
Air Oasis
BI-POLAR ICE

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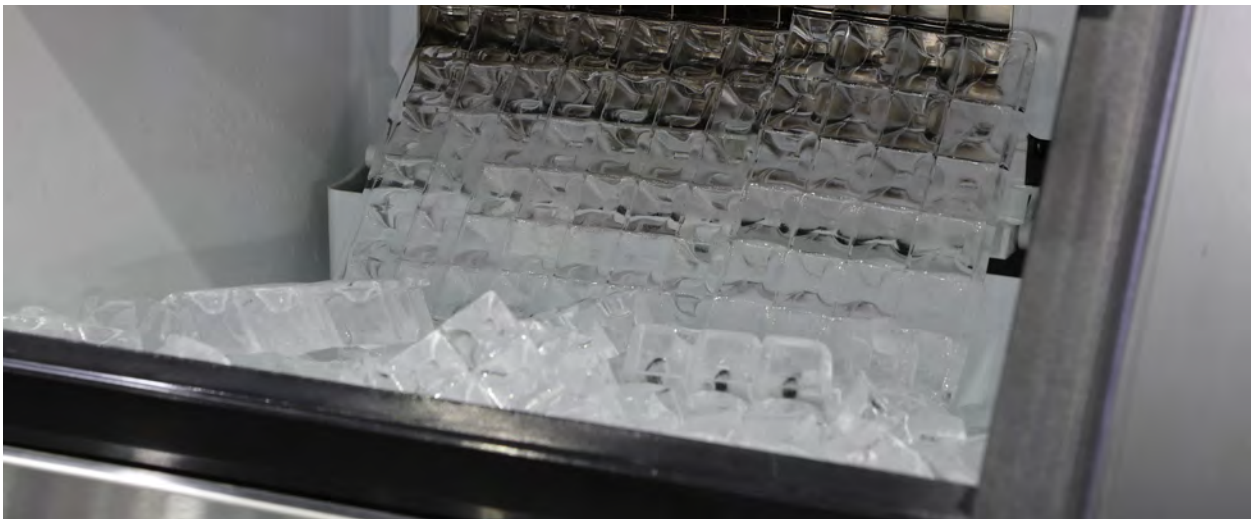

White Paper Purpose Statement: to highlight the widespread issue of ice machine contamination and provide insight into a new solution that will protect consumers, save operators thousands of dollars in maintenance expenses, and extend the operational life of ice machine equipment.

Introduction

It has long been known that normal operating conditions in commercial ice machines create breeding grounds for contaminants such as mold, slime and sludge. Despite the best designs and materials available to ice machine manufacturers, end users struggle to keep their machines free of these unsightly, unhealthy contaminants.

In a 2011 study of Las Vegas food establishments, more than 70 percent of ice samples tested positive for the presence of coliform bacteria. The U.S. Food and Drug Administration (FDA) defines ice as food. Ice is handled by facility staff and ingested by the general public. It can spread illness just as easily as other food sources if contaminated by viruses, bacteria, and mold.

Maintaining clean ice machines is most challenging in restaurant settings where bread is baked. The air is filled with yeast particles that exacerbate the slime and mold problem for food service operators. Their customers are exposed to unsanitary ice, their machines are prone to more wear and tear, and they are subject to the negative consequences of failed health inspections. Hotels, schools, and healthcare facilities face similar challenges.

Ice machine distributors lease ice machines to restaurants and other businesses. As the owners of the machines, these distributors typically bear the responsibility of safely maintaining the machines as part of their agreements. Doing so properly comes at a considerable expense, which in turn limits their operating capital and their ability to purchase additional machines from manufacturers.

Professionally cleaning an ice machine poses a number of challenges. It inconveniently takes the machine out of operation, which may interrupt business. In addition, the cost of these cleanings can easily exceed several hundred dollars.

Preventing Ice Contamination

Keeping ice machines sanitized and clean, as well as taking steps to properly handle ice are the two most important ways to prevent ice contamination. Regular professional inspection and cleaning is essential. The operating environment will dictate cleaning frequency. As noted previously, any establishment baking bread will likely require monthly ice machine cleaning to protect consumers and the equipment. It is recommended that only professionally trained technicians perform inspections and cleaning procedures. Commercial grade cleansers must be used and operating adjustments should be made at the time of cleaning as well.

