All this suggests that the mats help to assess biogeochemical role of microorganisms in ecosystems, shows an important role of microbial communities in hot springs in the evolution of life on the Earth, as well as taking an active part in the formation of travertine.

References


VOLTMETRIC DETERMINATION OF COENZYME Q10
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Coenzyme Q10 (2,3-dimethoxy-5-methyl-6-decaprenyl-1,4-benzoquinone, CoQ10) is a fat soluble, vitamin-like quinine commonly known as ubiquinone. This naturally occurring compound fulfills several biological functions in a living cell. It participates in electron and proton transport and ATP synthesis in the mitochondrial respiratory chain [1]. Ubiquinone is located in the cellular membranes and thus prevents several compounds and ions from getting out of the cell [2,3]. CoQ10H2, the fully reduced form of coenzyme Q10, exerts important effects against the oxidative damage of polyunsaturated fatty acids. The antioxidative activity of CoQ10H2 was found to be lower in comparison with that of vitamin E. In addition, the antioxidant functions of coenzyme Q10 reveals in the synergistic interaction with α-tocopherol by regenerating it from its oxidized form that is α-tocopheroxyl radical and thus should protects cells against peroxidative damage. It should be noted that CoQ10 is known to be the only endogenously synthesized lipid soluble antioxidant. However, the biosynthesis of ubiquinone decreases with age and the deficiency of these species cause cardiac disorders, blood circulation and neurodegenerative diseases. Therefore, their treatment involves pharmaceutical supplementation or an increased consumption of coenzyme Q10 with meals.

Fig. 1. Structure formula of coenzyme Q10

People with heart failure have been found to have lower levels of CoQ10 in heart muscle cells. Double-blind research suggests that CoQ10 may reduce symptoms related to heart failure, such as shortness of breath, difficulty sleeping, and swelling. CoQ10 is thought to increase energy production in the heart muscle, increasing the strength of the pumping action. Recent human studies, however, haven’t supported it.

In one study, 641 people with congestive heart failure were randomized to receive either CoQ10 (2 mg per kg body weight) or a placebo plus standard treatment. People who took the CoQ10 had a significant reduction in symptom severity and fewer hospitalizations.

Lower levels of CoQ10 have also been observed in people with Parkinson’s disease. Preliminary research has found that increasing CuQ10 may increase levels of the neurotransmitter dopamine, which is thought to be lowered in people with Parkinson’s disease. It has also been suggested that CoQ10 might protect brain cells from damage by free radicals.
A small, randomized controlled trial examined the use of 360 mg CoQ10 or a placebo in 28 treated and stable Parkinson's disease patients. After 4 weeks, CoQ10 provided a mild but significant improvement in early Parkinson's symptoms and significantly improved performance in visual function.

A larger 16 month trial funded by the National Institutes of Health explored the use of CoQ10 (300, 600 or 1200 mg/day) or a placebo in 80 patients with early stage Parkinson's disease. The results suggested that CoQ10, especially at the 1200 mg per day dose, had a significant reduction in disability compared to those who took a placebo.

To the best of our available knowledge, no voltammetry method has yet been established for the determination of CoQ10. The present paper describes an easy voltammetric method for the determination of CoQ10 in a least pure aqueous solution.

Voltammetric experiments were carried out with a three-electrode cell in which the glassy carbon electrode of 1 mm in diameter and silver chloride electrode were used as a working electrode and a counter electrode, respectively. All potentials were measured and reported against the external silver chloride reference electrode with 1 M NaCl solution. The surface of the working electrode was polished on fine emery paper. Finally, the electrode was rinsed with water and dried before use.

Standard solutions for electrochemical experiments were prepared by dissolving a suitable amount of coenzyme Q10 in an ethyl alcohol. The stock solution was stored in the dark and cool. Background solution was prepared by dissolving standard power of Na₃HPO₄ in 1 L volumetric flask.

All voltammetric experiments were performed using an electrochemical analyzer “TA-2” (“Tomanalyt” Ltd., Tomsk”).

The mechanism of ubiquinones reduction, which involves the transfer of two electrons, has been described by Moret. Cyclic voltammetry on glass carbon electrode was used to explore the voltammetric behaviour of coenzyme Q10 and the obtained voltammograms (Fig. 2) showed a reduction peak at a potential of about 0.600 V and an oxidation peak around -0.600 V vs Ag/AgCl. The shape of the cyclic voltammogram, and the heights of the maximum peak currents, depend on the scan rate, the optimum value being 30 mv s⁻¹.

