



## **Report on the effect of Chlor-Clean applications to Acrovyn thermoplastic resin materials over periods of time equivalent to one and ten years.**

### **Background**

Department of Health guidelines recommend the use of chlorine products at 1,000 ppm (0.1%) available chlorine for environmental disinfection of surfaces likely to be contaminated with pathogenic micro-organisms such as *Clostridium difficile*, MRSA, GRE, *Acinetobacter*, Norovirus, etc. Chlor-Clean tablets are designed to be dissolved in tap water to produce a solution of 1,000 ppm available chlorine with additional cleaning properties and is used extensively throughout the United Kingdom in NHS and private healthcare facilities as a disinfectant cleaning agent.

### **Objective of the Study**

This study has been instigated to determine what effects repeated applications of Chlor-Clean solutions will have on Thermoplastic materials used as protective coverings in healthcare facilities.

The testing consisted of daily applications over a period of 95 days for the 1,000 ppm solution, which is equivalent to a daily application of Chlor-Clean for a full year. In addition daily applications of a 10,000 ppm solution, i.e. ten times stronger than normal use, represented how any chlorine effect might build up over a period of 10 years.

### **Materials and Methods**

The Samples Tested were provided by Construction Specialties (UK) Ltd., of Westcott, Buckinghamshire and consisted of A4 sized sheets of the following:

Acrovyn - Polyvinyl chloride (PVC) - Pacific Blue

Acrovyn 4000 - Polyethylene terephthalate – glycol modified (PET-G) – Spectrum Red

Acrovyn 4000 - Polyethylene terephthalate (PET) - Transparent

The chlorine solutions used were made up using Chlor-Clean tablets, as used in many hospitals throughout the UK and supplied by Guest Medical Ltd. One tablet per litre of tap water gave a 1,000 ppm (0.1%) available chlorine solution and ten tablets per litre gave 10,000 ppm (1%).

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Each of the sample materials were divided into three sections. Each section was treated with ordinary local tap water as a control, a 1,000 ppm Chlor-Clean solution and a 10,000 ppm Chlor-Clean solution respectively. The Chlor-Clean solutions were made up freshly every day in ordinary tap water from a relatively hard water area and maintained at a temperature between 18 and 22°C.

An average of 3.87 applications of each of the solutions were made at regular intervals to the appropriate sample each working day for a total of 95 days commencing 3<sup>rd</sup> November 2016 and ending on 23<sup>rd</sup> March 2017. In total therefore, each sample received 367 applications, representing a daily 'clean' over a period of one year. The solutions were applied to the samples on a cloth with a 'rubbing' motion and then left to dry without any wiping off or rinsing to replicate the cleaning action and method used by Health Care Workers performing 'Terminal Cleans' or similar disinfection practices. The instruction to hospital personnel is to leave surfaces moist but not wet and allow to air dry.

In general NHS use, Chlor-Clean at the 1,000 ppm strength would be applied to surfaces only when an area had been occupied by a patient who had a specific infection, and then usually only when the patient ceased to occupy that area (i.e. to disinfect the area before the next patient takes up residence). Only in exceptional cases would the area be disinfected from time to time during occupation. For areas occupied by non-infectious patients ordinary cleaning with detergent wipes or neutral detergent solutions would only be used. It would be for very exceptional cases, for example serious outbreaks of infection and then only for a short period of time (a few weeks at the most) that the area would be disinfected daily. This is a general rule and the one that Guest Medical recommends for the use of its products, however there are exceptional circumstances where Chlor-Clean may be used daily all the time – but these are exceptional.

Hence the 367 applications of the total study will represent use in the NHS over a year on a theoretical daily basis, but in practise it is more likely to represent use for considerably longer.

Chlor-Clean is not intended to be used at the 10,000 ppm strength. This concentration of chlorine is recommended by the Department of Health for spills of blood and blood-stained body fluids and would be applied directly to the spill area then mopped up quickly afterwards. The area would then be cleaned with detergent and water or wipes, so that the stronger chlorine solution would only have a minimal contact time with surfaces.

The study using the stronger solution on the third sample was performed to observe the likely effect of chlorine build-up on the surface over a longer period of time – basically to test it to destruction. The 367 applications of the ten-times-stronger-than-normal solution would therefore be equivalent to daily applications of the 1,000 ppm solution over approximately ten years and it is considered that if no effect is visible after such applications it is unlikely to appear after longer periods of time.

The samples were observed under a strong light with a hand lens at regular intervals throughout the study for signs of deterioration and/or damage.

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### **Results:**

No damage or deterioration was observed on the samples tested with either the 1,000 or the 10,000 ppm Chlor-Clean solutions over the period of the study.

However after approximately five weeks, a grey-to-white deposit or streaky effect was noted on the samples being treated with the 10,000 ppm solution. This also appeared on the 1,000 ppm treated samples but only after several more weeks. This phenomenon has been noted in previous studies using chlorine products and is a result of the chlorine precipitating limescale out of the hard water used to dissolve the tablets. Hospitals in hard water areas will be familiar with this problem and may choose to ignore it (as tends to happen in very hard water areas) or treat surfaces once a week or once a month, depending on the degree of severity of the problem, with a dilute solution of a propriety limescale remover.

Ordinary cleaning products (i.e. not chlorine-based) contain a chemical (EDTA) that dissolves limescale and therefore prevents the phenomenon described above. Unfortunately it is not possible to add this or similar products to the Chlor-Clean tablets or solution as the chemicals react adversely with the chlorine.

### **Discussion:**

Following the total period of the investigation no detrimental effect from the chlorine applications to the samples had been found. The grey-to-white streaks noted above were, as expected, removed with a dilute limescale remover solution – however it must be noted that such chemicals must NEVER be mixed with the Chlor-Clean solution as toxic gases will be produced and an exothermic reaction is likely. The treatment with limescale remover diluted to 50% of its standard strength did not appear to have any detrimental effect on the surfaces tested.

The overall conclusion is that Chlor-Clean solutions used at the correct concentration applied to the PVC, PET and PET-G materials tested will have no effect over many years of average use within NHS and healthcare facilities. Hospitals situated in hard water areas may appreciate some advice concerning limescale build-up on these materials.

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4<sup>th</sup> October 2017