There are three main areas of an ice machine in which mold and bacteria grow most rapidly. The ice production area, also known as the head of the machine, remains moist and dark, creating prime conditions for mold to grow and spread.

The ice bin is also problematic, as this is where outside contamination most frequently occurs. Consumers and staff handle ice scoopers, which become contaminated, and the contamination is subsequently spread into the bin. The drain trough at the bottom of the bin remains wet and difficult to keep clean. Lastly, the water supply tubes and inlet valves supplying water to the machine become easily contaminated. A main reason is that the small size of these parts make them problematic to clean.

Ice Machine Sanitation Systems

It is also recommended that owners of commercial ice machines consider installing sanitation systems to alleviate the need for so many costly cleanings. An NSF approved, professional grade sanitation system will extend the life of ice machines by preventing slime, mold, yeast, and other bacteria from accumulating. Cleaning cycles are significantly reduced, saving both time and money.

Until this year, sanitation devices used to keep the machine production head and bin clean were limited to devices requiring UV light or ozone technology. UV and ozone technologies are flawed for a number of reasons. Installation of these systems, especially retrofitting machines already in operation, is time consuming and expensive. Doing so requires drilling holes in walls of the machine and affixing bulky devices to their exterior. These devices employ glass parts which are hazardous if broken inside the machine, and their bulbs often contain mercury. Devices such as these are typically ozone (O3) generators, where ozone is the ion used for decontamination.

Based on these challenges, some have experimented with another form of ionization known as bi-polar ionization, or cold plasma. Cold plasma devices have none of the drawbacks plaguing UV light ionization technology. There are no glass bulbs nor the hazards they bring. Installation is far simpler, with no drilling into the ice machine exterior. Lastly, bi-polar ionization produces no ozone.

Bi-Polar® Ice by Air Oasis

One such cold plasma device is the Bi-Polar® Ice by Air Oasis. The patent-pending, NSF certified, and UL listed Bi-Polar® Ice uniquely provides a cost-effective, simple solution for reducing mold, slime, yeast, bacteria and viruses commonly found in commercial ice machines. The harmless ions produced by this compact, easily installed product significantly lengthen ice machine cleaning intervals by as much as two to three times. This saves a significant amount of time and money for operators.

Bi-Polar® Ice is designed with a compact electrical housing connected by food-grade wiring to the ion production assembly. The assembly consists of two carbon fiber brushes safely housed according to NSF specifications. The 1.7” x .7” x 3.25” brush assembly fits any ice machine. Through the brushes flow positive and negative charges, which together produce a cloud of positive and negative ions (H+, O-).

The ions circulate within the ice machine and greatly reduce contamination. More than 190,000,000 ions are created at each non-ozone producing brush.

As these ions reorganize to their natural state of water vapor, contaminants such as mold are rendered unable to replicate. Once the machine is clean, it will remain clean for much longer with this device. No ozone is produced -- only hydrogen and oxygen ions.

Bi-Polar® Ice is the first cold plasma device approved by both NSF for food-grade use and listed by UL with a UL-867 rating for electrical safety. It fits easily in various ice machines, even those with limited space. Carbon-fiber brushes extend from the compact electronic housing by food grade wire, allowing them to be positioned for maximum effectiveness and longevity. The brushes are protected by a plastic housing and easily replaced if ever necessary.

The Bi-Polar® Ice allows ice machine owners to significantly reduce their cleaning cycles by up to 80 percent. It is covered by a one-year warranty and is expected to operate well beyond the warranty period. In less than one year, the return on investment is clear: fewer cleaning cycles, fewer health inspection discrepancies, and, most importantly, consumers will consume clean ice.

Scientific Study

After evaluating the Bi-Polar® technology in commercial ice machines, we discovered its ability to sanitize ice machine surfaces. There was a significant reduction in microbial contaminants, including bacteria, fungi, slime molds and Cyanobacteria. Bi-Polar ionization technology, also known as cold plasma, has been used for decades in air purification. It is now available for clean ice production in restaurants, hotels, schools, and hospitals.

