New World of Business with Plasma and AHPCO Nano-Technology in Marketing Air Purifier, Cell Phone and Ice-Maker Sterilizer

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Abstract - Present day's business world demands newer technologies to build cheap and efficient marketable products. A decade research in aerobiology and biotechnology developed an air purification system that uses Advanced Hydrated Photo Catalytic Oxidation (AHPCO) and Plasma Nanotechnology to reduce indoor aeroallergen to improve air quality and better food preservation. Air Oasis and air purifiers utilize a new generation AHPCO technology that does not rely on filters or air passing through the air purifier. Innovations in technology continue to have massive impact on business and society. Technology is a process and a body of knowledge as much as a collection of artifacts. Biology is no different and we are just beginning to comprehend the challenges inherent in the next stage of biology as a human technology. It is this critical moment, with its wide-ranging implications, that Robert Carlson considers in Biology Is Technology [1]. He offers a uniquely informed perspective on the endeavors that contribute to current progress in this area, the science of biological systems and the technology used to manipulate them. During the past nine years, we have been assessing the AHPCO and Plasma Nanotechnology for net reduction of bacteria, fungi, VOCs with the specific effect on Methicillin resistant Staphylococcus aureus, MRSA. A 5-year research project carried out at the BSA Hospital and Coulter Animal Hospital in Amarillo, Texas evidenced a gradual reduction of airborne bacteria, aeroallergens and VOCs in the indoor air thereby improving the air quality significantly when specialized air purification units were used in the
Microbiology and Mycology Laboratories of the BSA Hospital. Evaluations on safety measures showed no side effect on human cell cultures. Indoor aeroallergens such as, airborne fungal spores, airborne bacteria, and animal dander reduced significantly on using the air purification units to improve indoor air quality and alleviating breathing ailments.

Keywords - Bi-Polar® Unit, Plasma-Nanotechnology, Advanced Hydrated Photo-Catalytic Oxidation Nano-Technology, Air Purifiers, VOC, Ice-Maker Sterilizer

I. INTRODUCTION

Biofilm microflora in ice machine-Biofilms are the collections of microorganisms, mainly bacteria, growing together in a matrix of polymers secreted by the microorganisms. Once microbes grow into well-developed biofilms, cleaning and sanitation become difficult. With the advent of moisture and organic media biofilms are formed on the walls of the ice makers and refrigerators. You purchase a glass of soft drink with floating ice cubes from your favorite restaurant. Imagine a group of known and unknown, bacteria and molds are entering in your mouth and elementary canal with every sip. These microbial agents may come from the ice cubes floating in your drink. The ice served in six out of ten of Britain’s most popular high street restaurants contains more bacteria than the toilet water; in a recent investigation “The Daily Mail” has found [2]. Scientific tests revealed that ice from many restaurants had higher levels of bacteria than samples of water taken from their lavatory bowls [3]. Dirty ice machine causing contamination via ice cubes is also a major health problem in other countries including the United States [4]. To prevent any potential contamination, the interior surface biofilm microflora in the ice machine must be sanitized regularly. We evaluated the Bi-Polar® unit built by Air Oasis in sanitizing the ice machine surface.

II. MATERIALS AND METHODS

Two sets of petri-plates containing Brain Heart Infusion Agar were inoculated with sterile cotton swab with the inoculum collected from the ice-maker surface at the time intervals of 24, 48, 72, 120 and 168 hours. Developed colonies were observed after 24 hours of incubation at 37° Celsius. Bacterial/fungal colonies were isolated using a SZ-40 stereo-scope. Prepared slides from bacterial colonies stained with Gram staining and fungi with Lacto-Phenol Cotton Blue stain.

Fig 1. The Bi-Polar® Unit Created by Air Oasis [5,6].
Fig. 1. shows the Bi-Polar® unit that has a size of a cell phone. It creates a cold plasma discharge which consists of positive and negative ions from water vapor in the air. The ions get attached to particles and cluster together to create larger particles and those larger heavy particles drop out of the air were observed and micrographed at 100X with a Leica DM-750 microscope. After running the Bi-Polar® 168 hours, there was a significant reduction in microbial entities.

Experiment involved using 6 plates for each different setting for the time intervals of 24, 48, 72, 120 and 168 hours. These plates were inoculated with sterile cotton swabs with inoculum randomly collected from at the appropriate time intervals to observe the microbial growth after 24 hours of incubation at 37° Celsius. We prepared slides from bacteria stained with Gram staining and fungi with Lacto-Phenol Cotton Blue stain. The slides were observed and micrographed at 100X with a Leica DM-750 microscope.

