

# Australian Standard<sup>®</sup>

AS 4969.14—2009

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

### Method 14: Calculation of the acid-producing potential of acid sulfate soil using an acid base accounting method

#### PREFACE

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee EV-009, Sampling and Analysis of Soil and Biota and Working Group EV-009-02-01, Analysis of Acid Sulfate Soil.

The objective of this Standard is to provide a method for the calculation of acid-producing potential in acid sulfate soil.

#### METHOD

##### 1 SCOPE

This Standard provides an acid base accounting method to calculate the net acid-producing potential of acid sulfate soil materials by individually assessing the acid producing capacity due to oxidation of inorganic sulfides, the existing acidity and the effective acid consuming capacity.

NOTE: If the acid-producing capacity due to inorganic sulfide oxidation exceeds the effective acid consuming capacity then the soil material is termed an acid sulfate soil requiring careful management to avoid adverse environmental effects due to acidification.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which it applies. An ‘informative’ appendix is only for information and guidance.

##### 2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard.

AS

- |        |                                                                                                                                                  |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| 4969   | Analysis of acid sulfate soil—Dried samples—Methods of test                                                                                      |
| 4969.0 | Part 0: Introduction and definitions, symbols and acronyms                                                                                       |
| 4969.2 | Method 2: Determination of $pH_{KCl}$ and titratable actual acidity ( $TAA$ )                                                                    |
| 4969.3 | Method 3: Determination of peroxide pH ( $pH_{OX}$ ) and titratable peroxide acidity ( $TPA$ ) and excess acid neutralizing capacity ( $ANC_E$ ) |

- 4969.4 Method 4: Determination of 1 M potassium chloride extractable sulfur ( $S_{\text{KCl}}$ ), calcium ( $Ca_{\text{KCl}}$ ) and magnesium ( $Mg_{\text{KCl}}$ )
- 4969.6 Method 6: Determination of acid extractable sulfur in soil residue after peroxide oxidation ( $S_{\text{RAS}}$ )
- 4969.7 Method 7: Determination of chromium reducible sulfur ( $S_{\text{CR}}$ )
- 4969.9 Method 9: Calculation of titratable sulfidic acidity ( $TSA$ )
- 4969.10 Method 10: Calculation of peroxide oxidizable sulfur ( $S_{\text{POS}}$ ), reacted calcium ( $Ca_A$ ) and reacted magnesium ( $Mg_A$ )
- 4969.11 Method 11: Calculation of net acid-soluble sulfur ( $S_{\text{NAS}}$ ), calcium ( $Ca_{\text{NAS}}$ ) and magnesium ( $Mg_{\text{NAS}}$ )
- 4969.13 Method 13: Determination of acid neutralizing capacity by back-titration ( $ANC_{\text{BT}}$ )

### 3 DEFINITIONS

For the purpose of this Standard the terms and definitions used in AS 4969.0 apply.

### 4 GENERAL

The method calculates the net acidity of acid sulfate soil. The properties required for such a calculation include:

- (a) The Potential Sulfidic Acidity (acidity that can develop upon oxidation of inorganic sulfides).
- (b) The Existing Acidity, which is the sum of Titratable Actual Acidity (consisting of readily soluble and exchangeable acidity) and Retained Acidity (consisting of sparingly soluble acidity residing in iron and aluminium hydroxy-sulfate phases such as jarosite).
- (c) The Acid Neutralizing Capacity, consisting of exchangeable alkalinity and carbonates.

A Fineness Factor is used to modify acid neutralizing capacity to allow for the often poor reactivity of coarser carbonate or other acid neutralizing materials. The minimum value for the fineness factor is 1.5 for finely divided pure agricultural lime, but may be as high as 3.0 for coarser shell material.

The Net Acidity in the soil material is calculated as given in Clause 6(a).

If Net Acidity is positive then the acid sulfate soil material is considered to be capable of causing adverse environmental effects due to acidification.

