Metal Nanoshells for Biosensing Applications [1]

Biosensors are analytical tools used to detect the presence of a number of chemical and biological agents such as viruses, drugs, or bacterium in biological or ecological systems. Nanoshell biosensors work by emitting a signal that is characteristic of the virus [2], toxin, or bacteria [3] to be measured, thus identifying the presence or absence of the material. The ratio between the thicknesses of the gold nanoshell to the non-conductive, silicon [4] core determines the signal to be emitted. Gold is used because of its non-reactive properties and conductive nature, allowing the nanoparticle [5] to absorb specific frequencies of infrared or ultraviolet light [6].

These particles can range in size, but typically have a shell thickness range of 5-20 nm and a core diameter of 120 nm. These patented metal nanoshell particles allow for the accurate sensing of biological analytes and can also be used for electrochemical labeling of molecules such as drug metabolites, while remaining inert in solution or suspension[1]. In medicine, these biosensors can be used for everything from monitoring blood glucose levels in diabetics to detection of pathogens to detection of drug or toxin metabolites[2].

References


Author:

Tai Wallace [14]

Product Name:

- Metal Nanoshells [15]
Development Stage:

- Commercial [16]

Key Words:

- Virus [2]
- Biological Sensing [17]
- Electrochemical Sensing [18]
- Nanoshells [19]

Mechanism:

- Passive Nanostructure [20]

Source:

Nanotechnological Applications in Health and Medicine [12]

Summary:

Metal nanoshell biosensors allow for the more accurate and cost effective sensing in biomedical and environmental monitoring [21].

Function:

- Biological Sensing and Monitoring [22]

Material:

- Gold [23]
- Silicon [24]

Source:

Metal Nanoshells for Biosensing Applications [United States Patent], [10]
Benefit Summary:

This product has the potential to improve human health \textsuperscript{25} as well as environmental health \textsuperscript{25} by allowing for the faster and more precise monitoring and sensing of harmful pathogens and toxins.

Benefit:

- Health \textsuperscript{26}
- Improved Environmental Quality \textsuperscript{27}
- Monitoring/Early Warning \textsuperscript{28}

Risk Summary:

While gold is an inert metal, many elements react differently at the nanoscale. Free small aspect nanoparticles \textsuperscript{29} may pose biological health \textsuperscript{25} risks, especially if inhaled or released into the environment. The risks of these particles is relatively unknown and more research must be conducted to determine what their ecological and biological effects are. There may be concerns with any nanoparticle \textsuperscript{5}, not just these, that relate to bioaccumulation and changes in physiochemistry.

Risk Characterization:

- Uncertain \textsuperscript{30}

Risk Assessment:

- Ecological Risks \textsuperscript{31}
- Health Risks \textsuperscript{32}

Source:

Platinum group elements in raptor eggs, faeces, blood, liver and kidney \textsuperscript{33}

Facility:

- Medicine \textsuperscript{34}
Activity:

- Sensing [35]

Substitute:

- Existing Technology [36]

Challenge Area:

- Health [37]

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