

CHEMISTRY OF DARK RED COLOURED LIQUID TISSUE HAVING DEEP METALLIC ODOUR THROUGH OXYGENATED α,β -UNSATURATED ALDEHYDE

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ABSTRACT

Unsaturated fatty acid has tendency to undergo rancidification due to the presence of double bond (σ : sigma bond and π : pi bond) in oxidative catabolism in-vivo by oxidase enzyme and in-vitro due to air oxidation. Unsaturated part undergoes reaction steps by Initiation, Propagation and Termination steps followed by free radical formation in Initiation step, peroxide formation in Propagation step and hydro-peroxide step in Termination step which produce obnoxious smell due to the formation of epoxide. Since blood is a biological fluid tissue so it produces metallic smell of characteristic odour.

KEYWORDS: (2E)-3-(3-pentyl-2-oxiranyl)acrylaldehyde, trans-4,5-Epoxy-(E)-2-decenal, (2E)-3-[(2S,3S)-3-pentylloxiran-2-yl]prop-2-enal, α,β -unsaturation, linoleic acid, initiation, propagation, termination, peroxide, hydroperoxide, epoxide, oxirane.

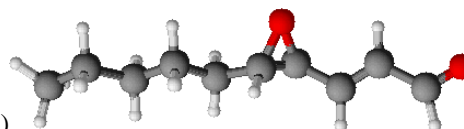
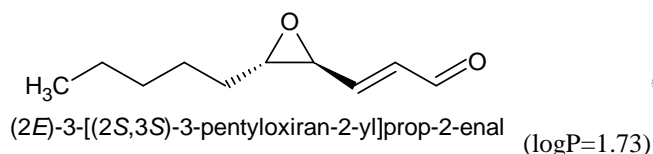
INTRODUCTION

Blood is a bodily fluid in humans and other animals that delivers necessary substances such as nutrients and oxygen to the cells and transports metabolic waste products away from those same cells. When it reaches the lungs, gas exchange occurs when carbon dioxide is diffused out of the blood into the pulmonary alveoli and oxygen is diffused into the blood. This oxygenated blood is pumped to the left hand side of the heart in the pulmonary vein and enters the left atrium. From here it passes through the mitral valve, through the ventricle and taken all around the body by the aorta. Blood contains antibodies, nutrients, oxygen and much more to help the body work. The coloring matter of blood (**hemochrome**) is largely due to the protein in the blood responsible for

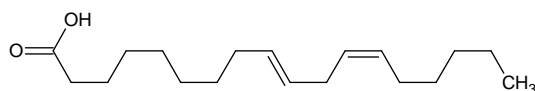
oxygen transport. Different groups of organisms use different proteins.^[1]

CHEMISTRY

Blood is a liquid tissue having red in colour with characteristic metallic smell or odour. Smells are notoriously hard to pin down, describe and identify but most people agree that the smell of fresh blood has a distinct, metallic tang. You might assume this comes from the iron in our blood, but an organic compound—a type of aldehyde—is to blame. (2E)-3-(3-pentyl-2-oxiranyl)acrylaldehyde or trans-4,5-Epoxy-(E)-2-decenal or (2E)-3-[(2S,3S)-3-pentylloxiran-2-yl]prop-2-enal all are same substances having aldehyde moiety (-CHO).

**Structure-1: Oxygenated biogenic aldehyde**

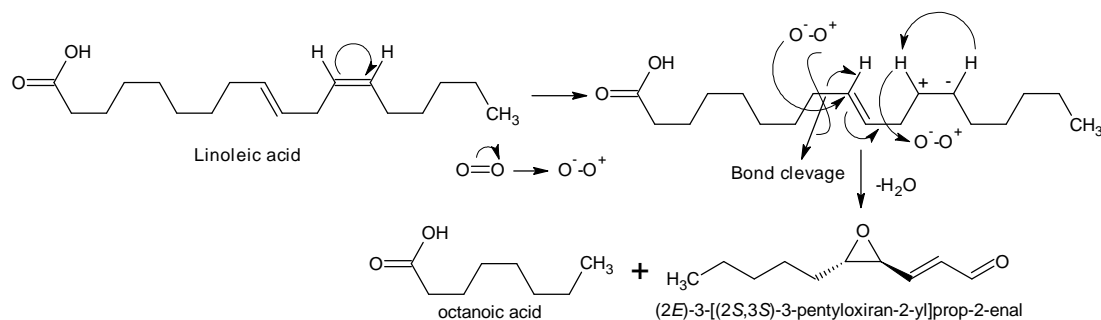
Molecular Formula=C₁₀H₁₆O₂; Formula Weight=168.23 g/mol; Composition=C(71.39%), H(9.59%), O(19.02%); Molar Refractivity=49.98±0.3cm³; Molar Volume=164.5±3.0cm³; Parachor=409.8±4.0cm³; Index of Refraction=1.519±0.02; Surface Tension=38.4±3.0dyne/cm; Density=1.022±0.06g/cm³; Chemspider ID=4509321



Structure-2: Linoleic acid

In a new study, researchers found that this single component drew the interest of tigers and wild dogs just as much as the scent of fresh horse blood. Whatever

