A white paper on chemical reduced swimming pool

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Introduction

SIF's proprietary technology: dpasys is a patented system that utilizes the cavitation technology to treat water. Through careful and well defined design parameters, the effects of cavitation are controlled to generate desired effects.

By passing the influent through the inlet of the system, the influent is subjected to high and low pressures within the enclave of the cavitation chamber i.e. de-pressurization and pressurization. This process is designed such that in the de-pressurization process, vapor pockets are formed in the liquid; while in the pressurization process, the bubbles will collapse. The collapse of the bubbles will break down the large clusters of water into smaller clusters, which leaves through the outlet of the system. Through this cavitation process, the effluent will be imparted with substantial improvements in its water quality.

This chemical free treatment system distinguishes itself from conventional cavitation because it does not consist of any mechanical parts, does not require any external power source and works purely on the circulation of the water flow rate.

Background

Chlorine is a common chemical used to disinfect swimming pools. For general pool treatment, chlorine serves three essential purposes namely: a) disinfection agent b) effective algaecide and c) strong oxidizer for unwanted contaminants.

However, there are some undesirable side-effects involved with the use of chlorines and they include: skin/eyes/nose irritation, bleaching effects on hair and possible dental issues if consumed by accident. While alternatives to chlorine have been developed including the use of other chemicals or the use of ion generators, such methods are more expensive and do not achieve the cleanliness and oxidative levels that chlorine produces.

Actual Site Installation

SIF was commissioned to install a dpasys and conduct water quality tests assessment for the waters in a commercial swimming pool. In this evaluation, 2 pools, namely Pool 1 and Pool 2 were tested. Pool 2 was installed with the dpasys to determine its treatment performance with respect to its ability to reduce the chlorine dosage, while Pool 1, without the dpasys was used as a control tool. To establish the capabilities of the dpasys, the system was operated to run continuously for 24 hours daily for a time span of 24 weeks. The assessment was further extended to 12 months.

To quantify the impacts of the effluent, samples are analysed using standard procedures for the following parameters: Total dissolved solids (TDS), Total dissolved oxygen (TDO), Oxygen saturation (O_2 Sat), Free chlorine, and Total place count (TPC) [1].

Technical Specifications

Volume of Pool 1/ Pool 2 = 6.0m^3

Dimensions of Pool 1/ Pool 2 = 12.0m (L) X 1.0m (B) X 0.5m (H)

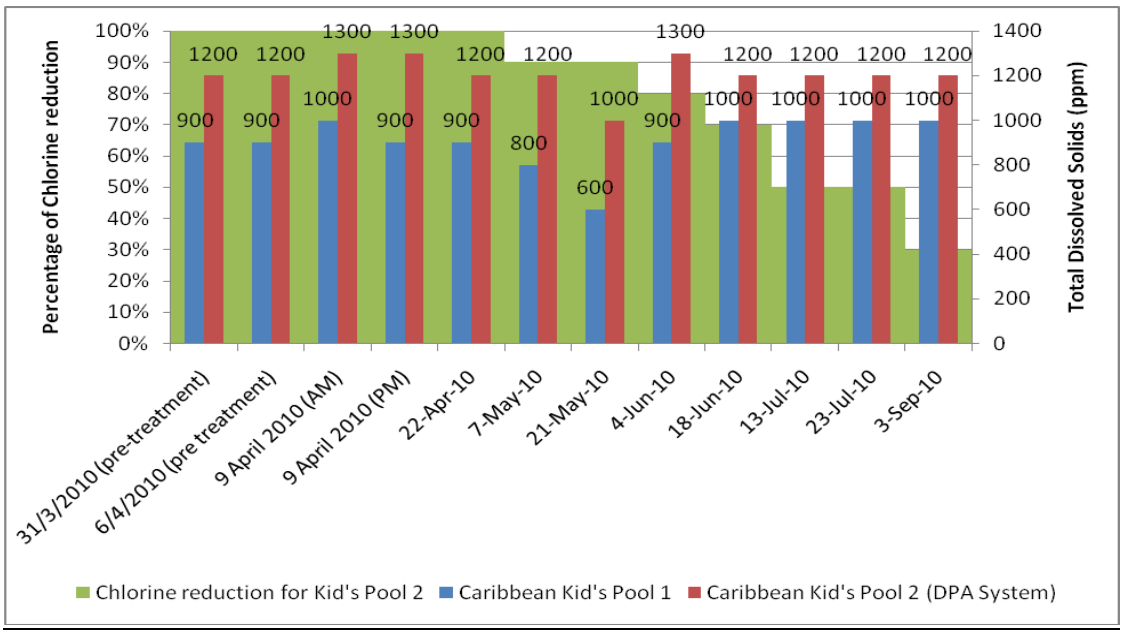
According to the Environment Health Department, Environment Public Health Division of the National Environment Agency (2005), the Water Quality Standards for Swimming Pool are as follows:

Parameter	**Values**
Free Chlorine Residual	1.0 – 3.0 mg/l
pH	7.2 – 7.8
Turbidity	5 NTU
E.Coli	-NIL-
TPC	< 200 bacteria/ml

Interpretation of Water Quality Data

The following is the analysis of the physical-chemical parameters involved to assess if improvements are made to the water quality.

