters

Esters are derived from carboxylic acids. Carboxylic acid contains the -COOH group and hydrogen in the ester is replaced by a group of hydrocarbons. It can be an alkyl group, such as methyl or ethyl, or a group containing a benzene ring, such as a phenyl or benzyl group. The most commonly discussed ester is ethanoate ethyl. In this case, hydrogen in the -COOH group has been replaced by an ethyl group. The pattern of ethanethyl is: It should be noted that the ester is named in the opposite way from the way the formula is typed. Bit ethananoin comes from ethanic acid. A bit of ethyl comes from an ethyl group that replaces hydrogen. Example In any case, make sure that you can see how names and formulas relate to each other. It should be noted that the acid is named by counting the total number of carbon atoms in the chain - including carbonyl carbon. Thus, for example, \ (CH\_3CH\_2COOH) is propanoic acid, and \ (CH\_3CH\_2COO) is a group of propanoate. Animal and vegetable fats and oils consist of long-chain, complex esters. The physical differences observed between fat (like butter) and oil (like sunflower oil) are caused by differences in the melting points of the ester mixture they contain. If the melting point of the substance is lower than room temperature, it will be liquid - oil. If the melting point is above room temperature, it will be solid - fat. The causes of differences in melting points are discussed below. Esters can be made from carboxylic acids and alcohols. This is discussed in detail on another page; In general, the two combine together, losing a water molecule in the process. Consider a very simple ester, such as ethyl ethanolate. The figure below shows its formation from ethanic acid and ethanol. Figure: The graph shows the relationship between ethanic acid, ethanol and ester. It's not supposed to be a complete equation. Water, of course, is also produced. The same process can be carried out with more complex alcohols. The following diagram shows the structure of propane-1,2,3-triol (commonly known as glycerol). As with ethanol in the previous equation, I pulled this back-to-front to make the next diagrams clearer. It is usually drawn with -OH groups on the right. Three groups of ethane may be formed in the esterification process shown above. Elongating each carbon chain creates triglyceride, otherwise known as fat. CH3(CH2)16COOH is called okacan acid, often referred to by its colloquial name stearic acid. The full name of the ester of this propane-1,2,3-triol is propane-1,2,3-triyl trioctadecanoate, surprisingly known by the common name tristearin glycerin. If the fat or oil is saturated, the acid from which it comes does not have double carbon-carbon bonds in its chain. Stearic acid is saturated acid; glycerin is saturated fat. If the acid has only one double bond of carbon carbon somewhere in the chain, it is called mono-unsatiable. If it has more than one double carbon-carbon bond, it is polyunsaturated. The following acids are saturated acids and therefore form saturated fats and oils: oleic acid is a typical mono-unsaturated acid: linoleic and linolenic acids are typical polyenesaturated acids. The terms omega-6 and omega-3 have become popular in the context of fats and oils. Linoleic acid is an omega-6 acid. This means that the first double carbon-carbon bond starts at the sixth carbon from the end of CH3. Linolenic acid is omega-3 for the same reason. Because of their relationship with fats and oils, all acids above are sometimes described as fatty acids. Small esters have boiling points that are similar to aldehydes and ketones with the same number of carbon atoms. Esters, like aldehydes and ketones, are polar molecules, so they have dipole-dipole interactions, as well as van der Waals dispersion forces. However, they do not form hydrogen ester-ester bonds, so their boiling points are much lower than acid with the same number of carbon atoms. molecular-type ester (°C) CH3COOCH2CH3 77.1 CH3CH2CH2COOH carboxylic acid 164 Small esters are quite water soluble, but solubility decreases as the chain length increases, as shown below: ester solubility (g per 100 g water) ethyl methanethane HCOOCH2CH3 10,5 ethanol ethanate CH3COOCH2CH 3 8.7 ethyl propatan CH3CH2COOCH2CH3 1.7 The reason for this solubility trend is that although esters cannot bind to hydrogen , may bind hydrogen to water molecules. One of the partially positive hydrogen atoms in a water molecule can be sufficiently attracted to one of the lone pairs on one of the oxygen atoms in the era, forming a hydrogen bond. Dispersion forces and dipole attractions are also present. Creating these intermolecule attractions releases some of the energy needed to solvate the ester. As the chain length increases, some hydrocarbons are wiling between water molecules, breaking relatively strong hydrogen bonds between water molecules without offering energy compensation; In addition, water molecules are forced to align orderly along the chain, reducing entropy in the system. This makes the process thermodynamically less beneficial, and therefore reduces solubility. Physical properties of fats and oils Fats and oils are not water soluble. The length of the chain is so large that too many hydrogen bonds between water molecules must be broken; it is not an energy-efficient contract. Melting points determine whether the substance is fat (solid at room temperature) or oil (liquid at room temperature). Fats usually saturated saturated They allow for more efficient van der Waals dispersion forces between molecules: more energy is needed to separate the chains, increasing the melting point. A higher number of double bonds or the degree of ins saturation in molecules results in a lower melting point because van der Waals forces are less effective. The effectiveness of van derWaals forces depends on the ability of molecules to closely self. The presence of two-wheel carbon carbon bonds in the chains otherwise interferes with neat packaging. Here is a simplified scheme of saturated fats: Chains of hydrocarbons are of course in constant motion in the liquid, but it is possible that lie neatly when the substance solid solidifies. If the chains in one molecule can lie neatly, it means that adjacent molecules can get closer. This increases the attraction between one molecule and its neighbors and thus increases the melting point. Unsaturated fats and oils shall have at least one double carbon-carbon bond in at least one chain. The rotation around the two-liter carbon-carbon bond is limited, blocking a permanent break in the chain. This makes packing molecules close