EVALUATION OF THE BI-POLAR® UNIT USING PLASMA-TECHNOLOGY IN STERILIZING THE ICE-MAKERS

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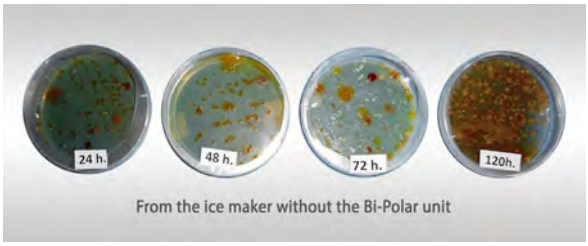

Fig.1. Shows the Petri-plates inoculated with sterile cotton swabs after incubation of 24, 48, 72 and 120 hours (left to right). Petri plates incubated for 120 hours showed maximum number of microbial colonies (arrow).

Fig.2. Petri Plate showing NO colonies of microbes after 120 hour of running the Bi-Polar unit.

Experimental Trials: We used Brain Heart Infusion Agar Petri-plates (Difco) to assess the capability of the Bi-Polar® unit in reducing contamination in the ice maker.

The experiment involved using 6 plates for each different setting for the time intervals of 24, 48, 72, 120 and 168 hours. The slides were observed and micrographed at 100X with a Leica DM-750 microscope. We compared the inoculated Petri-plates and slides prepared from the two sets, with and without running the Bi-Polar® unit.

The result: we found various forms of bacteria and molds, Cyanobacteria and their spores from the swab randomly collected from the wall and the floor of the ice-maker (Figs. 3 A-F).

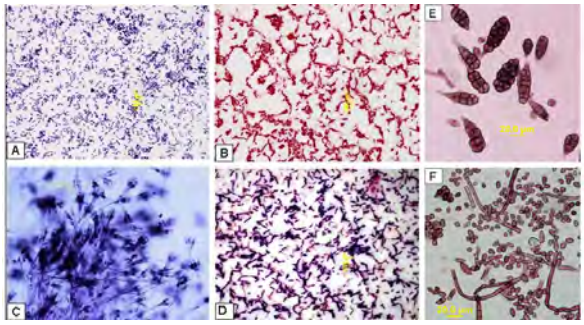

Fig.3A. showing the Gram positive Bacilli from the swab sample collected from the ice maker. B. Gram negative Bacilli from the ice maker floor. C. Penicillium sp. from swab from the wall of the ice maker. D. Swab cultures show spore-forming Bacilli collected from the surface of the ice maker. E. Alternaria alternata conidia. F. Stachybotrys sp. Cultures from the set with no Bi-polar® unit, incubated for 24 hrs.

- Reduce ice machine cleaning time
- Increase the life span of ice machines
- Reduce service calls
- Reduce the threat of health code violations
- Protect your brand and reputation

The following third party EMSL lab tests were conducted on our air treatment device, the Bi-Polar 2400. The same ion output and core technology is also found is our Bi-Polar® Ice device, which has been redesigned to meet NSF food grade standards.

EMSL Analytical, Inc. Certificate of Analysis

Project: Bi-Polar-2400 Efficacy Testing

Product: BP-2400
EMSL NO: 151508127-rev1
Sample received: 10/1/15
Start date: 10/7/15
Report date: 10/14/15
Challenge Bacteria: Legionella pneumophila

Experimental Summary:

The testing procedure was designed after discussions between EMSL Analytical, the testing company, and the client. The testing was conducted on the BP-2400 system for its ability to disinfect (kill) bacteria on a solid surface. The testing was conducted in our Houston Microbiology Laboratory.

Experimental Results:

Table 1: Reduction of *L. pneumophila*

***L. pneumophila* Control**			***L. pneumophila* Test**	
Time (min)	**Avg CFU**	**Log10**	**LR**	**%Reduction**
Control	$3.73x10^5$	5.57		
5	$3.24x10^5$	5.51	0.06	13.03
15	$6.43x10^3$	3.81	1.76	91.65%
30	$1.07x10^3$	3.03	2.54	99.68%

Log Reduction and %Reduction compares initial CFU and treated CFU recovered.
Any negative LR or %Reduction is the result of an increase in cells. ND=none detect <100.
Blank controls had no growth, Limit of detection = 100 CFU.

Conclusions/Observations:

The efficacy of the BP-2400 system to disinfect a solid surface against Legionella pneumophila was tested. The system demonstrated the strongest efficacy after 30 minutes of exposure by killing 99.71% of the L. pneumophila bacteria.

