

18/MHS06/052

MLS

1, Describe the stages of beta-oxidation

Answer

Beta oxidation is a metabolic process involving multiple steps by which fatty acid molecules are broken down to produce energy.

There are four steps namely;

1, Dehydrogenation

2, Hydration

3, Oxidation

4, Thiolysis

Dehydrogenation; In the first step, acyl-CoA is oxidized by the enzyme acyl CoA dehydrogenase. A double bond is formed between the second and third carbons (C2 and C3) of the acyl-CoA chain entering the beta oxidation cycle; the end product of this reaction is trans- Δ^2 -enoyl-CoA (trans-delta 2-enoyl CoA). This step uses FAD and produces FADH₂, which will enter the citric acid cycle and form ATP to be used as energy.

Hydration; In the second step, the double bond between C2 and C3 of trans- Δ^2 -enoyl-CoA is hydrated, forming the end product L- β -hydroxyacyl CoA, which has a hydroxyl group (OH) in C2, in place of the double bond. This reaction is catalyzed by another enzyme: enoyl CoA hydratase. This step requires water.

Oxidation; In the third step, the hydroxyl group in C2 of L- β -hydroxyacyl CoA is oxidized by NAD⁺ in a reaction that is catalyzed by 3-hydroxyacyl-CoA dehydrogenase. The end products are β -ketoacyl CoA and NADH + H. NADH will enter the citric acid cycle and produce ATP that will be used as energy.

Thiolysis; Finally, in the fourth step, β -ketoacyl CoA is cleaved by a thiol group (SH) of another CoA molecule (CoA-SH). The enzyme that catalyzes this reaction is β -ketothiolase. The cleavage takes place between C2 and C3; therefore, the end products are an acetyl-CoA molecule with the original two first carbons (C1 and C2), and an acyl-CoA chain two carbons shorter than the original acyl-CoA chain that entered the beta oxidation cycle.

