Effects of Concentrated Solutions of Sodium Hydroxide and Hydrochloric Acid on Enviro-Brom® Tablets

February 28, 2013
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Background

Food processing facilities sometimes use caustic and/or acid during CIP washes. Once the caustic or acid wash has been completed it may be disposed of down the drain without dilution. Thus, it is important to know what, if any, adverse effects these solutions will have on Enviro-Brom® tablets they contact. Examples of possible adverse effects would be the development of irritating fumes or vapors; development of an exotherm; rapid physical deterioration of the tablets; or rapid decomposition of the tablets

Purpose

The purpose of this study is to determine if Enviro-Brom® tablets will react with 25% w/w liquid sodium hydroxide (NaOH) or hydrochloric acid (HCl) solutions.

Materials and Methods

Hydrochloric Acid Test

500 mL of 25% w/w HCl solution was prepared. Image 1 shows this solution and a 100 gram Enviro-Brom® tablet prior to the introduction of the tablet to the solution.

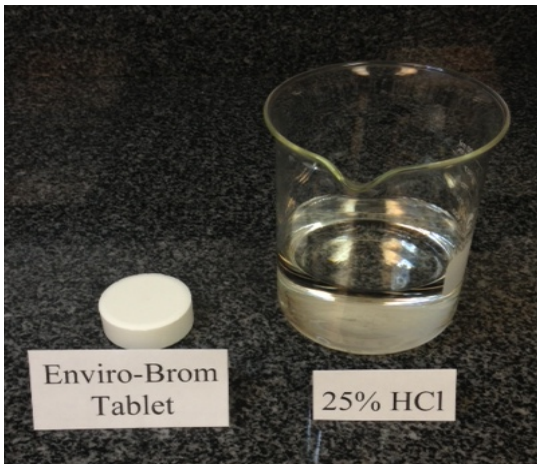


Image 1 100g Enviro-Brom® tablet and 25% HCl solution before test.

The Enviro-Brom® tablet was placed in the 25% HCl solution and allowed to sit undisturbed for 3 hours. Photographs were taken at 30 seconds and 3 hours after the tablet was placed into the

HCl solution (See Image 2). The Enviro-Brom® tablet did not show any signs of change such as increased dissolution rate, discoloration, or production of any gas or vapor, and we therefore conclude that tablets in contact with strong acid solutions for extended periods of time do not pose a risk either to the safety of workers or the integrity and functionality of the tablet.

Image 2 shows the Enviro-Brom® tablet in the 25% HCl solution 30 seconds (left image) and 3 hours (right image) after the tablet was placed in the solution.

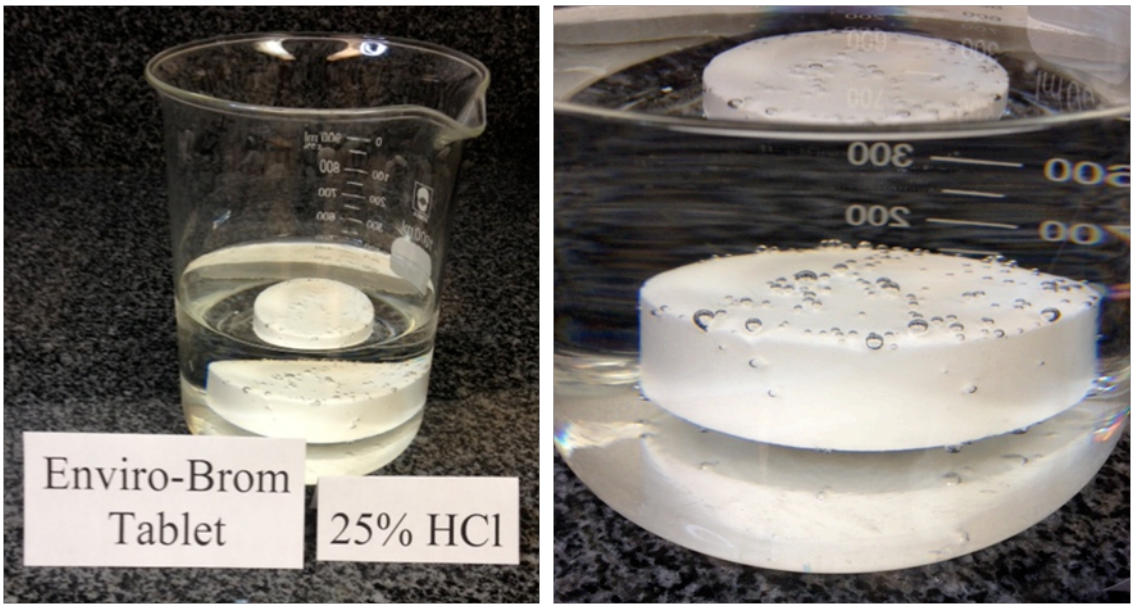


Image 2 Enviro-Brom® tablet at 30 seconds and 3 hours after addition to the acid solution.

Sodium Hydroxide Test

500 mL of 25% w/w NaOH solution was prepared. Image 3 shows this solution and a 100 gram Enviro-Brom® tablet prior to the introduction of the tablet to the solution.

