Comparison of the pH profiles of Aquila™ OEM and a competing solution "SolX": a preliminary investigation.

By Loo San Yeo and Loo Yen Yeo. Verdant EcoLogic Private Limited, Singapore.

Report no. 001-280505-ve-aq / public.

Keywords
GoodAire – revitalisor – revitalizer – botanical concentrates – pH – dilution – Aquila – hydroxyl ions – lipid peroxidation - ROS

Abstract
pH versus dilution curves of both Aquila™ OEM and of a market-comparable solution which we shall call "SolX" were made and compared. The results indicate that both products are different, and that SolX is persistently more alkaline than Aquila™ OEM. A possible source of the basic ions is discussed and concludes considering the potential impact of these ions.

Introduction

A new class of household electrical appliances called "air scrubbers" have come to prominence in the Far East, partially as a result of increased particulate levels from forest fires in Indonesia and the Severe Acute Respiratory Syndrome (SARS) epidemics. Most of these appliances operate in conjunction with solutions diluted from concentrates. The GoodAire® brand owned by Royale Wings International Private Limited, Singapore (RWI) is the market leader in air scrubbers and concentrates.

Aquila™ OEM by Verdant EcoLogic Private Limited is supplied to RWI by a long-term exclusive OEM agreement, which is marketed by the latter under their brand name as GoodAire® concentrates. SolX is a solution which formerly had a significant share in the air scrubber consumables market. Both formulations are not generally known to the public.

This report is an in-house preliminary investigation of the chemical characteristics of both Aquila and SolX in terms of acidity or alkalinity of both products upon dilution, by measuring the concentration of hydronium ions in solution otherwise known as pH.

Materials

The Aquila OEM (Aquila) base test sample did not incorporate essential oils or fragrances. The SolX base test sample did not incorporate essential oils or fragrances. All dilutions were made with potable distilled water based on weight: a specific gravity standard of 1.00 grams per millilitre was adopted. A Shimadzu UW6200H Uniblock Auto-calibrating Precision weighting scale, correct to 2 decimal places, was used to determine the appropriate volume of dilution based on specific gravity. pH was measured using an analytical grade Engineered Systems & Designs pH meter model no: PH57. pH buffer solution standards from Hanna Instruments: HI7007 and HI7010 were used for calibrating the pH meter.

Methods

The specific gravity of Aquila was determined by measuring 1000mls of the solution in a graduated analytical measuring cylinder, and weighting the cylinder's contents in grams to two decimal places. The total weight in grams was divided by 1000 to yield the specific gravity in grams/ml. The specific gravity of SolX was similarly determined.

All dilutions were made by measuring 10.0mls of solution based on specific gravity, and diluting with an appropriate mass of potable distilled water assuming a specific gravity of 1.00grams/ml. For statistical confidence, three separate samples were made per dilution level at 1:5, 1:10, 1:20, 1:50, 1:100, and 1:200 per solution and measured.

Three further samples of each solution at 1:200 dilution were made using ordinary tap water and measured. The 1:200 dilution is a recommended dilution for application.

The pH meter was calibrated according to the two-point system according to the manufacturer's instructions using Hanna Instruments buffer standards at pH7.0 and pH10.0. The pH meter electrode was left immersed in each sample for a minimum of two minutes to allow it to equilibrate. Prior to and after each sample measurement, the electrode was rinsed in potable distilled water and immersed in the pH7.0 standard buffer to verify that it was still calibration and to avoid desiccation.

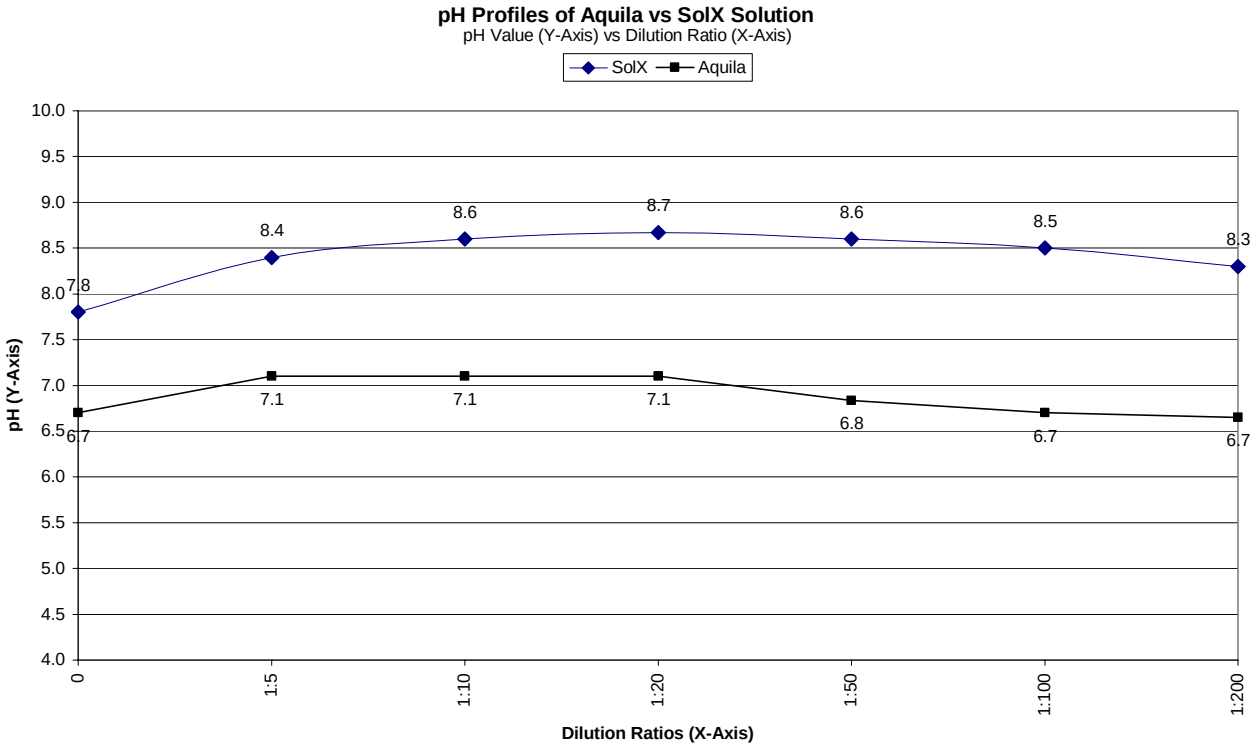
The pH of undiluted Aquila and undiluted SolX were also measured once each as positive controls.

