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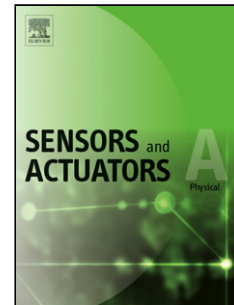
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Detection methods of Nitrate in water: A Review

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Abstract

Water contamination is a major problem all over the world and it is important to monitor the contaminating ions regularly to keep the groundwater or drinking water safe. The nitrate ion has a great impact on human health and the environment, and excessive use of this ion will damage the ecological system and the natural environment. Nitrate ions can be detected through laboratory-based methods or *in-situ* sensor-based methods to develop a monitoring system. Some such systems have a high sensitivity with a good limit of detection (LOD), but with expensive instrumentation. Others have a reasonable sensitivity with reduced cost where the proposed detection method uses a sensor-based portable sensing system. This review paper discusses the different detection and determination methods of nitrate ions in water. The various characteristics of the detection methods, such as the LOD and systems limitations, are included.

Keywords: Nitrate, Electrochemical, Electromagnetic, Chromatography, Flow-Injection Analysis

1. Introduction

Nitrogen is the most common natural element in the atmosphere, being nearly 80% of the air we breathe [3]. Nitrogen can be found in gaseous form in the air, such as Nitrogen (N_2), Nitrous oxide (N_2O), Nitric oxide (NO), Nitrogen dioxide (NO_2), and Ammonia (NH_3) [4]. Some of these gases react with rainwater and produce nitrate and ammonium ions, which can become part of the soil layer, or mix with groundwater in solution. Intake of the nitrate ion has several positive aspects for the human body, such as improved blood flow, reducing blood pressure, and cardio-vaso-protective effects. However, negative effects can occur to the human body with an excessive intake of nitrate ions, especially through drinking water, such as gastric, cancer and Parkinson's diseases. Infants can suffer "blue baby syndrome" or methemoglobinemia [5] which reduces the oxygen content of the blood [6, 7]. It affects those infants who are less than six months old.

The Nitrate ions have been successfully utilized in some of our various activities, but there is no doubt that our fondness for them has diminished in recent years due to their excessive use. The excessive and continuous use of nitrate has caused enormous problems and raised numerous concerns [8, 9]. These problems have been identified widely all over the world, and as a result different international and government organizations have created frameworks to control the level within the

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