

Difference Between Ubiquinone and Ubiquinol

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Key Difference – Ubiquinone vs Ubiquinol

Electron transport chain takes place in the [mitochondrion](#) inner membrane and electrons are transferred from one protein complex to another in the order of their increasing reduction potentials. Electron pools are present in order to capture the electrons released from complex I, II and III in the electron transport chain which finally participates in producing water associated with the complex IV. This effective method of electron transport generates an electro chemical gradient; the proton motive force which drives the process of [ATP](#) synthesis via ATP synthase. The overall process is known as [Oxidative phosphorylation](#). [Coenzyme Q10](#) acts as an electron pool for the electrons released from Complex I and II and shuttles these electrons to Complex III in a process called Q cycle. The key difference between ubiquinone and ubiquinol is that **ubiquinone is the oxidized form of Coenzyme Q10 while ubiquinol is the fully reduced form of Co enzyme Q10.**

What is Ubiquinone?

Ubiquinone (2,3-dimethoxy-5-methyl-6-multiprenyl-1,4-benzoquinone) is also referred to as CoQ10, and it is a fully hydrophobic compound that is found in lipid-rich areas of the membrane; it readily travels along the lipid bi-layer. Ubiquinone is the fully oxidized form which readily takes up the reducing equivalents that are coming from the oxidation of [NADH](#) and FADH₂ from complex I and II. Thus, ubiquinone obtains the electrons released during the oxidation process and undergoes reduction into its reduced form ubiquinol, thereby acting as an electron pool.

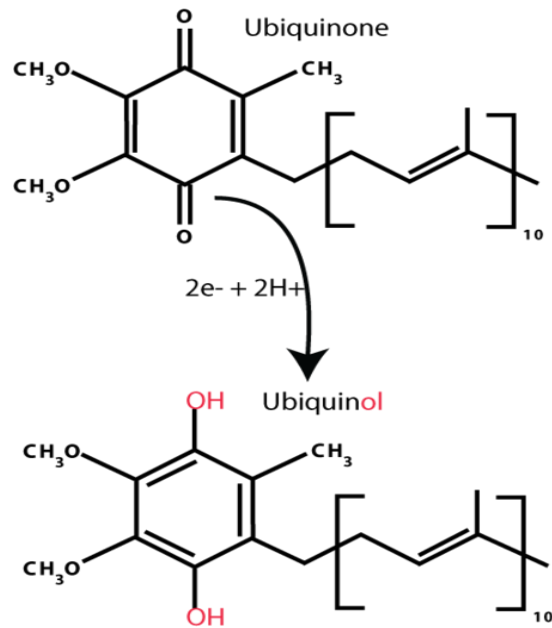


Figure 01: Ubiquinone Conversion into Ubiquinol

The synthesis of ubiquinone / CoQ10 takes place via the mevalonate pathway of [cholesterol](#) synthesis in most tissues, and the tail of isoprene units acts as the electron carrier under [hydrophobic](#) conditions.

What is Ubiquinol?

Ubiquinol (5, 6-dimethoxy-3-methylcyclohexa-2, 5-diene-1, 4-diol) is a hydrophobic molecule containing an isoprene tail similar to the structure of ubiquinone and is synthesized in the liver. Ubiquinol (QH₂) is the fully reduced form of CoQ10, and it has the ability to donate the captured electrons to complex III of the electron transport chain and convert back to its oxidized form. This process takes place via iron – sulfur centers of the complex III. Ubiquinol in its reduced form is an electron rich molecule. It is hydrophobic, and its activity is limited to the membrane structures as it can readily travel along the lipid bi-layer.

In addition to its function in the electron transport chain, ubiquinol is a powerful lipid soluble anti – oxidant that is capable of protecting the body from oxidative stress caused by free radicals. Thus, ubiquinol is also taken as a supplement by aging populations, and ubiquinol measurements are taken in order to analyze the aging of cells.