Results

	Specific Gravity	
	SolX Solution	Aquila Solution
1000 mls in grams	983.4	1017.87
grams/ml	0.98	1.02

SolX Solution				
Dilution Ratios (mls)	**Mean Values**	Sample-1	Sample-2	Sample-3
0	**7.8**	7.8	--	--
1:5	**8.4**	8.4	8.4	8.4
1:10	**8.6**	8.6	8.6	8.6
1:20	**8.7**	8.7	8.6	8.7
1:50	**8.6**	8.6	8.6	8.6
1:100	**8.5**	8.5	8.5	8.5
1:200	**8.3**	8.3	8.2	8.4
1:200 (Tap water)	**7.4**	7.4	7.2	7.5

Aquila Solution				
Dilution Ratios (mls)	**Mean Values**	Sample-1	Sample-2	Sample-3
0	**6.7**	6.7	--	--
1:5	**7.1**	7.1	7.1	7.1
1:10	**7.1**	7.1	7.1	7.1
1:20	**7.1**	7.1	7.1	7.1
1:50	**6.8**	6.7	6.9	6.9
1:100	**6.7**	6.7	6.7	6.7
1:200	**6.7**	6.7	6.6	6.2
1:200 (Tap water)	**6.7**	6.7	6.6	6.7



Please note: the graph axes are not to scale - pH values on the Y-axis range from 4.0 to 10.0, not 0.0 to 14.0; and the dilution ratios though broadly geometric are graduated arithmetically.

Discussion

The pH behaviours of Aquila and SolX are clearly different. SolX sustains an elevated pH level on dilution through to a 0.5% solution, although a downward taper can be observed between the 1:100 and 1:200 dilution data points.

In contrast, the pH profile of Aquila remains proximal to that of neutral (pH7.0) upon dilution across all data points, dropping below 7.0 in 2.0% to 0.5% solutions.

The pH values of SolX and Aquila differ upon dilution fairly consistently by an average value of approximately 1.5. Bearing in mind that pH is a logarithmic scale to the base 10 (*i.e.* a solution with a pH value of 8.0 is ten times more alkaline than one of pH value 7.0) SolX is **approximately 50 times** more alkaline than Aquila, even up to the application dilution range of 1:200.

pH values above pH7.0, by definition, indicate a decreased presence of the hydronium ion [H_3O^+] and imply a greater proportion of basic ions in solution.

Therefore, one or more components in SolX are capable of either: supplying the basic ion itself; or are catalysing the hydrolysis of water and sequestering protons resulting in fewer hydronium ions. Since the pH value of SolX remains at about 8.5 upon dilution with water, it is reasonable to attribute the basic properties of the solution to the presence of hydroxyl [$OH]^-$ ions. SolX can be observed in behaving as a buffered solution of approximately pH 8.6.

Although SolX continues to present alkaline properties throughout, the same cannot be said for Aquila which demonstrates a pH close to that of water. With the margins of variance being small (+0.1 to -0.3) no definitive statements can be made about the presence of radical-generating components in Aquila. Furthermore, little inference can be made concerning the presence of buffering components in Aquila given its pH values could be masked by the water used in dilution itself.

1:200 dilutions of both Aquila and SolX were investigated using potable distilled water and ordinary tap water. The former was used due its consistency with respect to SolX.

Conclusions

Although the formulations of SolX and Aquila are not publicly known, information can still be gleaned concerning their respective components and their interactions based on the observation of their physical and chemical characteristics.

This study highlights a striking difference between Aquila and SolX; the higher pH values subsequent to dilution with water of the latter, indicates the probable presence of elevated levels hydroxyl ions.

Whilst hydroxyl ions may be a primary contributor to anti-bacterial activity, they are still members of the Reactive Oxygen Species (ROS). Hence by the same token, their role in damaging cell membranes through interaction with lipids, proteins; and in DNA by interacting with the phosphate-sugar backbone is well documented [1,2,3]

Revitalisers and their solutions are a relatively recent introduction to the commercial marketplace, and as such their long-term benefits and drawbacks have yet to be fully ascertained. The authors would like to draw attention to potential issues related to the long-term exposure of the mucous membranes of the respiratory system to hydroxyl ion generating agents, and would like to indicate this as an area of further research, upon verification of the results presented here by a recognised external body.

Online References

1. http://www.auraresearch.com/freerads.html
2. http://www.sumeria.net/oxy/reactive.html
3. http://www.ispub.com/ostia/index.php?xmlPrinter=true&xmlFilePath=journals/ijanp/vol6n1/radicals.xml

Acknowledgements

Aquila™ OEM is a trademark of Verdant EcoLogic Private Limited, Singapore.
GoodAire® is a registered trademark of Royale Wings International Private Limited, Singapore.
All other trademarks are acknowledged as property of their rightful owners.