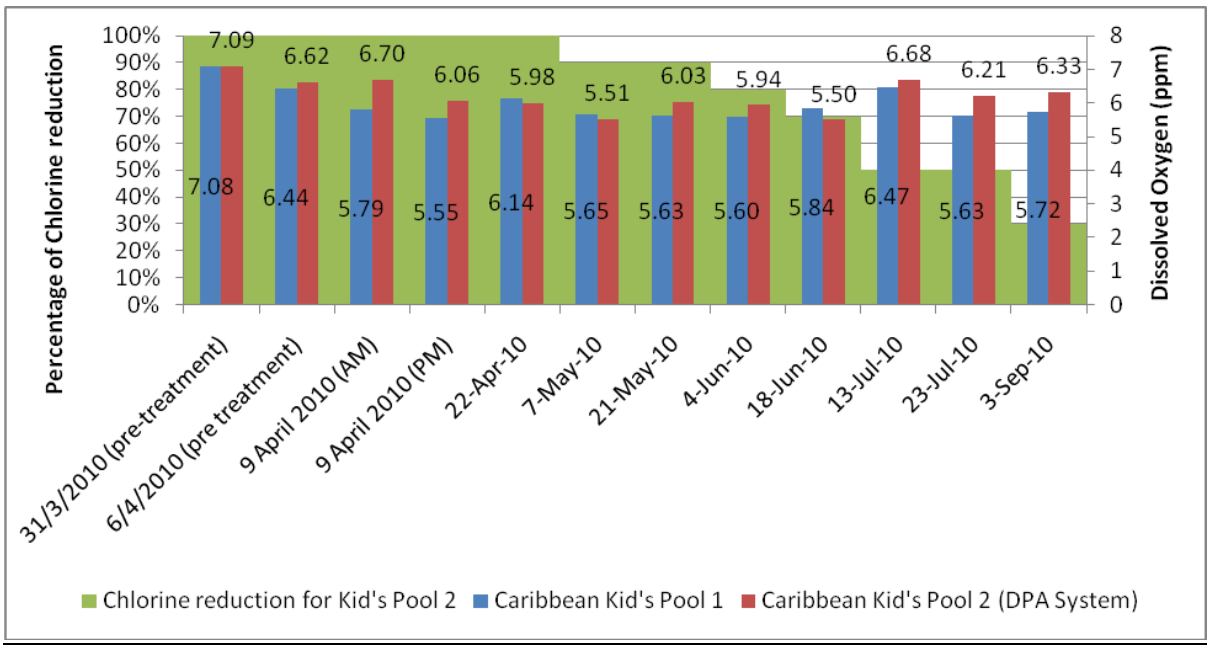
1) Total Dissolved Solids (TDS)

