Understanding pH – pH Without Tears Part 1 by Barry Moore from Tank Talk Volume 12 No 4 1988

pH WITHOUT TEARS -- Part 1: the Concept

by Barry Moore

What is pH? And why is it so difficult to understand? Well it involves some molecular chemistry --and that is certainly not everyone's speciality. So let's start at the beginning and see what we can make of it.

pH is really short for the Latin pondus Hydrogenii, which literally means 'weight of hydrogen', in other words, the amount or concentration of hydrogen ions in an aqueous solution. Now we all know that the chemical formula for water is H_2O and it happens that in pure, neutral water a very small amount of dissociation occurs into hydrogen ions (H^+) and hydroxyl ions (OH^-): $H_2O \longleftrightarrow H^+ + OH^-$ Since one hydrogen ion and one hydroxyl ion result from each molecule of water dissociating, their concentrations in pure water are obviously equal. Now it happens that when the two concentrations are multiplied together the result is **always** 10^{-14}. At neutrality each of them is therefore 10^{-7} ($10^{-7} \times 10^{-7} = 10^{-14}$).

Since the concentrations of H^+ and OH^- are interdependent in this way, it is not necessary to specify both of them and convention has it that the hydrogen ion is the one chosen. The pH is thus defined as the 'negative decadic (that is to the base 10) logarithm of the hydrogen ion concentration' which, in the above case of pure water, is therefore 7.

Now adding an acid to the water causes the H^+ concentration to rise, which means of course that its negative logarithm must fall, so a pH value of 6 indicates an acidic solution with a H^+ concentration 10 times higher than in neutral water; a pH of 5 means 100 times higher and so on. In each case the OH^- concentration drops correspondingly, to maintain the product of the 2 ions at 10^{-14}.

On the alkaline side, the H^+ concentration is less than in neutral water, so a pH of 8 indicates a solution with only 1/10 the concentration; a pH of 9, only 1/100 and so on. In these cases the OH^- concentration is higher by the same factors, of course.

How do we measure pH and what has it all to do with keeping fish? Well, these are certainly important questions that reflect on the quality of the water we are using, but they will have to be dealt with in later articles of this series.

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