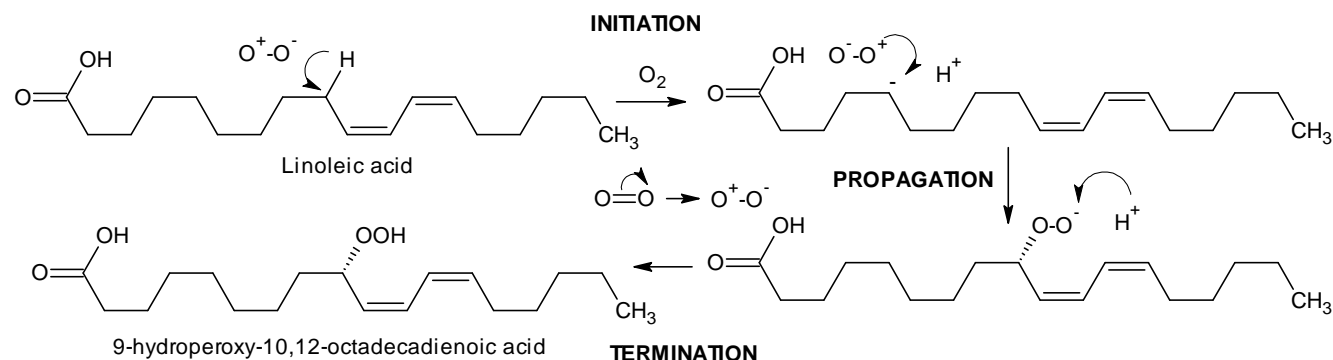
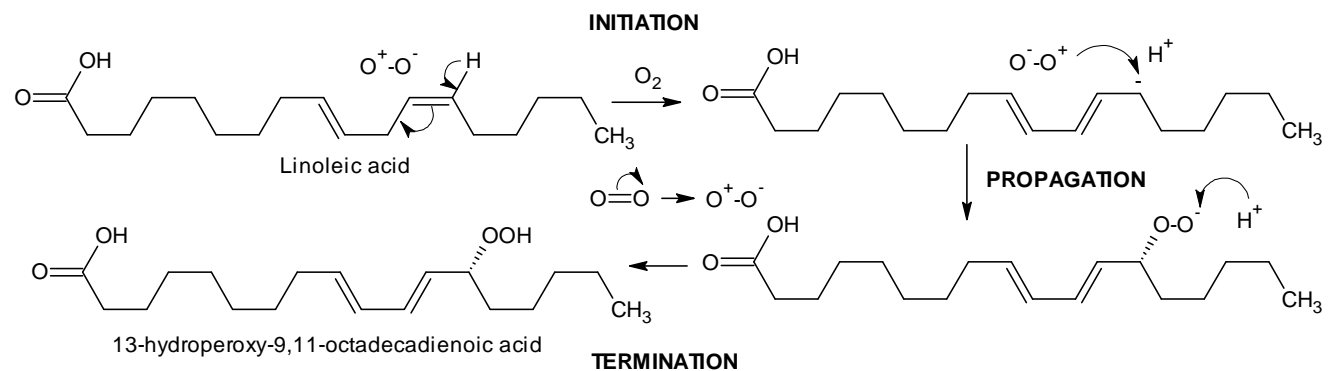
other complicated smells were in the horse blood did not make it more intriguing to the carnivores; this one compound by itself was enough to attract their full attention.^[2]



Structure-3: Biogenesis of oxygenated aldehyde

The fact that blood carries a distinct stench is well known and has even given rise to a few myths. Bears are not drawn to menstruating female campers. Sharks cannot detect a single drop of blood in a vast ocean. But their ability to home in on blood in the water is still impressive: they can detect the equivalent of 10 drops of blood in the average home pool. It makes sense for the smell of blood to be so potent. A carnivore can use the

scent to track wounded prey, and the prey species can use it as an alert that danger is close.^[3] *trans*-4,5-Epoxy-(*E*)-2-decenal is an oxygenated α,β -unsaturated aldehyde found in mammalian blood that gives blood its characteristic metallic odor. It is used by predators to locate blood or prey. Humans can smell it at a concentration of 1.5 pg/l in air, at 15 ng/L in water and 1.3 $\mu\text{g/L}$ in oil. It is permitted as a food flavouring in the EU.^[4]



Structure-4: Biochemistry of rancidification

It can be formed during baking fats that contain linoleic acid. 13-Hydroperoxy-9,11-octadecadienoic acid and 9-hydroperoxy-10, 12-octadecadienoic acid are

intermediates in the process. The aldehyde also forms in cooked beef when it sits in the refrigerator for too long contributing to a stale smell. It is also an important part of the smell of raw and cooked mutton.^[5]

CONCLUSION

Metallic odour of flesh or blood comes from the rancidification of linoleic acid is due to oxidation of unsaturated bonds by oxygen through initiation, propagation and termination steps of α,β -unsaturation of acid into oxygenated aldehyde. The unpleasant foul smell is generated by biochemical oxidative reactions both *in-vivo* & *in-vitro*. LogP of this substance is 1.73 so it is semipolar in nature due to three membered oxirane ring and double bond and aldehyde linkage, so it is easily atomized into the atmospheric environment to disperse the odour.

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