

Comparison of Sanitizing Efficacy of the Ionator and Activeion to Water

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Introduction:

Many different cleaners are used by the UWEC janitors to sanitize multiple surfaces all around campus. Sanitizing a surface entails reducing the number of microorganisms on inanimate objects to a safe level. There are many different sanitizers and disinfectants available with various claims of efficacy. We decided to test the sanitizing efficiency of one such product, the Ionator. The manufacturer claims that the Ionator kills 99.999% of most harmful bacteria as well as the H1N1 virus when used as directed. In addition, we tested a similar product made by the same manufacturer, the Activeion, that is used to clean hard surfaces but does not make the same sanitizing claims. According to the manufacturers, the Ionator takes regular tap water and converts it to ionized hydric acid that contains a low level electric field, which breaks down dirt and easily lifts it off of surfaces. They claim that this charge added to regular tap water ruptures the cell membranes of bacteria, killing them, or inhibiting them from causing disease. We tested these claims both on a chemical and microbiological basis.

Materials and methods:

Strains: We tested *Escherichia coli* (Gram negative bacteria) and *Staphylococcus aureus* (Gram positive bacteria) for their ability to be inhibited or killed by the test solutions.

Test solutions: We tested the effectiveness of the Ionator and Activeion Pro to sanitize by means of electrically charging water particles.

Control solutions: Tap water and distilled water were both used as control solutions against the Ionator and Activeion. The Ionator and Activeion were sprayed for 10 seconds prior to collection for tests (as directed).

Conductivity Test: We tested both the control and test solutions for the amount of ions present by using a conductivity meter (probe). Samples were sprayed or poured into vials and the conductivity meter was placed into each vial and reading was recorded. A known substance was poured into a control vial and used to ensure the accuracy of the conductivity meter.

pH Test: We measured the pH of both the test and control solutions in order to determine if a difference was present. Samples were sprayed or poured into vials and the pH meter was placed into each vial and reading was recorded. A known substance with a neutral pH (pH=7) was used to insure accuracy of the pH meter.

Absorbance Test : Both the control and test solutions were run through the Cary-50 BIO UV/VIS spectrophotometer. To test the percent of hydrogen peroxide (H₂O₂) present, a standard calibration curve of known percentage of H₂O₂ solutions vs. absorbance. We then used this data to find the percent H₂O₂ of test solutions after measuring their absorbance.

Spray Test : Strains was spread plated individually onto five dry CBA plates. Each plate was divided in half: one half was finely misted with a test solution while the other half had no treatment. Plates were incubated overnight at 37 degrees Celsius and observed.

Disk Diffusion Test: Bacterial strains were grown overnight at 37 degrees Celsius in Todd-Hewitt broth (THB) and then spread plated individually onto Columbian Blood Agar (CBA) plates. Whatman paper discs (1.3 cm) were soaked in test solutions, control solutions Quatsyl (Sterling Winthrop Inc.), and Morning Mist Disinfectant (Command Canter Inc.) (one disk per solution) and immediately placed onto a CBA plates inoculated with either *S. aureus* or *E. coli*. Plates were allowed to incubate overnight at 37 degrees Celsius. Zone of inhibition was measured as the diameter (mm) of the area around the disks.

Quantitative Bioanalysis Test: Serial dilutions were performed for both strains to determine the dilution that would yield 100 colonies/mL when plated on CBA. From the appropriate dilution, 100 µl were spread plated onto CBA plates and incubated overnight at 37 degrees Celsius. Colonies were counted after overnight incubation. To test the effects of the solutions we performed the dilutions in the test solution for 30 seconds prior to spread plating 100 µl of each strain onto individual CBA plates. Individual colonies were counted after the plates were incubated as described previously.

Tables/Figures:

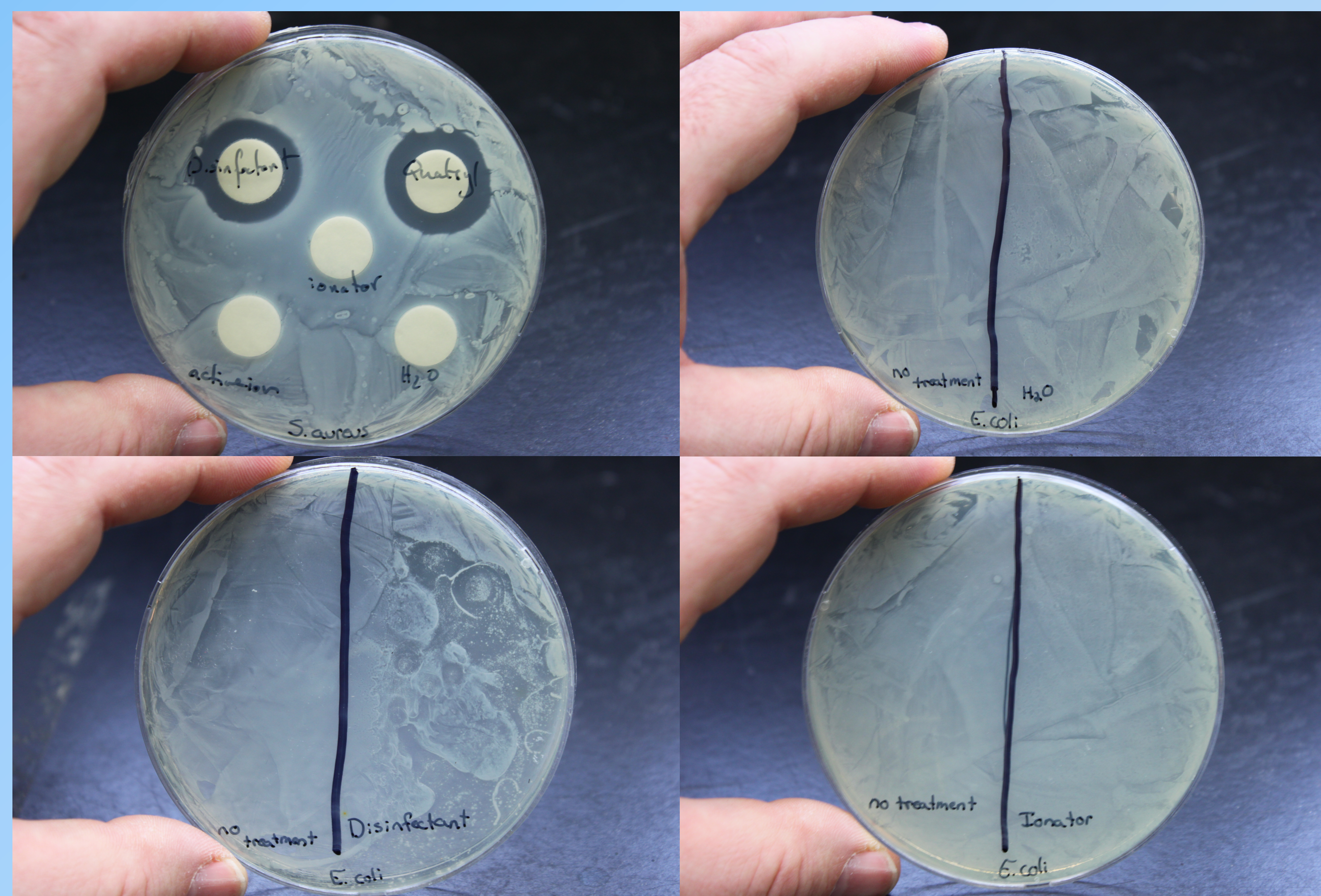


Figure 2: Top Left=2a. Disk Diffusion Test Results. Bottom Left=2b. Disinfectant Spray Test Results. Top Right=2c. Tap Water Spray Test Results. Bottom Left=2d. Ionator Spray Test Results

Table 1: Conductivity Readings

Sample	Trial 1	Trial 2
Active Ion	277	258
Ionator		199
Tap Water	275	257
Distilled Water	21	3
Control (1000 ms/cm)	998	1017

Table 2: pH Measurements

Sample	Trial 1	Trial 2	Trial 3	Trial 4	Average
Control	7.14	7.08	7.10	7.11	7.105
Tap water	6.46	6.05	6.22	6.37	6.275
Distilled water	6.96	6.77	6.81	6.90	6.86
Activeion	6.60	6.24	6.39	6.49	6.43
Ionator		5.98	6.19	6.22	6.13

Table 3: Disk Diffusion Test

Strain	Activeion	Ionator	Disinfectant	Quatsyl	Tap Water
<i>E. coli</i>	0 mm	0 mm	21 mm	19 mm	0 mm
<i>S. aureus</i>	0 mm	0 mm	21 mm	22 mm	0 mm

Treatment	Trial 1	Trial 2	Average CBA
Control	86	82	84
Disinfectant	0	0	0
Activeion	73	72	73
Ionator	69	73	71
Quatsyl	0	0	0
Tap water	66	65	66
Distilled water	78	77	78

Table 4a (above): Quantitative Bioanalysis of *E. coli*.

Table 4b (below): Quantitative Bioanalysis of *S. aureus*.

Treatment	Trial 1	Trial 2	Average CBA
Control	77	83	80
Disinfectant	0	0	0
Activeion	73	80	77
Ionator	ND	86	
Quatsyl	76	89	83
Tap water	80	106	93
Distilled water	77	99	88

Results/Discussion

Conductivity Test: The average of four independent trials of conductivity (See Table 1) indicate that there is not a significant difference in conductivity between the tap water in the Ionator and the water coming out of the Ionator.

pH Test: The average of four independent trials of pH readings (See Table 2) indicate that there is not a significant difference in pH between the tap water in the Ionator and the water coming out of the Ionator.

Absorbance Test: There was no significant difference in percent H₂O₂ between the Ionator and Activeion water and regular tap water.

Spray Test: The spray test showed that Quatsyl was the most effective disinfectant (showed most clearing on plates), the neutral disinfectant was the second most effective (See Figure 2b), and both the Ionator (See Figure 2d) and Activeion were just as effective at inhibiting growth as tap water. you have pictures of the spray test so you can see what the plates looked like for a god disinfectant and the Ionator/activeion.

Disk Diffusion Test: The results of the disk diffusion test are presented in Figure 2a and Table 3. Activeion and Ionator had the same effect on the bacterial strains as did tap water. Both Quatsyl and Disinfectant had zones of inhibition of about 22mm.

Quantitative Bioanalysis. The bioanalysis data (See Table 4) indicate that the disinfectant was effective against both test strains. Quatsyl was effective against *E. coli* but not against *S. aureus*. Both Ionator and Activeion were just as ineffective as tap or distilled water against both of the strains.

Conclusion:

- Both the Ionator and Activeion have the same pH, conductivity, and absorbance as tap water.
- Both the Ionator and Activeion are as ineffective at killing/inhibiting *S. aureus* or *E. coli* as tap water alone.
- In conclusion, the efficacy of the Ionator and Activeion is the same as tap water.
- At \$300 retail, the use of the Ionator as a sanitizer is cost prohibitive and more importantly may put individuals at risk of disease if they believe it to be an effective sanitizer.

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