EMSL Analytical, Inc. Certificate of Analysis

Challenge Bacteria:
Vancomycin-Resistant Enterococcus (VRE)-Enterococcus faecium - (ATCC 700221)

Experimental Summary:

The testing procedure was designed after discussions between EMSL Analytical, the testing company, and the client. The testing was conducted on the proprietary Bi-Polar Technology for its ability to disinfect (kill) bacteria on a solid surface. The testing was conducted in our Cinnaminson Microbiology Laboratory.

Experimental Results:

Table 1: Reduction of *Enterococcus faecium (VRE)*

***E. faecium* Control**			***E. faecium* Test**	
Time (min)	**Avg CFU**	**Log10**	**LR**	**%Reduction**
Control	$1.23x10^5$	5.09		
1	$9.57x10^4$	4.98	0.11	22.43%
15	$6.93x10^4$	4.84	0.25	43.78%

Log Reduction and %Reduction compares initial CFU and specified CFU.
A negative LR or %Reduction is the result of an increase in cells.

Conclusions/Observations:

The efficacy of the Bi-Polar Technology to disinfect a solid surface against Vancomycin-Resistant Enterococcus (Enterococcus faecium) was tested. It was observed that the Log Reduction was 0.25 for 15 minute and 0.11 for 1 minute (Table 1). In conclusion, the proprietary Bi-Polar Technology demonstrated the ability to disinfect Enterococcus faecium on a solid surface with observed percent reduction of 22.43% for 1 minute and 43.78% for 15 minutes. Extrapolating to 60 minutes, the disinfection rate would be over 99%.

EMSL Analytical, Inc. Certificate of Analysis

Project: Bi-Polar-2400 Efficacy Testing

Challenge Bacteria:
Escherichia coli ATCC 8739

Experimental Summary:

The testing procedure was designed after discussions between EMSL Analytical, the testing company, and the client. The testing was conducted on the proprietary Bi-Polar Technology for its ability to disinfect (kill) bacteria in the air. The testing was conducted in our Cinnaminson Microbiology Laboratory.

Experimental Results:

Table 1: Reduction of *E. coli*

***E. coli* Control**			***E. coli* Test**			
Time (min)	**CFU/m³**	**Log10**	**CFU/m³**	**Log10**	**Corrected LR**	**%Reduction**
1	$6.50x10^3$	3.81	$5.65x10^3$	3.75	0.06	13.03
5	$6.27x10^3$	3.80	$4.55x10^2$	2.66	1.08	91.65%
15	$4.25x10^3$	3.63	$1.17x10^1$	1.07	2.50	99.68%
30	$1.47x10^3$	3.17	5.83x10	0.77	2.34	99.54%
60	$7.46x10^3$	2.87	5.0x10	0.77	2.11	99.23%

Corrected LR = Log Reduction that has been compared to natural rate of decay for *E. coli*
Log Reduction and %Reduction compares initial CFU and specified CFU
A negative LR or %Reduction is the result of an increase in cells

Conclusions/Observations:

In conclusion, the Bi-Polar Technology demonstrated the ability to disinfect E. coli from the air with a 99.54% reduction after 30 min exposure and a 99.23% reduction after 60 min exposure. Furthermore, these results demonstrate that the bipolar ionization system tested does not require direct line of sight to produce kill rates like ultraviolet light. The bipolar ionization system's kill rates are indicative of those in the entire space.

Before Bi-Polar® Ice



Bi-Polar® Ice Case Study

To determine the efficacy of using Bi-Polar® ionization in commercial ice machines, we collaborated with a refrigeration specialist and a popular restaurant chain to conduct a case study.

This sandwich shop was plagued with the abundant growth of mold and yeast inside their ice machines. As seen in the attached photos, the water curtain, water distribution system and ice thickness probe were completely contaminated with mold in less than 60 days.

After Bi-Polar® Ice



Conclusion

Bi-Polar® Ice protects businesses and customers' health because clean ice is an important aspect of serving safe food. Scientific studies demonstrate that Bi-Polar® Ice deactivates even the most dangerous of bio-contaminants found in ice machines. After safety, cost effectiveness is at the heart of any business. With Bi-Polar® Ice, businesses enjoy both cost savings and the satisfaction of serving clean ice.

