

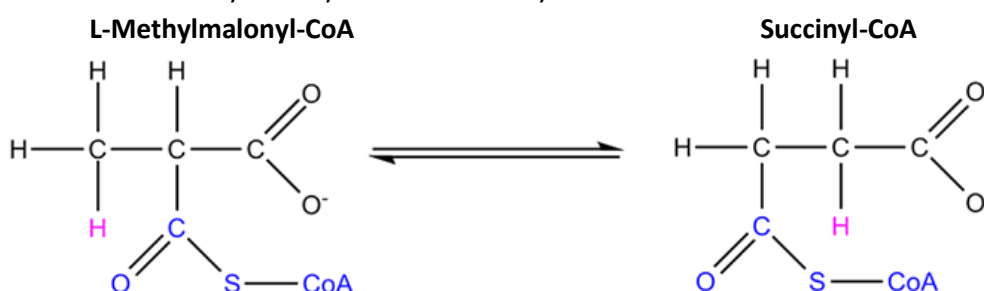
Answer on Question #46229 – Chemistry - Other

Vitamins and minerals are essential chemical substances that regulate many physiological processes. Almost all vitamins serve as cofactors in different enzymatic reactions: carbohydrates decomposition and transformation of energy, electrons-protons transport (B1, B3, B2, PP), single-carbon-transfer reactions, transmethylation (Bc, B12), aminoacids metabolism, their decarboxylation and deamination (H, B6), antioxidant activity (C, E, A), blood coagulation (K), vision (A), calcium metabolism regulation (D).

Minerals like vitamins participate in different enzymatic reaction and serve as cofactors for biochemical reactions (metal ions). They regulate electrons-protons transport (Fe, Cu). Carbonates and phosphate anions are components of the blood buffer systems.

Cyanocobalamin is a widely produced form of the vitamin B12. Cyanocobalamin is biologically inactive and must be transformed into active forms methylcobalamin or 5'-deoxyadenosylcobalamin.

5'-deoxyadenosylcobalamin is a coenzyme of methylmalonyl-CoA mutase in the trans isomerisation reaction of L-Methylmalonyl-CoA into Succinyl-CoA:



In the methylmalonyl-CoA mutase reaction, the group -CO-S-CoA at C-2 of the original propionate exchanges position with a hydrogen atom at C-3 of the original propionate. There is an exchange of an alkyl or substituted alkyl group (X) with a hydrogen atom on an adjacent carbon, with no mixing of the transferred hydrogen atom with the hydrogen of the solvent, H₂O.

Steps:

1. The Co-C bond undergoes homolytic cleavage, yielding Co²⁺ and the 5'-deoxyadenosyl free radical.
2. The radical is converted to 5'-deoxyadenosine by abstraction of a hydrogen atom from the substrate, producing a substrate radical.
3. The substrate radical is rearranged, producing a new radical with the carbon skeleton of the product. For methylmalonyl-CoA mutase, the migrating group (X) is -CO-S-CoA.
4. A hydrogen from the 5'-CH₃ of the deoxyadenosine is returned to the productlike radical, forming product.
5. The bond between the 5'-CH₂ of the deoxyadenosyl radical and cobalt is re-formed, regenerating the B12 cofactor in its Co³⁺ form, ready to undergo another reaction.