HOW TO HANDLE pH TROUBLES

by Rene Jez

This article is a follow-up to the 3-part series by Barry Moore in previous issues of this magazine (see TANK TALK 13 (2): 38). It is the result of monitoring the practical problems of different tank set-ups and these findings and remedies help to illustrate the severity of the difficulties one can encounter in the hobby.

Let's start with a little bit of history. Some 10-15 years ago I had very little trouble in combatting changes of pH. The tanks were full of plants and with very modest numbers of fish. Tanks of size 120 x 35 x 45 cms, with 40-60 tetras, would not show a significant increase in nitrate count or appreciable shift in pH for several months. Maintenance was limited to simple syphoning of debris from the tank bottom, for I have discarded all filters as unnecessary gadgets in tanks that were trouble-free.

My battle with keeping the pH within reasonable limits (6.0-7.0) started with the use of some bare tanks, with no gravel or plants. I filled them with 400-600 fish a time and suddenly, some inexplicable fish losses started to occur. I had to try to diagnose the reasons. Part of the problem was probably mixing fish of differing tolerances to low pH values. For example, Emperor Tetras are easily adapted to pH 5.0, whereas young Black Neons would die under such conditions, without any indication of disease, apart from some changes in behaviour and breathing rhythm.

As I was not monitoring the water conditions, I had to rush to buy a pH measuring kit and I chose the cheap Wardley junior model. This proved totally unsuitable because of the very minor colour changes in response to large shifts in pH. The logical next step was to replace it with the Tetra pH kit, where the colour scale is very wide (from red, yellow, green to blue).

I have lived for a long time with the endless 'drop here, drop there' approach, in trying to economise in use of the test liquid, but have been frustrated by the continuous need to rectify pH and the often wild fluctuations encountered. There were not enough consistent data to form a continuous picture of the pH fluctuations in a given tank.

I had often contemplated buying an electronic pH meter but the prices were prohibitive: an Australian model was $450 and the equivalent from Silicon Valley was about US$250. As a desperate try I purchased a Woolworth's garden pH meter ($15) which, for my purpose, was a complete waste of money spent, and my frustration mounted. However, by happy chance, our Secretary, Mike Owen, mentioned an advertised electronic meter kit, so I was back to former plans. The kit was not exactly cheap ($120) in view of the work it entailed and the expertise required.

My knowledge of electronics is rather limited but quite a few years ago I had built a Hi-fi tuner, with a friend's help. So I started to solder painstakingly a number of capacitors, resistors and transister chips on the supplied printed circuit and with my electronically educated friend, tuned the thing to produce some readings. The outcome was a reasonable looking device registering pH as promised.

The ease of handling and the quick readings for successive tanks suggested a further step: instead of recording data I prepared a simple chart, where dates and coloured dots represented pH readings and water changes.

The picture emerging from the chart was surprising: no really new discoveries but it has shown the frequency and speed of pH shifts for particular tanks. This is not scientific research, for the starting conditions were not standardised but it does help to illustrate the problem of fluctuating pH and the final remedy I have used.

The basic conditions for the exercise were the following:-

1. Canberra water is very soft and its pH is regulated at the treatment plant (by adding lime) to attain 7.2-7.5.

2. My fish are fed mostly with live food but occasionally with lean beef or beef heart, prepared in a food processor.

The prepared food has the tendency to increase waste products, through its high content of very fine particles. In previous articles in TANK TALK, I described the nitrifying process and its impact on balance and concentration of H^+ ions in tank water and further details are given in Barry Moore's articles.

The following charts show pH movements in different tank set-ups, plantings, gravels and numbers of fish. The graphics on these charts represent, by dotted lines, the drop in water volumes present in tanks during water changes, and by full lines, the fluctuations in pH. Dashed lines show rectification of pH through addition of sodium bicarbonate (baking soda).

The gravel with shell fragments was a natural mix of coastal pebbles and shells found in a particular location. All tanks were without any filtering system and aeration was provided by a single small airstone, the commonly available product. Water changes were irregular, with frequencies indicated on the charts, most of this work being undertaken at weekends.

The conclusions to be drawn from the charts are simple:-

1. Do not overcrowd the tanks.
2. Keep plants in the tanks to use up some of the nutrients.
3. Use scavengers (snails, bristlenose, catfish) to deal with algae and leftovers.
4. Use buffer protection to slow down drift in pH.
5. Check and adjust pH frequently.

