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Australia



Analysis of acid sulfate soil — Dried samples — Methods of test

Part 0: General series information



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Environment Protection Authority (Victoria)
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National Measurement Institute
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Preface

This Standard was prepared by the Standards Australia Committee EV-009, Sampling and Analysis of Soil, to supersede AS 4969.0—2008, *Analysis of acid sulfate soil—Dried samples—Methods of test, Part 0: Introduction and definitions, symbols and acronyms*.

The objective of this document is to provide industry bodies, consulting organizations and regulators with standard procedures for pre-treatment protocols and analytical methods that will assist them in setting a basis for acid sulfate soil assessment.

A list of all parts in the AS 4969 series can be found in the Standards Australia online catalogue.

The major change in this edition is the inclusion of new Australian guidance documents for acid sulfate soil published by the Australian Government Department of Agriculture and Water Resources.

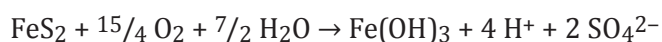
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Introduction

In Australia, it is estimated that acid sulfate soils (ASS) occupy an area of 215,000 km², of which 58,000 km² occur in coastal areas (Fitzpatrick et al., 2008). Acid sulfate soils belong to a special group of soils that, because of the many complex chemical reactions associated with them, require specialized sampling, pre-treatment and analytical methods for their characterization, in order to implement appropriate management practices that ensure they will have minimal impact on the environment.

Acid sulfate soils are a complex group of predominantly low-lying coastal soils and sediments that contain iron sulfides and/or their oxidation products. Typically the sulfide present is in the form of pyrite, (FeS₂), although in some instances iron “monosulfides” may be important. Acid sulfate soil is most prevalent in tropical and sub-tropical regions but also occurs in temperate and sub-arctic regions. When maintained in reduced and waterlogged conditions, the pyrite and other sulfides in these soils will not oxidize and when they are in this state the soils are generically termed potential acid sulfate soils (PASS). However, when these soils are exposed to atmospheric and dissolved oxygen by any disturbance, the sulfides they contain oxidize to sulfate and ferric ions, producing acid at the same time. The complete oxidation of pyrite by oxygen is generally represented by the following equation:



However, the oxidation of pyrite does not always go to completion in the short term, with oxidation products other than ferric hydroxide and sulfuric acid often forming. The iron hydroxy-sulfate mineral jarosite [KFe₃(SO₄)₂(OH)₆], can be a conspicuous product of the oxidation process in acid sulfate soil. These oxidation products, as well as other metal ions from the soil (e.g. aluminium) that are dissolved by the acid, can have deleterious environmental, agronomic and economic impacts. If the pH of these soils falls to 4 or below (as a consequence of sulfide oxidation), they are generically termed actual acid sulfate soils (AASS). When potential acid sulfate soil contains carbonate or other minerals with an acid neutralizing capacity (ANC) (e.g. calcite in the form of finely divided shell material), they may not become acidic when they oxidize.

Because of the many possible complex chemical reactions, the characterization of acid sulfate soil using analytical methods can be a complex process, but accurate characterization is crucial to the management of these soils. Chemical analysis provides the data necessary to assess the acid-producing potential of these soils. From these data, acid base accounting (ABA) can be used to determine the dosing rate of alkaline ameliorants needed to fully treat any net acidity that may be produced. Once dosed appropriately, these soils should not generate acidity, thereby minimizing potential adverse impacts on the environment and/or infrastructure.