Test kits for water sampling

1 Purpose and scope

This document provides background information on the use of test kits for water sampling.

2 Introduction

Test kits are used for rapid testing of water quality and can provide on-the-spot water quality information. However, test kits are often subject to a range of limitations and interferences and should be used with caution. Different brands and types of test kit can differ in a number of ways, such as in the level of accuracy, limit of detection, detection range and method used for the testing. The results produced by test kit-based analyses can also vary depending on whether they are being used to analyse freshwater, wastewater or saline waters. The most suitable test kit for each application should always be chosen and all instructions should be strictly followed.

Test kits should only be used in three situations:

- As a screening tool for the presence of an analyte of interest. The test kit must be capable of detecting the analyte at the environmentally significant concentration. If the analyte is detected, a water quality sample **must** be taken to determine a more reliable result through laboratory analysis.
- Where the holding time for an analyte is so short that it is not possible for the sample to be analysed by a laboratory (see example of chlorine below). In this case the test kit **must** be validated before use. It may be appropriate to undertake validation in conjunction with a National Association of Testing Authorities (NATA) accredited laboratory.
- As an emergency backup for instrument readings (for example, a damaged pH probe).

The performance of test kits must be verified to ensure they are fit for their intended purpose. Validation experiments covering, for example, the analytical range of the test kit should be undertaken before a particular test kit is used in the field. Validation should be undertaken in conjunction with a NATA accredited laboratory. Standards (if they are available) should be used to check results from a test kit each time it is used.

Key points regarding the use of test kits:

- Check the expiry date of the test kits and reagents and do not use them if it has passed.
- Store test kits correctly (for example, within the nominated temperature range, or out of direct sunlight, etc.).
- If possible, use the same test kit for the entire sampling program in order to reduce the risk of getting slightly different results from different test kits.
- If the test kit requires the same equipment to be used for each sample (for example, a tube to hold the water sample, or a dropper to transfer the sample), make sure it has been appropriately cleaned to minimise risk of cross-contamination.
- When using a test kit that relies on a colorimetric comparison to a reference chart, photograph the test solution against the colour chart (as in Figure 1).
- Water containing suspended particulate matter can potentially affect test kit results even at low concentrations, and so should be filtered appropriately before using the test kit.

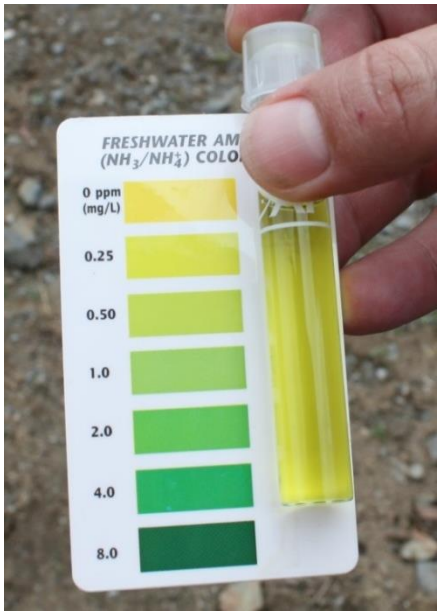

Figure 1: Freshwater ammonia test kit including tested water sample in vial and colour chart

3 Chlorine—an example of the suitable use of test kits

Chlorine is widely used for disinfection of public water supplies, swimming pools, and treated wastewaters. Some of the chlorine can be consumed in reactions with substances present in the water including ammonia, nitrite, and organic matter, producing chloramines and other disinfection by-products. Chlorination usually involves the addition of a measured dose of one or more of the following - chlorine gas (Cl_2), sodium hypochlorite (NaOCl), or hypochlorous acid (HOCl). The addition of chlorine gas alone results in a mix of all three in proportions dependent on factors such as pH and temperature.

The terms ‘free chlorine’ or ‘free residual chlorine’ are used to refer to the concentration of dissolved chlorine gas, hypochlorite ion, and hypochlorous acid left after the initially added chlorine has reacted with water constituents. The term ‘combined chlorine’ refers to chloramines produced by the reaction of chlorine with (most commonly) ammonia, and the terms ‘total chlorine’ or ‘total residual chlorine’ refers to the sum of ‘free chlorine’ and ‘combined chlorine’. Because the levels of ‘free chlorine’ relative to ‘combined chlorine’ can change over a very short period of time, it is usual to measure chlorine using a test kit or probe attached to a water quality meter. Test kits commonly used for chlorine testing are based on a colorimetric system, involving the addition of a chemical DPD (N, N-diethyl-p-phenylenediamine), typically supplied in the form of tablets or powder in a sealed container, to be applied to a prescribed volume of sample water. The intensity of pink colour produced by the reaction of the DPD with the chlorine present in the water is then measured.

The methods used to measure the colour intensity vary between test kit types. Simple kits involve comparison by eye of the colour intensity with a calibrated chart or filter (similar to the ammonia chart illustrated in Figure 1). More sophisticated (and accurate) methods measure colour intensity digitally, using a handheld spectrophotometer. The results from DPD-based test kits may be adversely influenced by colours and interferences from chemicals present in the waters being tested.