
**Soil quality — Determination of
perchlorate in soil using liquid
chromatography-tandem mass
spectrometry (LC-MS/MS)**

*Qualité du sol — Détermination du perchlorate dans le sol par
chromatographie en phase liquide couplée à la spectrométrie de
masse en tandem (CL-SM/SM)*





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Foreword

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Introduction

Although perchlorate (ClO_4^-) occurs naturally, it is mainly considered a manmade anion. Usually, it is combined with NH_4^+ , Na^+ , and K^+ to form ammonium perchlorate, potassium perchlorate, and sodium perchlorate, respectively. It has been reported that more than 90 % of manufactured perchlorate is used in military activities. Due to the outstanding oxidizing capacity of perchlorate, it is added to propellant for rockets, missiles, and satellites. Various routes of manmade perchlorate exposure to soil can be assumed. For example, complete or incomplete explosion of a signal bomb in a target or impact area, an oversupply of perchlorate for complete combustion at firing points, and large-scale fireworks display can be sources of perchlorate exposure to soil. Additionally, other routes could come from waste treatment processes. Because perchlorate in missiles naturally deteriorates over time, they need to be recharged. In the past, incineration was the preferred treatment for deteriorated perchlorate. When the incineration process is carried out in an open space and kept as ash onsite without caution, this becomes a detrimental route for soil contamination. Perchlorate is very stable in water and is not strongly retained by soil particle. As such, surface water or groundwater can become easily contaminated by the surface runoff or the leaching process. Perchlorate in growth medium also contaminates vegetation. This kind of pathway could subsequently affect higher level organisms through the food chain. Perchlorate contamination of drinking water and the food chain can potentially affect human health through interfering with iodide uptake by the thyroid gland. This kind of interference causes a decrease in thyroid hormone production and leads to hyperthyroidism. The permitted level of perchlorate concentration in drinking water is below 15 ppb in South Korea. Although some states in the USA have an advisory level for perchlorate in drinking water, it is very difficult to find a country which regulates the perchlorate level in soil as perchlorate contamination of soil is rare in normal circumstances. However, perchlorate is considered a major contaminant in military fields and so the management of perchlorate in soil is necessary. Accordingly, ISO 20295 proposes a standard method for determining perchlorate in soil using ion chromatography. For the standard method of ISO 20295, the limit of quantitation of perchlorate is 0,1 mg/kg soil. However, since perchlorate in soil is frequently found to be lower than the designated level, an analytical method for determining perchlorate at ppb levels is required. For this purpose, a standard method for analysing the trace level of perchlorate in soil has been developed.