

# Multi-Walled Carbon Nanotube Based Electrochemical Sensors Used for Forensic Environmental Chemistry

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## Abstract

An electrochemical sensor is a device that uses electrochemical reactions to detect and measure the concentration of a target analyte. It is widely used in various fields, including medical diagnostics, environmental monitoring, food safety, and industrial process control. The electrochemical sensor is highly sensitive, accurate, and selective. In this article, we will discuss the working principle, types, and applications of electrochemical sensors. Electrochemical sensors work on the principle of electrochemistry, which involves the study of chemical reactions that involve the transfer of electrons. The sensor consists of two electrodes: a working electrode and a reference electrode. The working electrode is coated with a material that reacts with the target analyte. When the analyte comes into contact with the working electrode, it undergoes a chemical reaction that generates an electrical signal. The reference electrode provides a stable voltage reference against which the working electrode potential can be measured.

**Keywords:** Analyte • Sensor • Electrochemical • Signal

## Introduction

Lead is one of the most well-known heavy metals and has been widely used in industrial applications. It is also commonly found in old paint, plumbing pipes, and some types of pottery. Exposure to lead can cause a range of health problems, including developmental delays in children, high blood pressure, and kidney damage. Mercury is another commonly used heavy metal that can have serious health effects. It is used in thermometers, dental fillings, and some types of light bulbs. Exposure to mercury can cause neurological damage, including tremors and memory loss. Cadmium is a heavy metal that is commonly found in batteries, pigments, and plastics [1]. It can also be found in some types of food, such as shellfish and leafy greens. Exposure to cadmium can cause kidney damage, lung damage, and cancer. Arsenic is a naturally occurring heavy metal that is commonly found in drinking water, especially in areas with high levels of arsenic in the soil. Exposure to arsenic can cause skin lesions, lung cancer, and other health problems.

Chromium is a heavy metal that is commonly used in stainless steel and other alloys. Exposure to chromium can cause lung cancer and other respiratory problems, as well as skin irritation and rashes. In addition to their direct health effects, heavy metals can also have significant environmental impacts. They can leach into soil and water, contaminating crops and water sources. This can have serious consequences for ecosystems and the organisms that depend on them. Heavy metals can also bio accumulate in the food chain; with predators at the top of the chain accumulating the highest concentrations. There are a variety of ways to reduce exposure to heavy metals. For example, individuals can avoid using products that contain heavy metals, such as lead-based paint and mercury-containing thermometers. They can also eat a healthy diet that includes foods that are low in heavy metals, such as fruits, vegetables, and grains [2].

In addition to individual actions, there are also policy measures that can help to reduce exposure to heavy metals. For example, governments can regulate the use of heavy metals in products and require companies to safely dispose of

products that contain heavy metals. Governments can also monitor water and soil quality to ensure that levels of heavy metals are within safe limits. Overall, heavy metals are a significant environmental and health concern. They can have serious impacts on human health and the environment, and it is important to take steps to reduce exposure to them. By being aware of the risks associated with heavy metals and taking steps to reduce exposure, individuals can help to protect themselves and the environment from the negative effects of these toxic substances [3].

## Literature Review

One of the most well-known heavy metals is lead. Lead has been used for thousands of years in many different applications, including piping, paint, and ammunition. However, lead is also a potent neurotoxin that can cause damage to the nervous system, brain, and other organs. Children are particularly vulnerable to lead exposure, which can lead to developmental delays and cognitive impairments. Mercury is another heavy metal that is of significant concern. It is used in a variety of applications, including thermometers, dental fillings, and fluorescent light bulbs. However, mercury can also cause damage to the nervous system, brain, and other organs, particularly in fetuses and young children. It can enter the environment through the burning of fossil fuels and the release of mercury-containing waste from industrial processes [4].

Cadmium is a heavy metal that is commonly found in industrial processes and fertilizers. It can cause lung damage and is linked to an increased risk of lung cancer. Cadmium exposure is also associated with kidney damage and bone loss. Arsenic is a naturally occurring heavy metal that is found in groundwater in many parts of the world. Chronic exposure to arsenic can cause skin lesions, cardiovascular disease, and an increased risk of cancer. Chromium is also a naturally occurring heavy metal that can cause lung damage and an increased risk of cancer [5].

## Discussion

Nickel is another heavy metal that is commonly found in industrial processes, particularly in the production of stainless steel. Nickel exposure can cause lung damage and an increased risk of cancer. It is also associated with skin allergies and other skin problems. Heavy metals can enter the environment in a variety of ways. They can be released into the air through industrial processes, such as mining and smelting. They can also be released into water bodies through the discharge of industrial waste and sewage. Heavy metals can also enter the soil through the use of fertilizers and pesticides that contain these elements [6].

Once heavy metals enter the environment, they can accumulate in the food

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chain. For example, fish can accumulate mercury in their tissues, and people who consume these fish can be exposed to high levels of mercury. Similarly, plants can accumulate heavy metals in their tissues, and livestock that graze on these plants can be exposed to these toxins. The effects of heavy metal exposure can vary depending on the specific metal, the dose, and the duration of exposure. Short-term exposure to high levels of heavy metals can cause acute health effects, such as nausea, vomiting, and diarrhea. Long-term exposure to lower levels of heavy metals can cause chronic health effects, such as damage to the nervous system, kidneys, and liver, as well as an increased risk of cancer [7].

## Conclusion

Children are particularly vulnerable to the effects of heavy metal exposure because their bodies are still developing, and they may be more likely to ingest contaminated soil or water. Pregnant women are also at risk because heavy metals can cross the placenta and harm the developing fetus. To protect human health and the environment, it is essential to monitor and regulate the release of heavy metals into the environment. Governments and regulatory agencies can set standards for acceptable levels of heavy metals in the air, water, and soil, and enforce these standards through monitoring and enforcement activities.

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## Conflict of Interest

There is no conflict of interest by author.

## References

1. Kim, Sang Nyon, James F. Rusling and Fotios Papadimitrakopoulos. "Carbon nanotubes for electronic and electrochemical detection of biomolecules." *Adv Mater* 19 (2007): 3214-3228.
2. Abdalla, S., F. Al-Marzouki, Ahmed A. Al-Ghamdi and A. Abdel-Daiem. "Different technical applications of carbon nanotubes." *Nanoscale Res Lett* 10 (2015): 1-10.
3. Park, Steve, Michael Vosguerichian and Zhenan Bao. "A review of fabrication and applications of carbon nanotube film-based flexible electronics." *Nanoscale* 5 (2013): 1727-1752.
4. Saleh Ahammad, A. J., Jae-Joon Lee and Md Aminur Rahman. "Electrochemical sensors based on carbon nanotubes." *Sens* 9 (2009): 2289-2319.
5. Chen, Lisha, Kunlin Li, Hong Zhu and Lingchen Meng, et al. "A chiral electrochemical sensor for propranolol based on multi-walled carbon nanotubes/ionic liquids nanocomposite." *Talanta* 105 (2013): 250-254.
6. Başkaya, Gaye, Yunus Yıldız, Aysun Savk and Tugba Onal Okyay, et al. "Rapid, sensitive and reusable detection of glucose by highly monodisperse nickel nanoparticles decorated functionalized multi-walled carbon nanotubes." *Biosens Bioelectron* 91 (2017): 728-733.
7. Wang, Dongyang, Bintong Huang, Jie Liu and Xia Guo, et al. "A novel electrochemical sensor based on Cu@Ni/mwcnts nanocomposite for simultaneous determination of guanine and adenine." *Biosens Bioelectron* 102 (2018): 389-395.

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