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Soil quality — Determination of perchlorate in soil using ion chromatography

Qualité du sol — Détermination du perchlorate des sols en utilisant la chromatographie ionique

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Foreword

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This document was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 3, *Chemical and physical characterization*.

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Introduction

Although perchlorate occurs naturally, it is mainly a manmade anion (ClO_4^-). Usually, it is combined with NH_4^+, Na^+ and K^+ to form ammonium perchlorate, potassium perchlorate, and sodium perchlorate, respectively. It was reported that more than 90 % of perchlorate is used in military activities. Due to the excellent oxidizing capacity of perchlorate, it is added into propellant of rocket, missile, and satellite. We can presume some routes of manmade perchlorate exposure to soil and groundwater. For example, complete or incomplete explosion of the signal bomb (containing about 2 000 µg of perchlorate) in target or impact area, oversupplying of perchlorate for complete combustion in firing point, grand scale of fireworks could be the route of perchlorate exposure to soil and groundwater. In addition to these, other route could come from waste treatment process. Because perchlorate in missile is naturally deteriorated according to time, it should be recharged with a new one. In the past, incineration was preferred for the treatment of deteriorated perchlorate. When the incineration process was carried out in open space and kept as ash on site without any caution, it could be an important route of soil and groundwater contamination. Perchlorate is very stable in water and is not adsorbed easily on soil particle. From that view, surface water or groundwater could be contaminated more often than soil due to surface runoff or leaching process. However, perchlorate can also contaminate soil and vegetation. This kind of contamination could affect high level organisms in food chain. Perchlorate contamination of drinking water and food chain potentially affect human health because it can interfere with iodide uptake by the thyroid gland. Through this kind of interference, thyroid hormone production is decreased and it cause hyperthyroidism. The permitted level of perchlorate concentration in drinking water is below 15 ppb in Korea. Some states in the USA have an advisory level for perchlorate in drinking water. It is very difficult to find a country to regulate perchlorate level in soil because it seems that perchlorate contamination of soil is very rare in normal areas. However, perchlorate could be one of the major contaminants at a target area or firing point in military field and it is needed to manage the perchlorate concentration of soil to protect the vegetation, surface water, and groundwater. For this purpose, a standard method for perchlorate analysis in soil has been developed.