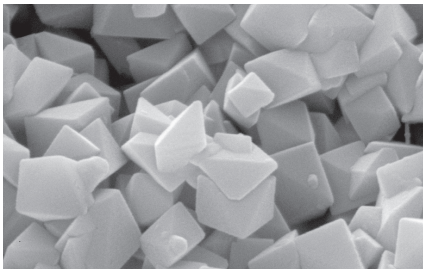
EAL Environmental Analysis Laboratory

Interpreting acid sulfate soil field pH screening results

Field pH tests can be used to screen acid sulfate soil (ASS) samples for further laboratory testing. The test compares the field pH (pH_F) of a soil:water suspension with the pH of another sub-sample, reacted with hydrogen peroxide (pH_{FOX}).

The pH_F relates to the acidity present in the field at the time of sampling. A $pH_F < 4$ may indicate the presence of acidity from the oxidation of sulfides. However, organic-rich soils, such as peats and heavily fertilised soils, can also have low pH.

The pH_{FOX} is intended to represent the acidity present in the field at the time of sampling, plus the acidity that would develop if all sulfides were oxidised. However, other soils constituents, such as organic matter and manganese oxides, can produce large amounts of acidity and a vigorous reaction following addition of H_2O_2.

A comparison of pH_F and pH_{FOX} (ΔpH) gives a better indication of the presence of ASS. The greater the drop in pH following the addition of H_2O_2 the stronger the indication of ASS. A combination of a large ΔpH, a strong reaction with H_2O_2 and a $pH_{FOX} < 3$ is most suggestive of ASS. However, confirmation of ASS can only follow appropriate laboratory quantification.

EAL recommends the Chromium Suite for identification of ASS. The Chromium Suite does not suffer from the interferences inherent in the alternative methods.

The following tables provide guidance on interpreting pH_F and pH_{FOX}

pH Value	Result	Comments
$pH_F \leq 4$	Actual acid sulfate soils (AASS) indicating oxidation of sulfides.	Generally not conclusive as highly organic soils, such as peats and heavily fertilised soils, may also give $pH_F \leq 4$.
$pH_F \leq 3.7$	Expected if jarosite exists in the sample.	May be AASS. Jarosite needs a pH of 3.7 or lower to form. Horizons with jarosite and other mottling (red, grey) mixed through higher pH soil may have a pH > 3.7. This depends on the level of oxidation and the ability of the soil to 'hold' the acidity.
$pH_F > 7$	Expected in waterlogged, unoxidised, or poorly drained soils.	Marine muds commonly have a pH > 7 which reflects a seawater (pH 8.2) influence. Oxidation with H_2O_2 required to determine if it is potential acid sulfate soil (PASS).
$4 < pH_F \leq 5.5$	An acid soil.	Investigate further for a possible ASS link, for example, it could be an AASS with shell present.

Source: modified from DER 2015

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pH Value	Result	Comments
Strong reaction with H_2O_2	Useful indicator but cannot be used alone.	Organic rich substrates such as peat and coffee rock, and soil constituents like manganese oxides, can also cause a reaction. Care must be exercised in interpreting these results.
pH_{FOX} value at least one unit below field pH_F and reaction with H_2O_2	May indicate PASS, dependent on the pH_F and pH_{FOX}.	Larger pH changes (ΔpH) are more indicative of PASS. The lower the final pH_{FOX} the better the indication of a positive result. For example, a change from pH 8 to 7 would not indicate PASS, however, a unit change from pH 3.5 to 2.5 would be indicative.
pH_{FOX} < 3, large ΔpH and a strong reaction with peroxide	Strongly indicates PASS with a potential for the soil to produce sulfuric acid on oxidation.	The lower the pH_{FOX} below 3, the greater the likelihood of finding sulfides. A combination of all three parameters – pH_{FOX} ΔpH and reaction strength – gives the best indication of PASS.
pH_{FOX} 3–4 and reaction with H_2O_2	Less positive and a borderline result.	Sulfides may be present, however, organic matter may also be responsible for the decrease in pH. Laboratory analyses are required to confirm the presence of sulfides.
pH_{FOX} 4–5	Neither positive nor negative.	Sulfides may be present in small quantities, poorly reactive under rapid oxidation, or the sample may contain shell/ carbonate which neutralises some or all acid produced on oxidation. Equally, the pH_{FOX} value may be due to the production of organic acids with no sulfides present.
pH_{FOX} > 5, small or no ΔpH, but reaction with H_2O_2	Net acidification low level to none.	For neutral to alkaline pH_F with shell or white concretions, the fizz test with 1 M HCl can be used to identify carbonates.

Source: modified from DER 2015

Please refer to the following documents for more detail on interpreting field pH screening results:

Ahern, CR, Ahern, MR and Powell, B. 1998. Guidelines for sampling and analysis of lowland acid sulfate soils (ASS) in Queensland. Queensland Department of Natural Resources: Brisbane, Qld. Pp. 28–30.

Ahern CR, Stone, Y and Blunden, B. 1998. Acid sulfate soils assessment guidelines. Acid sulfate soils manual. Acid Sulfate Soil Management Advisory Committee: Wollongbar, NSW. Pp. 56–58.

DER. 2015. Identification and investigation of acid sulfate soils and acidic landscapes. Acid Sulfate Soils Guideline Series. Department of Environment Regulation: Perth, WA.

Hey, KM, Ahern, CR and Watling, KM. 2000. Using chemical field tests to identify acid sulfate soil likelihood. In: Ahern, CR, Hey, KM, Watling, KM and Eldershaw VJ (eds.) Acid sulfate soils: environmental issues, assessment and management, Technical Papers. Queensland Department of Natural Resources: Brisbane, Qld. Pp. 16/9–16/12.

Hey, KM (ed.) 2002. Field testing, sampling and safety for acid sulfate soils. Queensland Department of Natural Resources and Mines: Brisbane, Qld. Pp.12–16.

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