A number of approaches exist for the determination of most of the components within the acid base accounting procedure. The individual components can be combined into analytical suites that streamline the process of acid base accounting. The two principal analytical suites are the Chromium suite and the *SPOCAS* suite. These suites are discussed in AS 4969.0.

The results required to complete the acid base accounting vary with the soil actual acidity, as represented by  $pH_{\text{KCl}}$ . Tables A1 and A2 in Appendix A show the analyses required for the Chromium and *SPOCAS* suites respectively. These Tables use results reported in acidity units. Alternatively, results in sulfur units may be utilized.

## 5 PROCEDURE

### 5.1 Determination of Potential Sulfidic Acidity

Potential Sulfidic Acidity, expressed in acid equivalent units, shall be measured as either—

- (a) chromium reducible sulfur ( $a-S_{CR}$ , see AS 4969.7); or
- (b) peroxide oxidizable sulfur ( $a-S_{POS}$ , see AS 4969.10).

### 5.2 Determination of $pH_{KCl}$

The  $pH_{KCl}$  shall be determined using AS 4969.2.

If  $pH_{KCl} < 4.5$  then both the Titratable Actual Acidity (see AS 4969.2) and the Retained Acidity (see AS 4969.6 or AS 4969.11) need to be determined.

If  $4.5 \leq pH_{KCl} < 6.5$  then the Titratable Actual Acidity (AS 4969.2) needs to be determined.

If  $pH_{KCl} \geq 6.5$  then the Acid Neutralizing Capacity (either AS 4969.3 or AS 4969.13) needs to be determined.

### 5.3 Determination of Existing Acidity

Existing Acidity = Titratable Actual Acidity + Retained Acidity

Titratable Actual Acidity ( $TAA$ ) is determined using AS 4969.2.

Retained Acidity expressed in acid equivalent units, is either determined as residual acid soluble sulfur ( $a-S_{RAS}$ ) using AS 4969.6 or calculated as net acid soluble sulfur  $a-S_{NAS}$  using AS 4969.11 and AS 4969.4.

If jarosite is visibly identified in the sample then Retained Acidity needs to be determined regardless of the  $pH_{KCl}$  of the sample.

### 5.4 Determination of Acid Neutralizing Capacity

Acid Neutralizing Capacity, expressed in acid equivalent units, shall be measured where  $pH_{KCl} \geq 6.5$  by determining—

- (a) acid neutralizing capacity by back titration ( $a-ANC_{BT}$ , see AS 4969.13); or
- (b) excess acid neutralizing capacity ( $a-ANC_E$ , see AS 4969.3) in combination with peroxide oxidizable sulfur ( $a-S_{POS}$ , see AS 4969.10), where  $pH_{OX}$  (see AS 4969.3) is greater than 6.5; or
- (c) calculating titratable sulfidic acidity ( $TSA$ , see AS 4969.9), in combination with peroxide oxidizable sulfur ( $a-S_{POS}$ , see AS 4969.10), where  $pH_{OX}$  (see AS 4969.3) is less than or equal to 6.5.

#### NOTES:

- 1  $ANC$  can be determined by alternate methods such as inorganic carbon ( $C_{IN}$ ) or the sum of reacted calcium ( $a-Ca_A$ ) plus magnesium ( $a-Mg_A$ ) (see AS 4969.10).
- 2  $a-ANC_{BT}$  is usually utilized to calculate the  $ANC$  component in the chromium suite for acid base accounting (see Table A1 and AS 4969.13).
- 3  $a-ANC_E$ ,  $TSA$ ,  $a-Ca_A$  and  $a-Mg_A$  are usually utilized to calculate the  $ANC$  component in the  $SPOCAS$  suite for acid base accounting (see Table A2 and AS 4969.0).

### 5.5 Fineness Factor

The minimum value for the Fineness Factor is 1.5 for finely divided pure agricultural lime and finely divided carbonates in soil, but may be as high as 3.0 for coarser shell material.

NOTE: A default value of 1.5 is typically used for the fineness factor but the appropriate regulatory authority should be consulted in each state regarding the application of the fineness factor.