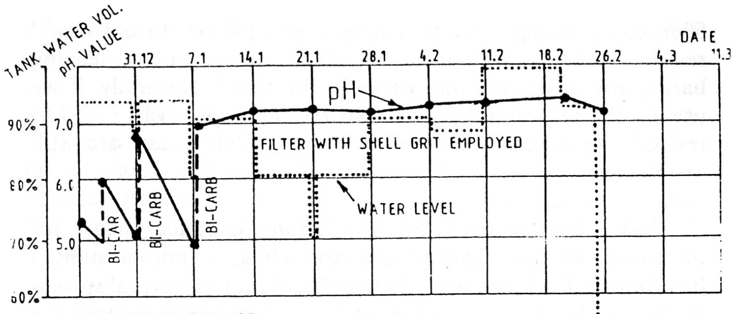
Now what is the best approach to pH control? Well the answer is not to rely entirely on water changes. Frequent use of such changes is often of little use in this context. A water change is certainly justified to lower nitrate content but one needs inordinately large changes to have a significant effect on pH, particularly if the new water is close to neutrality. The system behaves according to the Ostwald dilution law. Thus when adjusting our tank water from pH 4.0 to 5.0, we need 1 litre of new (neutral) water to every litre of tank water, i.e., a 50% water change, whereas to go from pH 5.0 to 6.0 would require a 90% change and from 6.0 to 7.0, even more, leaving hardly any of the original water in the tank! Naturally, if we use Canberra water for the changes, its higher pH (7.2-7.5) reduces significantly the volume ratios but these are still excessive.

Thus it is often necessary to use some chemical means for increasing the pH and a safe and cheap agent is sodium bicarbonate (baking soda). Prepare a solution of several spoons of the powder in water and pour the required quantity into the tank. After carrying out several adjustments, one knows that a particular tank needs, say, 2 spoons of the solution to bring the water from pH 5.0 to 7.0. The action is quick but fish do not show any particular stress. Incidentally, the pH adjusting agent sold in pet shops is more expensive.

Such chemical treatment removes H^+ ions to form safe soluble compounds but the whole step is just a short-term rectification and frequent repetition is often necessary.

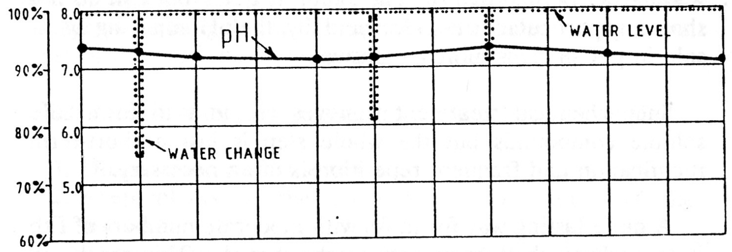
A more lasting way for tanks with moderate numbers of fish is to include shell fragments in the gravel. This results in prolonged pH control. Even better is placing the shell-grit in the filter. The quantity needed depends on the size of the tank (a handfull for a standard 4-footer). The action is quite fast and in 2-3 days the pH reading should be close to 7.2-7.5. Then the pH stabilises but it progressively diminishes in the long term, as bacteria envelop the grit surface. Snails of course love the alkaline environment.

As mentioned above, most of the fish are not affected by the corrective adjustments of pH but care must be taken with fish transported from different water as a simultaneous change in pH, temperature and nitrate concentration can give rise to shock.



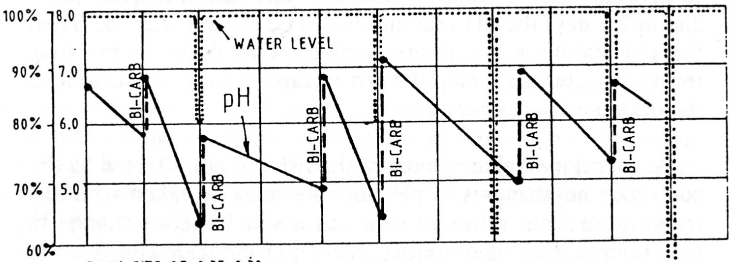
TANK SIZE 1.2×0.35×0.45m
20×PLANT BARCLAYA LONGIFOLIA IN CONTAINERS
HALF BOTTOM BARE GLASS
7×LARGE DISCUS

FIG. 1.



TANK SIZE 1.2×0.35×0.30m
50×PLANT CRYPTOCORYNE
BOTTOM GRAVEL WITH EST.HANDFULL OF SHELL FRAGMENTS
60×NEON & PENCIL TETRA

FIG. 2.



TANK SIZE 1.2×0.35×0.30m
NO PLANTS
BOTTOM BARE GLASS
400×PENGUIN TETRA

FIG. 3.

In my case, the use of shell-grit opened new aspects of pH control and in certain circumstances, it brought fish into a spawning mode. However, it is not applicable to spawning tanks, where low pH and low hardness are required. Some plants reacted too but, in general, low pH has more harmful effects. Water changes primarily employed for removal of nitrates also lower water hardness, of course.

Obviously one should try to experiment but in many cases the approaches described here will provide the ultimate answer.

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