together more difficult. If the chains cannot pack well, van der Waals' forces will be less effective. This effect is much stronger for molecules, in which the hydrocarbon chains at both ends of the double bond are arranged ying- to each other, as shown in the figure below: In trans-construction, the effect is not so marked. However, this is rather more than the following scheme suggests due to changes in the mate angles around the double mate compared to the rest of the chain. Trans fats and oils have higher melting points than the corresponding yist conformations, as the packaging is not interrupted to the same extent. Naturally occurring unsaturated fats and oils tend to take cis-conformation. Co-authors Jim Clark (Chemguide.co.uk) Identify the general functional ester properties of the Esters group are functional groups commonly found in organic chemistry. They are characterized by carbon associated with three other atoms: a single carbon bundle, a double oxygen bundle and a single oxygen bundle. Individually bound oxygen is associated with another carbon. The names of esters are derived from parent alcohol and parent acid. While simple esters are often called by their common names, all esters can be named using the systematic name IUPAC, based on the acid name followed by the suffix -oate. Esters react with nucleophiles to carbonyl carbon. Carbonyl is poorly electrophilic, but is attacked by strong nucleophiles. C-H bindings adhering to carbonyl are weakly acidic, but deprotonate with strong bases. Esters are an important functional group in organic chemistry and are generally written RCOOR' or The Ester Ester is characterized by and bonding of the atoms shown, where R and R' are carbon-initiated chains of different lengths, also known as alkyl groups. As usual, R and R' are either alkyl groups or carbon initiation groups. Esters are derivatives of carboxylic acids in which the hydroxyl group (OH) has been replaced by the alcoxia group (O-R). They are commonly synthesized from the condensation of carboxylic acid with alcohol: [latex] RCO\_2H +R'OH \rightarrow RCO\_2R' + H\_2O[/latex] Esters are ubiquitous. The most naturally occurring fats and oils are glycerol fatty acid esters. Esters are usually fragrant, and those with low enough molecular weight to be volatile are commonly used as perfumes and are found in essential oils and pheromones. Polymerized or polyester esters are important plastics, with monomers connected by ester units in this way: CO2RCO2RCO2R... Etc. The word ester nomenclature was coined in 1848 by the German chemist Leopold Gmelin, probably as a contraction of the German Essigäther, or acetic ether. The names of the ester are derived from parent alcohol and acid. For example, an ester formed by ethanol and ethanic acid is known as ethyl ethanol; ethanol is reduced to ethyl, while ethanic acid is reduced to ethane. Other examples of ester names include methyl propanot, methanol and propanoic acid, and butyl octagon, with butane and octane acid. Ethyl ethanateThe name of ethananate ethyl comes from the ingredients from which it is synthesized: ethanol and ethanic acid. In this diagram, the red part of the molecule represents the part previously attributed to ethane (minus H), and the green part of the molecule represents the part of ethane acid (minus OH). Esterification is a form of dehydration synthesis, so the components H and OH are removed as water. In the case of esters formed from common carboxylic acids, more colloquial terms are sometimes used. For example, ethane acid is commonly known as acetic acid, and therefore its esters contain acetate instead of ethane in their names. Other such replacements include formate instead of metahanoate, propionate instead of propanoate and butter instead of butanoate. The chemical formulas of organic esters are usually written in RCO2R' (R and R) format, respectively, carboxylic acid and alcohol hydrocarboxylic acid. For example, butyl acetate, systematically known as ethane acid, comes from butanol and acetic acid and would be recorded with CH3CO2C4H9. Alternative presentations are common, including BuOAc and CH3COOC4H9. Cyclic esters are known as lactones. Structures and bonding esters contain carbonyl center, resulting in 120 degrees C-C-O and O-C-O bonding angles due to SP2 hybridization. Unlike amides, esters are structurally flexible functional groups C-O-C bond rotation has a lower energy barrier. Their elasticity and low polarity affect their physical properties on a macroscopic scale; they tend to be less rigid, leading to a lower melting point and more volatile, leading to a lower boiling point than the corresponding amide. The PKa of alpha-hydride, or hydrogen attached to carbon adhering to carbonyl, per esters is about 25, which makes them essentially non-acidic, except for the presence of very strong bases. Physical properties and esters of characteristics are more polar than ethers, but less than alcohols. They participate in hydrogen bonds as hydrogen bond acceptors, but cannot act as hydrogen bond donors, unlike parent alcohols and carboxylic acids. This ability to participate in hydrogen gluing gives a certain solubility in water, depending on the length of the attached alkyl chains. Since they do not have hydrogen combined with oxygen, like alcohols and carboxylic acids, esters do not mate on their own. Therefore, esters are more volatile than carboxylic acids of similar molecular weight. Characteristic esters and analyses are usually identified by gas chromatography, using their variability. Infrared spectrums for esters have an intense, sharp bar in the range of 1730-1750 cm−1 assigned to vC=O or binding vibrations C=O. This peak varies depending on the functional groups attached to the carbonyl. For example, a benzene ring or double bond in carbonyl conjugation will lower the wavenumber to about 30 cm−1. Reactive esters react with nucleophiles to carbonyl carbon. Carbonyl is poorly electrophilic, but is attacked by strong nucleophiles such as amine, alcohids, hydride sources and organolyte compounds. Carbonyl electrophilicity can increase if it is protonated; In acidic media, the ester can be hydrolyzed by water, forming carboxylic acid and alcohol. C-H bindings adhering to carbonyl are weakly acidic, but deprotonate with strong bases. This process is the one that usually initiates condensation reactions. Carbonyl oxygen is poorly basic (less than in amides), but can form adductors with Lewis acids. Acids.

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## Carboxylic acid esters

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