pH of Distilled Water

■ Introduction

Pure water, whether from a still, deioniser or reverse osmosis system, is an excellent solvent and will dissolve carbon dioxide from the atmosphere to form a very dilute solution of carbonic acid with a pH below 7. The reason tap water is not similarly acidic is that the buffering effects of the other contaminants in the water mask the effect of the dissolved carbon dioxide. In a water still, this solution can form as the steam liquefies in the condenser, resulting in a distilled water output with a pH which may be as low as 4, although pH 5.0 to 6.5 is more usual.

■ Acidity level

Many people are concerned about this seemingly highly acidic solution – but take a moment to consider the actual level of acidity involved. A solution of pH 5 would be obtained by taking just 0.01ml of molar hydrochloric acid and diluting to 1 litre.

How much CO_2 will cause a pH of 5 in distilled water?

pH is defined as the negative of log_{10} of the molar concentration of the hydrogen ion.

Therefore, if pH = 5, $[H^+]$ = 0.00001g/l or 0.01mg/l

Since 1 molecule of CO_2 releases 2 hydrogen ions, this concentration of H^+ ions would be produced by just 0.22mg/ml of CO_2, i.e. 0.22ppm.

A pH of 4 would, therefore be caused by just 2.2ppm of carbon dioxide in solution.

An acidity of pH 4-5 does not mean that the water is grossly contaminated, as only very few parts per million of dissolved carbon dioxide will result in a pH value in this range.

■ Neutralising or removing the acidity

In those applications where pH is critical, such as some microbiological and tissue culture procedures, the effect of dissolved carbon dioxide can be overcome by the addition of buffer solutions to the reaction mix but the effect on most laboratory procedures is negligible.

If absolutely necessary, the carbon dioxide may be removed by boiling the water but then great care must be taken to protect the water from contact with the air until it has cooled, otherwise it will very quickly redissolve.