

M.Sc Sem – IV (Organic Chemistry)

Lecture – 1 ;Terpenoids

By – Dr. Mithilesh Kumar Singh

Department of Chemistry,

T P College, Madhepura,

B.N.M.U. Madhepura

Date ; 17 April 2020

Introduction :-

Terpenoids form a group of naturally occurring compounds majority of which occur in plants, a few of them have also been obtained from other sources. Terpenoids are volatile substances which give plants and flowers their fragrance. They occur widely in the leaves and fruits of higher plants, conifers, citrus and eucalyptus.

The term ‘terpene’ was originally employed to describe a mixture of isomeric hydrocarbons of the molecular formula $C_{10}H_{16}$ occurring in the essential oils obtained from sap and tissue of plants, and trees. But there is a tendency to use more general term ‘terpenoids’ which include hydrocarbons and their oxygenated derivatives.

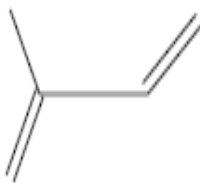
By the modern definition: “Terpenoids are the hydrocarbons of plant origin of the general formula $(C_5H_8)_n$ as

well as their oxygenated, hydrogenated and dehydrogenated derivatives.”

Isoprene rule:-

Thermal decomposition of terpenoids give isoprene as one of the products. Otto Wallach pointed out that terpenoids can be built up of isoprene unit.

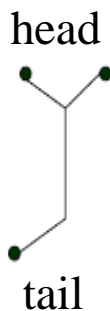
Isoprene rule states that the terpenoid molecules are constructed from two or more isoprene units.



isoprene unit

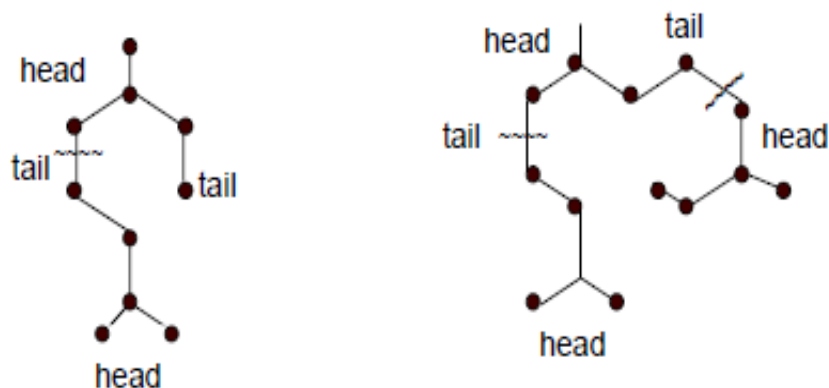
Further Ingold suggested that isoprene units are joined in the terpenoid via ‘head to tail’ fashion.

Special isoprene rule states that the terpenoid molecule are constructed of two or more isoprene units joined in a ‘head to tail’ fashion.

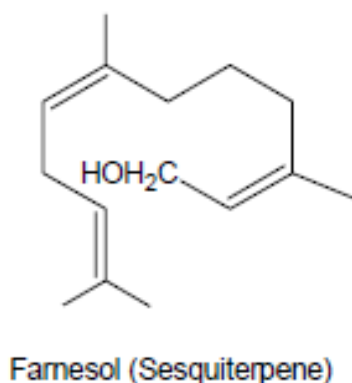
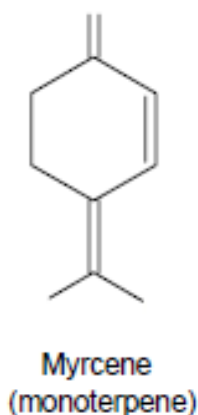


But this rule can only be used as guiding principle and not as a fixed rule. For example carotenoids are joined tail to tail at their central and there are also some terpenoids whose carbon content is not a multiple of five.

In applying isoprene rule we look only for the skeletal unit of carbon. The carbon skeletons of open chain monoterpenoids and sesqui terpenoids are,



Examples.



Ingold (1921) pointed that a gem alkyl group affects the stability of terpenoids. He summarized these results in the form of a rule called **'gem dialkyl rule'**.

It may be stated as "Gem dialkyl group tends to render the cyclohexane ring unstable where as it stabilizes the three, four and five member rings."

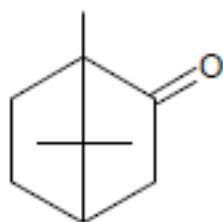
This rule limits the number of possible structure in closing the open chain to ring structure. Thus the monoterpene

open chain give rise to only one possibility for a monocyclic monoterpenoid i.e the p-cymene structure.

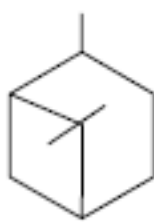


P-cymene structure

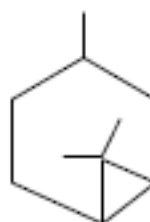
Bicyclic monoterpenoids contain a six member and a three member ring. Thus closure of the ten carbon open chain monoterpenoid gives three possible bicyclic structures.



Camphor
(6+5) system



Pinane
(6+4) system



Carane
(6+3) System