

Saturated, Cis, and Trans Fatty Acids

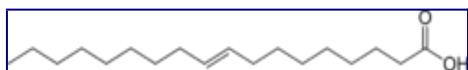
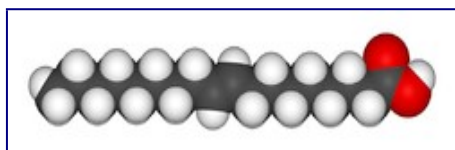
(Taken from <http://en.wikipedia.org/wiki/Transfat> with additional diagram at end)

In chemical terms, *trans fat* is a fat (lipid) molecule that contains one or more double bonds in *trans* geometric configuration.

A double bond may exhibit one of two possible configurations: *trans* or *cis*. In *trans* configuration, the carbon chain extends from opposite sides of the double bond, whereas, in *cis* configuration, the carbon chain extends from the same side of the double bond. The *trans* molecule is a straighter molecule. The *cis* molecule is bent.

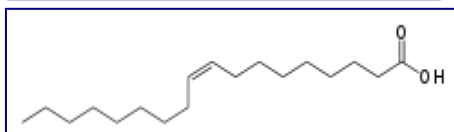
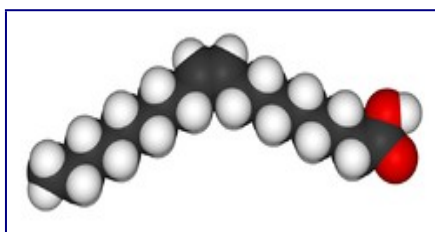
Trans (Elaidic acid)

Elaidic acid is the principal *trans* unsaturated fatty acid often found in partially hydrogenated vegetable oils.[34]



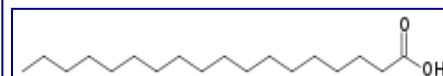
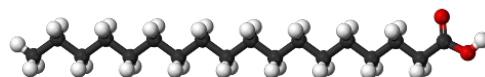
Cis (Oleic acid)

Oleic acid is a *cis* unsaturated fatty acid making up 55–80% of olive oil.[35]



Saturated (Stearic acid)

Stearic acid is a saturated fatty acid found in animal fats and is the intended product in full hydrogenation. Stearic acid is neither *cis* nor *trans* because it has no carbon-carbon double bonds.



These fatty acids are geometric isomers (structurally identical except for the arrangement of the double bond).

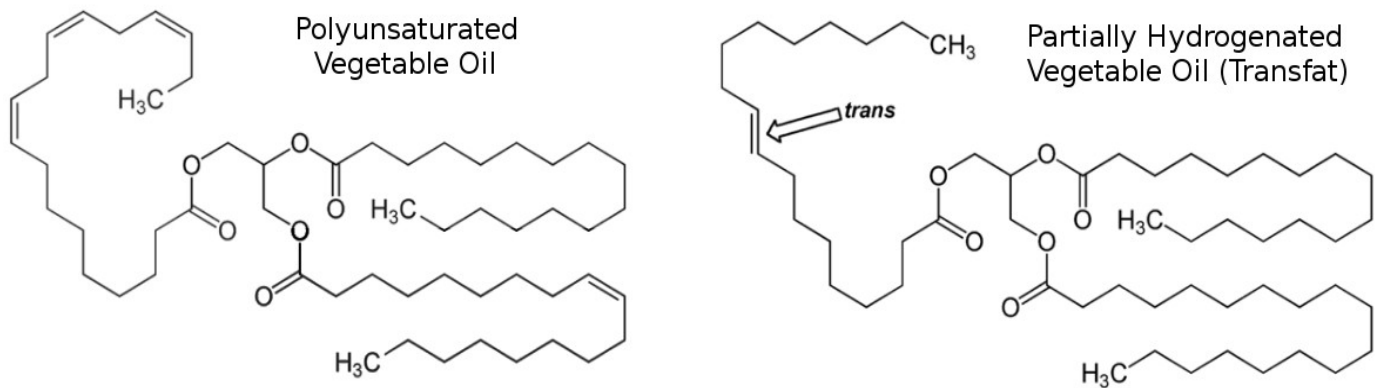
This fatty acid contains no carbon-carbon double bonds and is *not* isomeric with the previous two.

