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Examining Heavy Metals in Seaweed Species Using Microscopic Spectroscopy

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Abstract

Seaweeds are aquatic plants that are found in various coastal and oceanic environments. They are used in various food, pharmaceutical, and cosmetic products due to their high nutrient content and medicinal properties. However, seaweeds have been found to accumulate heavy metals in their tissues, which can have adverse effects on human health. Heavy metal contamination of seaweed can occur due to various anthropogenic and natural sources, such as industrial effluents, sewage, agricultural runoff, and volcanic activity. Therefore, it is essential to monitor the levels of heavy metals in seaweed species to ensure their safety for consumption.

Keywords: Microscopic spectroscopy • Aquatic plants • Heavy metals

Introduction

Atomic spectroscopy-based analysis is a commonly used technique for the quantitative determination of heavy metals in various samples, including seaweed. This technique involves the use of electromagnetic radiation to excite the atoms or ions of the target analyte, which results in the emission or absorption of radiation at specific wavelengths. The intensity of the emitted or absorbed radiation is proportional to the concentration of the analyte, which allows for its quantitativedetermination. In this article, we will discuss the various atomic spectroscopy-based techniques used for the analysis of heavy metals in seaweed species. Atomic Absorption Spectroscopy (AAS) is a widely used analytical technique for the determination of heavy metals in various samples, including seaweed. This technique involves the measurement of the absorption of radiation by the ground state atoms of the analyte in the presence of a radiation source. AAS can be used for the determination of several heavy metals, including cadmium, lead, mercury, and arsenic, in seaweed samples [1].

In AAS, the sample is atomized in a flame or graphite furnace, and the atoms of the analyte are excited by a radiation source, such as a hollow cathode lamp. The radiation source emits radiation at a specific wavelength that is absorbed by the ground state atoms of the analyte. The absorption of radiation by the analyte atoms is measured by a detector, and the concentration of the analyte is determined by comparing the absorbance of the sample with that of a standard solution [2].

AAS has several advantages for the analysis of heavy metals in seaweed samples, including its high sensitivity, accuracy, and precision. However, AAS also has some limitations, such as its inability to determine the total concentration of a metal in a sample, as it only measures the concentration of the analyte in the atomized portion of the sample. Additionally, AAS is limited by interferences from other elements, which can affect the accuracy and precision of the measurements. Inductively coupled plasma atomic emission spectroscopy (ICP-AES) is a highly sensitive and precise analytical technique for the determination of heavy metals in various samples, including seaweed. This technique involves the use of Inductively Coupled Plasma (ICP) as the radiation source and a spectrometer to measure the emitted radiation at specific wavelength [3].

In ICP-AES, the sample is introduced into the ICP, which is a high-temperature plasma generated by an electromagnetic field. The plasma excites the atoms of the analyte, which emit radiation at specific wavelengths. The emitted radiation is then measured by a spectrometer, and the concentration of the analyte is determined by comparing the intensity of the emitted radiation with that of a standard solution. Atomic spectroscopy is a technique that analyses the electromagnetic radiation emitted or absorbed by atoms. The basic principle behind atomic spectroscopy is that atoms can absorb or emit light of specific wavelengths, which can be used to identify and quantify the elements present in a sample. The three main types of atomic spectroscopy are Atomic Absorption Spectroscopy (AAS), Atomic Emission Spectroscopy (AES), and Atomic Fluorescence Spectroscopy (AFS) [4].

Literature Review

Atomic Emission Spectroscopy (AES) is a technique that measures the amount of light emitted by atoms in a sample. AES works by exciting the atoms in the sample with a high-energy source such as a flame or plasma. When the atoms return to their ground state, they emit light of specific wavelengths, which can be used to identify and quantify the elements present in the sample. A detector measures the amount of light emitted by the atoms, and the concentration of the elements in the sample can be determined from the amount of light emitted. Atomic Fluorescence Spectroscopy (AFS) is a technique that measures the amount of light emitted by atoms in a sample after being excited by a high-energy source. AFS works by exciting the atoms in the sample with a high-energy source such as a laser. When the atoms return to their ground state, they emit light of specific wavelengths, which can be used to identify and quantify the elements present in the sample. A detector measures the amount of light emitted by the atoms, and the concentration of the elements in the sample can be determined from the amount of light emitted [5].

Discussion

ICP-AES has several advantages for the analysis of heavy metals in seaweed samples, including its high sensitivity, accuracy, and precision. ICP-AES can determine the total concentration of a metal in a sample, as it measures the concentration of the analyte in the entire sample. Additionally, ICP-AES is less prone to interferences from other elements than AAS. Heavy metals are ubiquitous in the environment and can be present in significant concentrations in seaweed species. These heavy metals can pose a potential threat to human health, as they can accumulate in the food chain and be consumed by humans through the consumption of seafood. Therefore, the analysis of heavy metals in seaweed species is of great importance in food safety and environmental studies. Atomic spectroscopy is a powerful analytical

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technique that can be used to determine the concentrations of heavy metals in seaweed samples. In this essay, we will discuss the principles of atomic spectroscopy and how it can be used to analyze heavy metals in seaweed species [6].

Conclusion

AAS can be used to analyze heavy metals in seaweed samples. AAS works by passing a beam of light through a sample containing the atoms of interest. The atoms in the sample absorb some of the light, and the amount of light absorbed is proportional to the concentration of the atoms in the sample. The concentration of the heavy metals in the seaweed samples can be determined from the amount of light absorbed. Seaweed species can accumulate heavy metals from the environment through various pathways such as atmospheric deposition, ocean currents, and runoff from land. Heavy metals can pose a potential threat to human health, as they can accumulate in the food chain and be consumed by humans through the consumption of seafood. Therefore, the analysis of heavy metals in seaweed species is of great importance in food safety and environmental studies.

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Conflict of Interest

There is no conflict of interest by author.

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