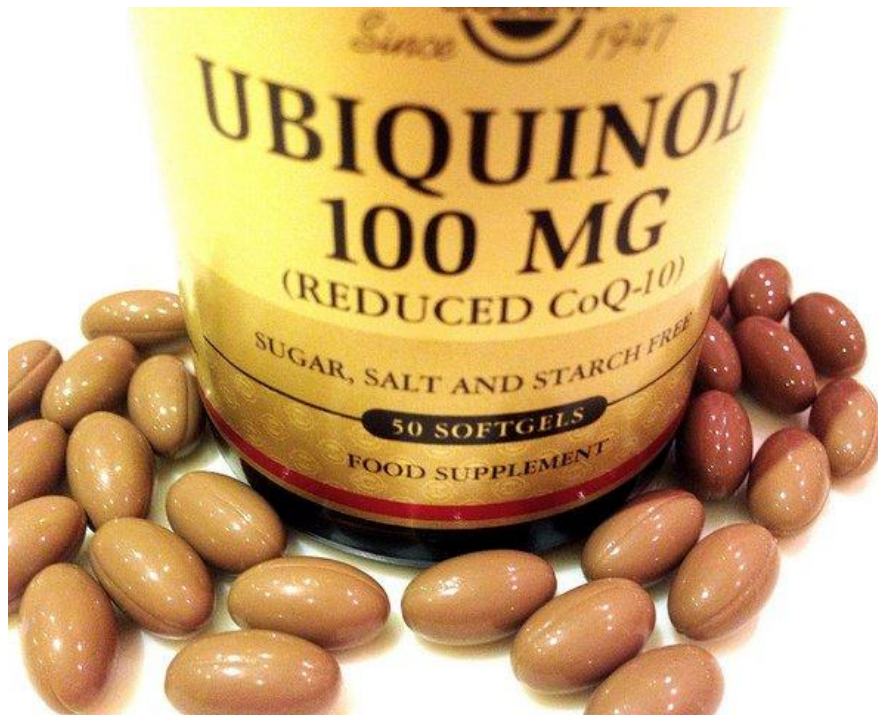


Figure 02: Ubiquinol supplements

What are the similarities between Ubiquinone and Ubiquinol?

- Ubiquinone and ubiquinol are hydrophobic.
- Both are lipid soluble.
- Both contain an isoprene chain, which is the electron carrier.
- Both molecules participate in the Q cycle and act as an electron pool in the electron transport chain.
- Both are two forms of the same compound (CoQ10).

What is the difference between Ubiquinone and Ubiquinol?

Ubiquinone vs Ubiquinol	
Ubiquinone is the fully oxidized form of CoQ10 and readily gains electrons to attain a reduced state.	Ubiquinol is the fully reduced form of CoQ10 and readily releases electrons to attain an oxidized state.
Stability	
Ubiquinone is less stable.	Ubiquinol is more stable.

Color	
Ubiquinone has a yellowish appearance.	Ubiquinol is milky white in appearance.
Function	
Ubiquinone accepts electrons released from complex I and II of the electron transport chain and act as an electron pool.	Ubiquinol releases the electrons to complex III via the Q cycle and also act as a powerful lipid antioxidant.

Summary – Ubiquinone vs Ubiquinol

CoQ10 is a widely studied compound due to its activity in the electron transport chain as a redox agent and contains two main forms: the oxidized form, ubiquinone and the reduced form, ubiquinol. Ubiquinone and ubiquinol participate in shuttling the electrons in the electron transport chain from complex I and II to complex III. In addition, these two compound are administered as treatment during organ failure, and aging and, thus is a current research interest among biochemists. The main difference between ubiquinone and ubiquinol is that ubiquinone is the oxidized form of CoQ10 while ubiquinol is the reduced form of CoQ10.

References:

1. “Ubiquinol CoQ10 | Health Benefits and Uses of Ubiquinol CoQ10.” Xtend-Life. [Available here](#). Accessed 16 Aug. 2017.
2. “Ubiquinone Uses, Benefits & Side Effects – Drugs.Com Herbal Database.” Drugs.com. [Available here](#). Accessed 16 Aug. 2017.

Image Courtesy:

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