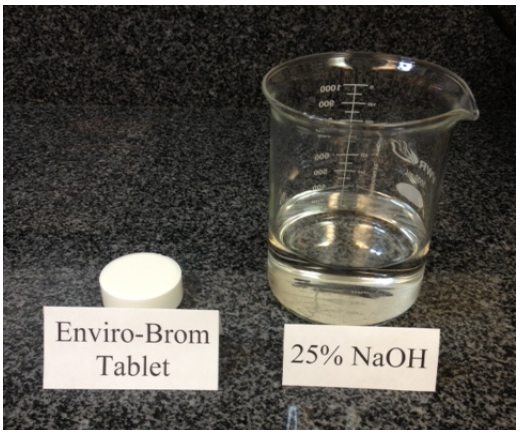
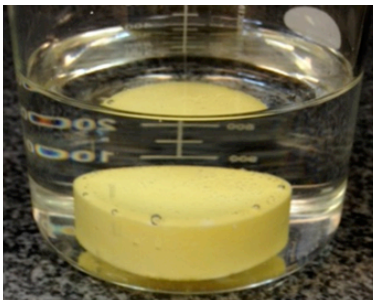


Image 3 100g Enviro-Brom® tablet and 25% NaOH solution before test.

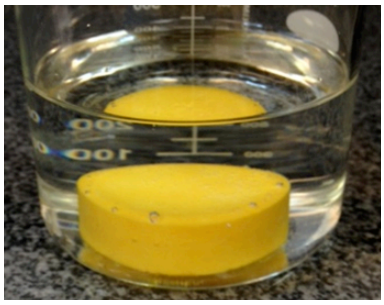
The Enviro-Brom® tablet was placed in the 25% NaOH solution and allowed to sit undisturbed for 3 hours. Photographs were taken at 30 seconds, 5 minutes, 10 minutes, 3 hours after the tablet was placed into the NaOH solution (See Image 4). The Enviro-Brom® tablet did turn a faint yellow color immediately after being placed in the NaOH solution but there was no gas or vapor release. The longer the tablet sat in the NaOH solution the more intense the color change became. Around the 10 minute mark, the tablet starting changing from a yellow color to a brownish color, and by the three hour mark the tablet was tablet was completely brown as was the NaOH solution. The color change is presumed to be due to the formation of sodium hypobromite through reaction between the bromine in the tablet and sodium hydroxide in the solution. However, sodium hypobromite is analogous to sodium hypochlorite bleach and functions as an antimicrobial in much the same way, so the antimicrobial properties of the Enviro-Brom® tablets are unimpaired. Additionally, at no point was there any production of gas or vapor that would pose a safety hazard.

Image 4 shows the Enviro-Brom® in the 25% NaOH solution at 30 seconds, 5 minutes, 10 minutes, and 3 hours respectively.

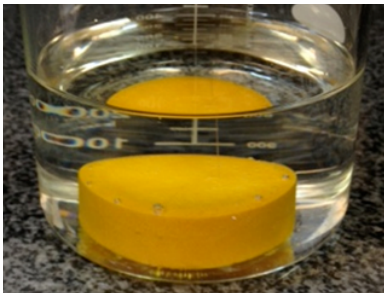
Image 5 shows both of the tablets after they were removed from their respective solutions.



(a) 30 seconds



(b) 5 minutes



(c) 10 minutes

(d) 3 hours

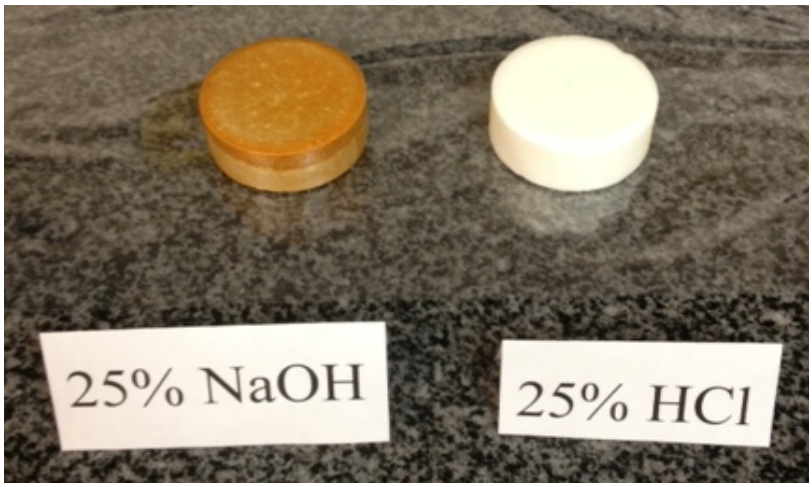


Image 5 Comparison of the tablets after having been in contact with their respective solutions.

Conclusions

- When an Enviro-Brom® tablet was placed in a 25% hydrochloric acid solution there was no gas or vapor production that would pose any health or safety risk to any person nearby nor was there generation of toxic or harmful chemicals that could not be washed down a drain. Image 5 shows that there was no change to the physical appearance of the Enviro-Brom® that was left in the 25% hydrochloric acid solution for three hours.
- When an Enviro-Brom® tablet was placed in a 25% sodium hydroxide there was a distinct color change with the tablet and solution that intensified over time. The color change is due to the formation of sodium hypobromite (NaOBr). At no time was there any gas or vapor production that would pose any health or safety risk to any persons.
- In this study the concentrations of caustic and acid used was well above what would commonly be experienced through contact with typical CIP cleaners such as acid washes, caustic washes, or chlorinated alkali cleaners.
- This test demonstrates that Enviro-Brom® tablets can come into direct and prolonged contact with strong caustic and strong acids without adverse effect.