Fatty acids are characterized as either *saturated* or *unsaturated* based on the presence of double bonds in its structure. If the molecule contains no double bonds, it is said to be saturated; otherwise, it is unsaturated to some degree.

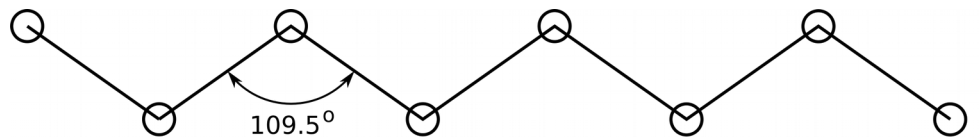
Only unsaturated fats can be *trans* or *cis* fat, since only a double bond can be locked to these orientations. Saturated fatty acids are never called *trans fats* because they have no double bonds, and, therefore, all their bonds are freely rotatable. Other types of fatty acids, such as crepenynic acid, which contains a triple bond, are rare and of no nutritional significance.

The figure on the next page shows how a triglyceride with polyunsaturated vegetable fats is converted to a *trans* fat.

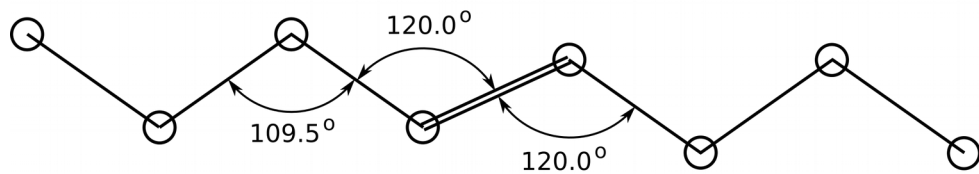
Transfats



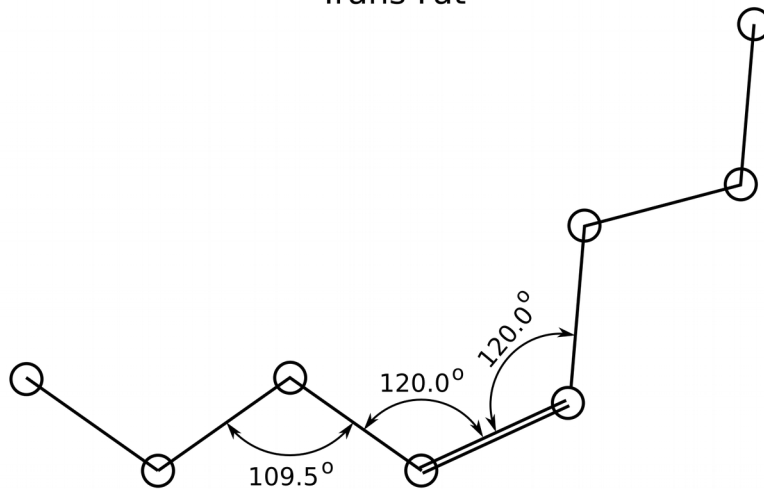
Reaction Scheme: By far the largest amount of **trans** fat consumed today is created by the food industry as a side effect of partially catalytic hydrogenation of unsaturated plant fats (generally vegetable oils) with **cis** carbon-carbon double bonds. These partially hydrogenated fats have displaced natural solid fats and liquid oils in many areas, the most notable ones being in the fast food, snack food, fried food, and baked goods industries.



Saturated Fat



Trans Fat



Cis Fat

The structural differences are more clearly shown in the above diagrams drawn with proper bond angles.