Fig 2. A-C Personnel Involved in Developing the AHPCO and Plasma Based Air Cleaning Systems for the Air Oasis: Jon Bennert (A), Dr. Jeff Bennert (B), Dr. N. Ghosh (C) using the NASA based Nanotechnology to Device Techniques to Improve the Indoor Air Quality by Introducing a New Generation Filter-Less Air Purifiers using AHPCO and Plasma Nanotechnology.

Fig 3. A-F Showing the Steps of Testing the Bi-Polar® unit (A). B-C. Installation. D. Collecting Swab from the Ice Maker’s Top, Bottom, Floor Walls and the Corners. E.

We compared the inoculated Petri-plates and slides prepared from the 2 sets with and without running the Bi-Polar® unit.

Fig 4. A. Showing the Gram Positive Bacilli from the Swab Sample Collected from the Upper Wall of the Ice Maker. B. Gram Negative Bacilli from the Ice Maker Floor. C. Swab Cultures Show Spore-Forming Bacilli Collected from the Floor Surface of the Ice Maker. D. Penicillium sp. from Swab from the Wall of the Ice Maker. E. Alternaria Alternata Conidia F. Pithomyces sp. Spores from the Swab from the Corners. Swab-Cultures Collected from the Set with No Bi-polar® unit Running After Incubation for 24 hours at 37° C.

Fig 5. A-E Showing Petri-Plates from Swab Cultures Collected While Running the Bi-Polar® unit. Figs A. The Microbial Colonies Formed After Running the Unit for 24 h. B. 48h., C. 72h., D. 120h. and E.168h.
We used the Brain Heart Infusion Agar Petri plates to standardize the assessment techniques which are often used in food safety, water safety, and antimicrobial susceptibility tests. Petri plates were sealed with Parafilm and stored in a refrigerator. At the end of each experiment, the plates were placed in an incubator at 37°C to observe the microbial growth. To assess the capability of the Bi-Polar® unit in reducing contamination in ice makers, two sets of Brain Heart Infusion Agar petri-plates were plated. For the control plates, the inoculum was taken from an ice machine before installing a Bi-Polar® unit. The “Treated or Testing” sets were prepared with inoculum collected from ice-maker surfaces at 24, 48, 72, 120, and 168 hours after the ice maker was turned on. The microbial colonies were observed with a SZ40 stereoscope after 24 hours of incubation at 37°C. The stereomicroscopic observation helped us to differentiate between the bacterial and fungal colonies. Prepared slides were stained with Gram Stain for bacterial colonies and Lacto-Phenol Cotton Blue for fungi and observed with a Leica DM-750 microscope.

III. RESULTS AND DISCUSSION

A gradual reduction in the number of microbial colonies was recorded from 72h., 120h. and 168h. (Fig. 6, Graph). Chances of contamination in the ice cubes reduced considerably on reduction of microbial population inside the ice-maker. On running the Bi-Polar® 168 hours or more, there was a significant reduction in microbial entities including bacteria, fungi, slime molds, and Cyanobacteria.

After running the Bi-Polar® 168 hours, there was a complete eradication of the icemaker microflora as evidence in the petri plates (Fig 5A-E). We also propose the usage of this novel Bi-Polar® technology to prevent contamination during meat and other food processing on the conveyor belt. Air Oasis has successfully implemented the AHPCO and Plasma technology, if used will prove to be an efficient way of reducing the food contaminants, especially during meat processing that toll thousands of lives in the world. Plasma nanotechnology has been used to prevent contamination in ice-makers and during food processing.

Recently Jon Bennert has tested the efficiency of the Bi-Polar® unit in reducing smoke in the indoor air. He built a fiber glass chamber and installed a Bi-Polar® Unit in it. He pumped smoke into the chamber keeping the Bi-Polar® unit on and recorded the time with a stop watch. The chamber was connected with a duct to pump smoke inside. The time lapse photography clearly showed a significant reduction of smoke within 60 seconds (Fig. 7 A-C).
The Bi-Polar® unit is efficient in reducing contamination in the ice makers by using the unique Plasma-technology [7]. Experiments with Air Oasis and air purifiers proved that negative ion purification system is a safe and effective means of eradicating aeroallergens such as mold and microbes and VOCs from indoor air [8]. Research and Development unit of Air Oasis has been developing, improving the quality and efficiency of the products, and marketing this novel air purification system, sterilizers and Bi-Polar® units all over the world. The Air Oasis units are already marketed in China, Hong Kong, Singapore, Dubai, Bangladesh, USA, and UK.

Abbreviations
AHPCO = Advanced Hydrated Photo-Catalytic Oxidation; VOCs = Volatile Organic Compounds; GC-MS = Gas Chromatography-Mass-Spectrum; MRSA = Methicillin Resistant Staphylococcus Aureus.

REFERENCES

(Arranged in the order of citation in the same fashion as the case of Footnotes.)