References

Bi-Polar® Ice Case Study: *Conducted by Department of Life, Earth and Environmental Sciences, West Texas A&M University, Canyon, Texas 79015*
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That's Gross: *Are You Really Going to Drink That?*
PRODUCTS | MOLD | ICE MACHINES

Dr. Jeff Bennert on June 1st, 2018
Find this article on the Air Oasis website at: https://info.airoasis.com/blog/thats-gross-are-you-really-going-to-drink-that

Report on Daily Mail
http://www.dailymail.co.uk/news/article-2334533/Ice-restaurants-bacteria-wa-tertoilets.html#ixzz3GvTycvvm

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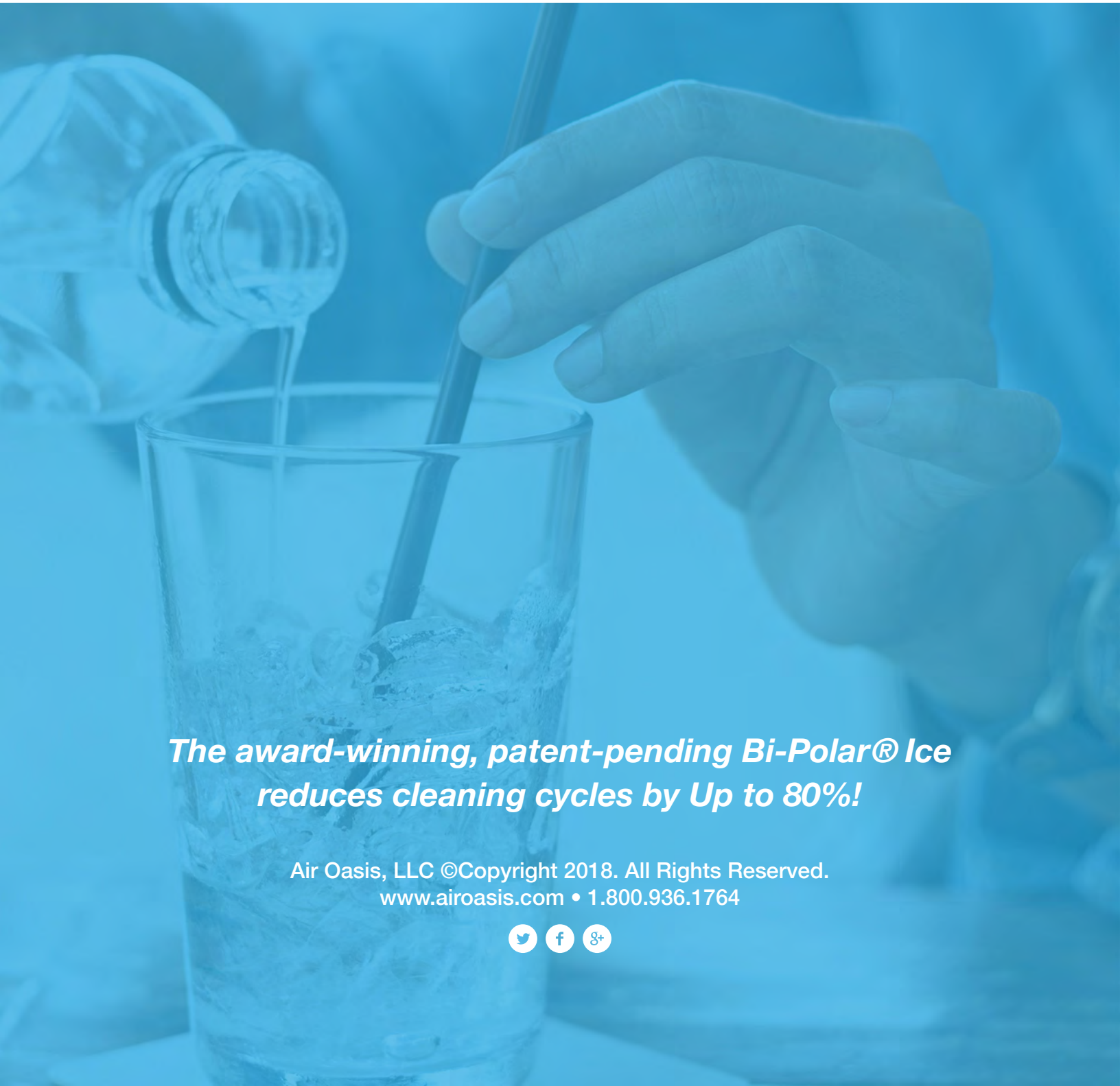

The award-winning, patent-pending Bi-Polar® Ice reduces cleaning cycles by Up to 80%!

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