It was observed that the peaks became better defined and the difference between the cathodic peak potential and anodic peak potential increases with the increase of the analyte concentration. The influence of CoQ10 concentration on the maximum peak was studied the optimal experimental conditions. The calibration graphs (Fig. 3) are linear within the range of concentration from 3·10⁻⁶ M to 3·10⁻⁴ M.

\[ y = -6.3856x + 2.9635 \]
\[ R^2 = 0.9977 \]
Coenzyme Q10 is electroactive at glass carbon electrode and, there for, a simple, rapid, sensitive, and accurate method determination of coenzyme Q10 was described.

References


VALUE ESTIMATION OF TOMSK TOWN TECHNOGENIC UNDERFLOODING USING GIS-TECHNOLOGIES

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Like many other cities and towns in the world, Tomsk is confronted by one and the same geological problem – anthropogenic underflooding. Anthropogenic underflooding is the rise of shallow groundwater levels provoked by the town’s activities under the influence of natural and anthropogenic factors, including territorial geological structure and drainage system, underground water intensity and its poor water flow and evaporation.

One of the main problems related to the urbanisation of Tomsk is underflooding related to the rise of shallow groundwater levels and the formation of perched water tables beneath historic and newly developed urban areas. This results in the formation of new aquifer horizons and results in a decrease in soil stability related to foundation works, the flooding of basement structures and failures of communications infrastructure. All these factors contribute to a worsening in the environmental and social situation of the area.

Tomsk is an ancient academic, student, cultural and industrial city, situated in a humid taiga zone of West Siberia on the River Tom, a major tributary of the Ob. It has an area of 154 km², most urbanisation being on the right bank of the Tom, but including a slightly developed left-bank and a green zone. The relief trends generally west-north-west, but is cut by the Tom and its associated terraces, and by a number its small tributaries, the Ushaika, Kirgizka and Basandaika. The interflue areas lie at elevations of some 190-210 m above sea level (m a.s.l.) in the south of the area, sloping down to 120-150 m a.s.l. in the north.

The historical central part of the city consists of two- and three-storey brick houses while, in newer neighbourhoods, blocks of wooden five-to ten-storey buildings form residential microdistricts. One of the most significant items in the town planning policy is the restoration and conservation of these monuments and buildings.

The hydrogeology of the area is controlled by its location at the edge of the West Siberian platform against the Kolyvan-Tomskaya folded zone. The aquifer complex is multi-layered and the interaction between different aquifer units is complicated. The deepest aquifer unit is the folded Palaeozoic basement, comprising mainly argillaceous slates and lesser sandstones. It outcrops in the Tom valley south of the city and also in the base of the Ushaika valley. The bearing components of the unit have a total thickness of 20-80 m, mainly in the upper part of the unit, in eluvial material and in a number of major fracture zones. Near the top of the units, a clayey weathering crust is often developed, which serves as a good aquitard. The unit has a confined character, with a piezometric surface at typical depths of 30-35 m. Water yields are variable but generally low. Specific capacities of boreholes range from thousandths up to 0.2 l/sec/m. Occasionally, specific capacities of up to 3.8 l/s/m have been noted in the east of the city (Makushin et al. 1975). In the north and north-west of the city the Palaeozoic occurs at depths of 80-100 m or more.

Unconsolidated aquiferous deposits of Cretaceous, Palaeogene and Quaternary age overlie the Palaeozoic.

The impact of urbanisation on the aquifer complexes is very varied. The Palaeogene and Palaeozoic deposits beneath Tomsk are used both for drinking water (DW) and industrial-technical (ITW) supply. Before 1972, these waters were used especially intensively. After 1972, major well-fields commenced operations on the left bank of the Tom (Lgotin & Makushin 1997). Many right-bank boreholes were abandoned, although several recommenced pumping in later years. According to the organisation «Tomsk Geomonitoring» the abstraction is currently 26,000 m³/day from within the bounds of the city. Most of the sources are single boreholes.

The boreholes have been operating at variable abstraction rates. Some of them work only a few hours a day, others almost continuously. Such decentralised operating caused a regional lowering of piezometric levels in the pre-Quaternary aquifers and formed a complicated depressed surface. In the northern part of the city, in the Palaeogene complex, levels were lowered by some 5-6 m. In the southern part of the city, where boreholes abstract from the Palaeozoic formations, regional levels were lowered by 7-8 m. Also, in the same areas, it was noted that cones of depression from separate wellfields were beginning to merge, resulting in groundwater levels some 10-15 m below the low-water level of the River Tom.

Due to the presence of effective aquitards, these changes did not significantly influence the Quaternary aquifers. In fact, water levels in the Quaternary complex exhibits a tendency towards underflooding. This may be related to increased recharge from urban processes or impedance of groundwater flow by foundations, and may result in the formation of perched water tables or the rise of water tables into previously unsaturated materials. The main causes of