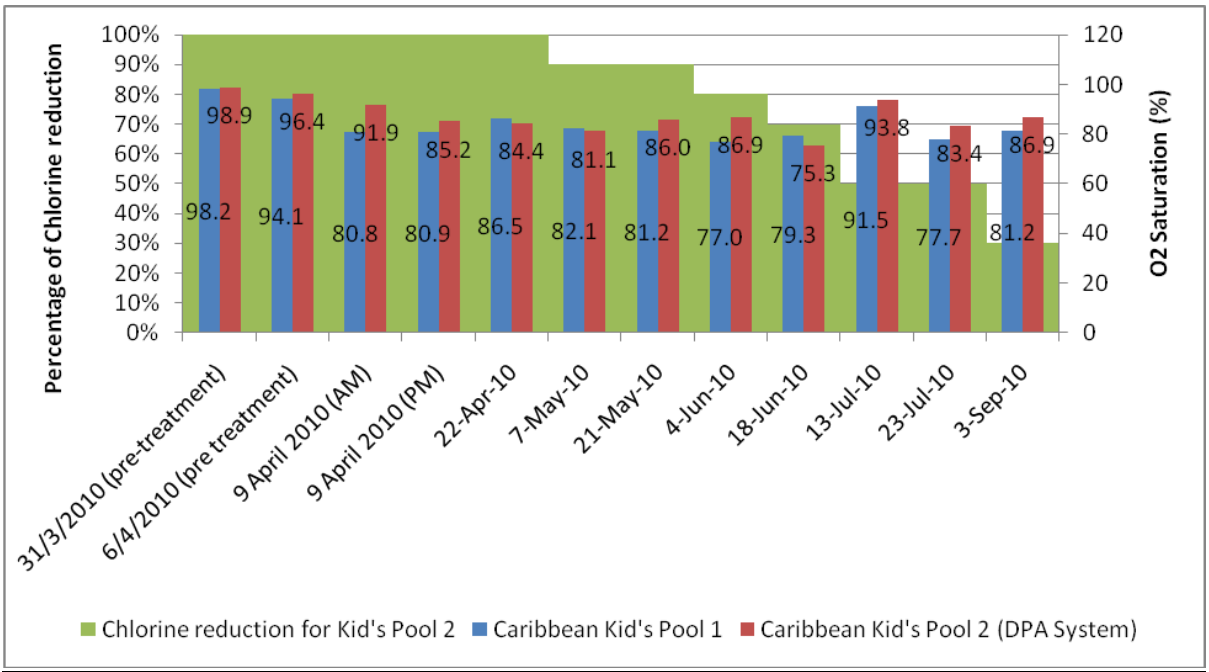


[1] Analysed by independent 3rd party SINGLAS accredited laboratory for bacteria analysis. Method of bacteria analysis endorsed by International Public Health Associations 9215D standards.

Overall, the TDS levels in both Pool 1 and Pool 2 remained generally constant throughout the evaluation. The average TDS at Pool 1 is 900ppm, while the average TDS at Pool 2 is 1209ppm. As seen in the graph above, the decline in chlorine dosage does not significantly impact the TDS values. The TDS level obtained in Pool 2 is higher than that of Pool 1 and this result is coherent because the use of dpasys would lead to increased mixing capabilities and O_2 levels which would in turn increase the degradation of inorganic salts, impurities etc found in the water, generating higher TDS levels.

