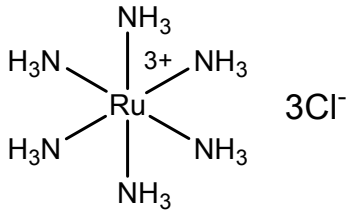
Hexaammineruthenium(III) Chloride as an Electron Mediator for Rapid Whole Blood Glucose Detection

metals · inorganics · organometallics · catalysts · ligands · custom synthesis · cGMP facilities · nanomaterials

Catalog #

44-0620 Hexaammineruthenium(III) chloride, 99%

CAS# *[14282-91-8]*



The Properties of Hexaammineruthenium(III) Chloride

Hexaammineruthenium(III) chloride, $[Ru(NH_3)_6]Cl_3$, is a powdery, pale yellow, air stable, water-soluble powder.

Hexaammineruthenium(III) chloride and hexaammineruthenium(II) chloride are readily interconverted via electrochemical reduction and oxidation, respectively. As a result, hexaammineruthenium(III) chloride is often used as the analyte in cyclic voltammetry demonstrations. This property also makes $[Ru(NH_3)_6]Cl_3$ highly useful in various biochemical analyses as an indicator of the occurrence of one-electron reactions.

The Need for Rapid and Accurate Blood Glucose Detection

As diabetes has become an increasing health problem around the world, demand for tools that enable the self-monitoring of blood glucose (SMBG) levels has also increased. Advances in the miniaturization of electronics and sensor fabrication techniques have enabled the development of accurate testing systems that require smaller blood sample volumes and provide results fairly rapidly.

Most systems are enzyme assays based on some form of glucose oxidase (GOD) or glucose dehydrogenase (GDH) and involve the use of artificial electron mediator.

Hexaammineruthenium(III) Chloride as an Electron Mediator for Glucose Detection

Glucose monitoring systems use hexaammineruthenium(III) chloride as an electron mediator. In one commercial blood glucose monitoring system, β-D-glucose reacts with GOD and hexaammineruthenium (III) chloride in the test strip, generating β-D-glucono-□-lactone and hexaammineruthenium (II) chloride. (Ref 1) The amount of hexaammineruthenium (II) chloride that is produced is directly proportional to the amount of glucose in the blood sample. Oxidation of the hexaammineruthenium(II) chloride back to hexaammineruthenium (III) chloride then generates an electric current. The meter is used to convert the current into the value of the glucose concentration.

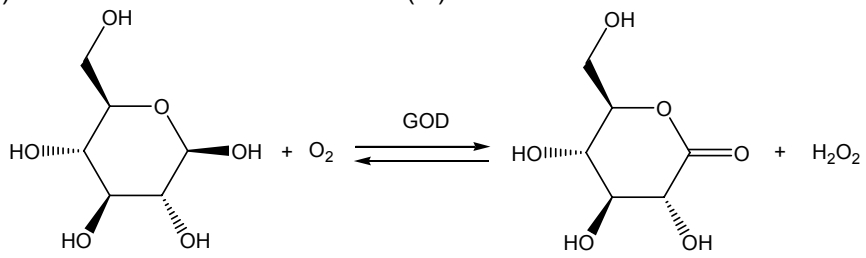
In another system reported in the literature, the thermostable FADGDH glucose-dehydrogenase complex, rather than GDH, was used as the enzyme and deposited' along with hexaammineruthenium (III) chloride, onto a screen-printed carbon electrode (SPCE) (Ref 2). The sensor was shown to measure the whole-blood glucose level within 1 sec using a 150-nL whole-blood sample with both high precision and reproducibility. Importantly, the sensor reading was stable for more than 60 days, even at 70 °C.

In these systems, the hexaammineruthenium (III) chloride must be of consistent purity and quality to ensure consistent and accurate test results.

Reactions:

β-D-glucose + Hexamminеruthenium(III) chloride + GOD → D-Glucono-δ-Lactone + Hexamminеruthenium (II) chloride

Hexamminеruthenium(II) chloride →Hexamminеruthenium(III) chloride + e-



β-D-glucose D-glucono-δ-lactone

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Similar Applications for Hexaammineruthenium(III) Chloride

Hexaammineruthenium(III) chloride has been shown by the Whitesides group (Ref 3) to be effective as an electron mediator in inexpensive *r*eferenced *E*lectrochemical *P*aper-based *A*nalytical *D*evices (rEPADs). These devices are used for direct and accurate voltammetric measurements that are referenced by an electrode with a constant, well-defined potential. Such rEPADs may be used in SMBG systems.

An assay for the high-throughput screening of drug candidates that inhibit telomerase has also been reported (Ref 4). This rapid electrochemical method, based on chronocoulometry coupled with hexaammineruthenium chloride, is an alternative to methods based on the polymerase chain reaction and gel electrophoresis and can discriminate between the direct binding of inhibitors to telomerase and indirect inhibition via binding to the quadruplex generated by telomerase.

References:

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