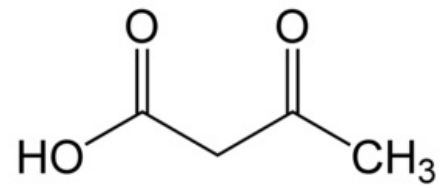


Acetoacetic acid

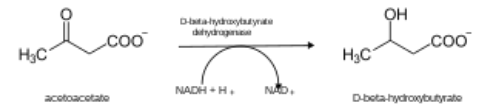
Acetoacetic acid (3-oxobutanoic acid) is a weak oxoacid. Its constitutional formula is $\text{CH}_3\text{COCH}_2\text{COOH}$. In practice, we encounter and use rather the name of its salt - **acetoacetate**. Acetic acid undergoes spontaneous decarboxylation to **acetone** or can be converted to β -hydroxybutyrate. The conversion to β -hydroxybutyrate is catalysed by the enzyme *β -hydroxybutyrate dehydrogenase*.

Acetoacetate is a product of **ketogenesis** or can be also formed during the **metabolism of selected biogenic amino acids**. Excess acetyl-CoA is converted into ketone bodies (acetoacetate, acetone and β -hydroxybutyrate) in the liver. The liver is unable to metabolize these substances and their utilization takes place in extrahepatic tissues. Under the influence of the enzyme *succinyl-CoA-acetoacetate transferase*, CoA is transferred to acetoacetate to form succinate. **Acetoacetate-CoA** enters the β -oxidation and succinate enters the citrate cycle.

Acetoacetate can also be a product of the metabolism of amino acids - *leucine*, *tryptophan* and *tyrosine*.



Acetoacetic acid (formula)



Conversion of acetoacetate to β -hydroxybutyrate

Synthesis of ketone bodies

- **1.** Acetoacetyl-CoA is an intermediate in fat breakdown. Acetoacetyl-CoA can be formed by the condensation of two acetyl-CoA.
- **2.** Condensation of acetoacetyl-CoA with the acetyl-CoA molecule gives β -hydroxy- β -methylglutaryl-CoA = HMG-CoA. It is used in the physiological state to produce steroid substances such as cholesterol. In plants, it is used to synthesize terpenes and carotenoids.
- **3.** HMG-CoA can be further cleaved by lyase to acetoacetate and acetyl-CoA.
 1. Acetoacetate is formed by non-enzymatic (spontaneous) decarboxylation to form acetone.
 2. Another possibility is the reduction of acetoacetate by liver dehydrogenase to β -hydroxybutyric acid (β -hydroxybutyrate).

References

Related articles

- Citrate cycle
- Amino acids
- Ketones

Bibliography

- MATOUŠ, Bohuslav, et al. *Základy lékařské chemie a biochemie*. 1. edition. Nakladatelství Galén, 2010. 508 pp. ISBN 978-80-7262-702-8.