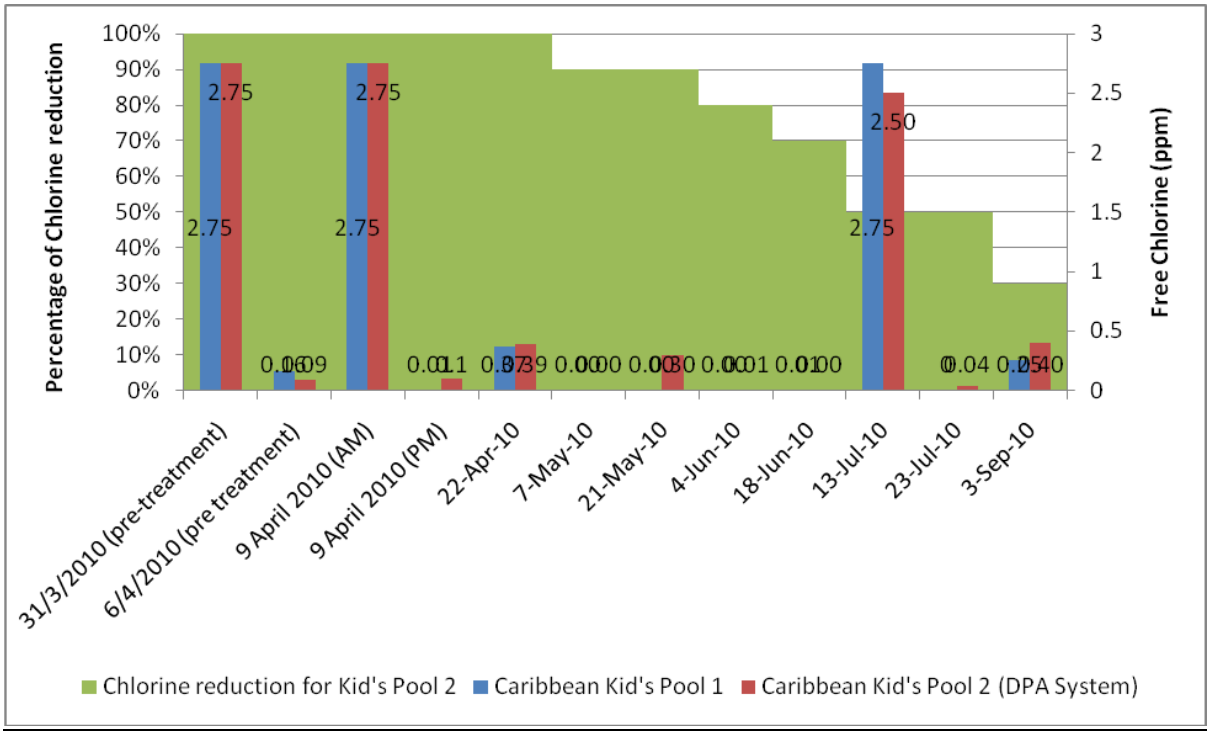
2) TDO/ O_2 Sat





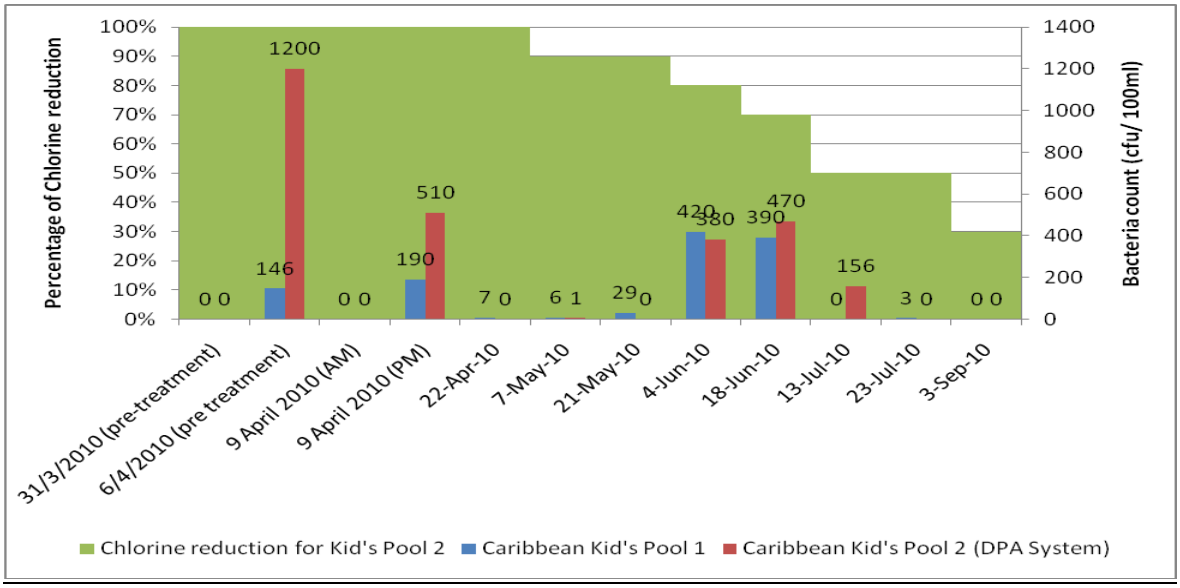
TDO and O_2 saturation values saw minimum fluctuations throughout the assessment. In general, Pool 2 experienced higher TDO and O_2 Saturation levels as compared to Pool 1. The higher levels of dissolved oxygen in Pool 2's water would oxidize impurities and it also encourages oil and particulates in the water to clump together so that they can be filtered more easily.

3) Free Chlorine Level



There is little difference between the free chlorine level between the 2 pools although over time, Pool 2 uses lesser chlorine than Pool 1. However, it is noted that the pool water is open to the air and the people that uses the pool. Therefore, this makes the pool water susceptible to contamination from these external sources. Moreover, chlorine chemicals may become less effective over time due to evaporation and exposure to the sun. Hence, this will account for the similar free chlorine levels in both pools despite the difference in initial chlorine dosage.

5) Total Plate Count (TPC)



Despite a 70% reduction in chlorine dosage, the desirable outcome of the low bacteria count i.e. well maintained below 5 bacteria/ ml (or 500 bacteria/ ml) is achieved in Pool 2. Pool 2's TPC[2] far exceeds the NEA's standard requirement for swimming pool, which stands at 200 bacteria/ml (or 20, 000 bacteria/ml).

Summary of Advantages of dpasys

- Low bateria count (< 5 bacterial/ml) achieved despite 70% reduction in chlorine usage
- No algae detected despite 70% reduction in chlorine usage
- Cost savings achieved in the long run due to sizeable reduction in chlorine usage
- Dpasys can be easily retro-fittted to treat water in exisitng pools

Conclusion

The results of the above mentioned case clearly articulates dpasys's capability of achieving up to 70% reduction of chlorine dosage in the swimming pool without any adverse effects on the pool.

This assessment helps prove the ability of the dpasys to alleviate the reliance on chlorine chemicals for disinfection purposes whilst maintaining high quality pool water for usage.

[2] Note: 1 sample (01 x 200ml sterile glass bottle) was collected directly from the two pools on a weekly basis and sent immediately for laboratory testing.

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