Ozone Cleaning in the Water Purification Process

Production of bottled water is a growing industry that is popular around the world. A main concern within the field is the purification of water. This is a necessary step in the production process. Customers who purchase bottled water need to be assured that the product is safe, clean, and of satisfactory taste. As water bottlers research purification techniques, they often find that ozone disinfection is one of the best choices for the job.

How Ozone Works

Ozone systems are able to deliver a clean and safe water product in an efficient manner. Ozone was first recognized for its success in water treatment in 1906 and has been refined and implemented around the world since then. Advances in technology have made ozone a rapidly growing and safe disinfectant treatment.

The disinfection process utilizes the unique chemistry of ozone to eliminate undesirable elements of water while maintaining a clean taste and leaving no residues. Ozone is an unstable molecule, and it readily gives up an atom of oxygen in reactions, making it a powerful oxidizing agent, which is toxic to many waterborne organisms. In order to meet regulations, bottled water must eliminate pathogenic germs, such as E. coli, and also naturally occurring substances such as iron, manganese, arsenic, sulphur, and fluoride.

When ozone is applied to the water, the water undergoes many chemical reactions. These reactions result in the oxidization of the contaminants, which leads to their subsequent elimination from the water. Ozone is able to do this without leaving behind a noticeable taste, giving it an advantage over chlorine. Once the water has been run through a filter, it emerges with a neutral odor and taste, and is purified.

Ozone Equipment

The ozone cleaning system itself is a precise and powerful mechanism. A high quality ozone delivery unit includes several different parts working together to maximize efficiency and performance. In order to run the unit with high confidence, there are several tools that should be employed by any company interested in ozone cleaning. These tools will help guide the cleaning process and remove guesswork for the equation, making a better end product.

The Proportional Integral Derivative, PID, is a process that feeds the ozone generator a signal, based on power and outputs, to increase or decrease production until a set point is reached. The PID operates along user-set parameters, allowing automated control.

The Programmable Logic Controller, PLC, is a powerful piece of software. This tool runs multiple algorithms and variables towards a desired output.

Reading and interpreting the signals from the monitors, analyzers, and sub-controllers of the unit can be a difficult task. To help with this, a company can employ a Supervisory Control and Data Acquisition, SCADA, system. This system will read and co-ordinate the signals, making a more user-friendly interface for operators.

Setting up these tools for an ozone process can be a costly investment. The systems are not inexpensive, however, by usi. Installation of these units removes the need for guesswork in the ozone process, resulting in a more efficient process and more confidence for the company.

Considerations for Ozone Cleaning

Ozone is an effective tool, but companies must remain considerate while employing it. At high concentrations, ozone can impair breathing and pose a risk for workers. OSHA does have guidelines regarding ozone concentration. The standard is currently set at 0.1 ppm (0.2mg/m3), time weighted over an eight-hour period. Over 15 minutes, that limit is 0.3ppm.

To stave off ozone problems, a company can employ an ambient ozone monitor. The monitor can detect ozone levels at the OSHA cutoff points and relay signals to the control computers that can trigger alarms and even prevent the system from engaging or force open a vent. These ambient ozone monitors can also alert operators to a gas leak in the system due to over sizing, which can occur if more ozone than necessary is being applied. Operators and other personnel are alerted quickly by these alarms, which can help prevent ozone waste.

Efficiency

An ozone system can be set up in a multitude of ways. They are supremely flexible in ability to meet the needs of a company. In bottled water operations, ozone can be applied at varying concentrations depending on which part of the process is receiving the ozone. Using the correct dosage amounts, as calculated by the supplementary equipment like a PID, allows for disinfection of all parts of the water process with no wasted energy. A well-programmed control system is key to this flexibility.

The system needs to be able to monitor all three of the key processes in the ozone generation process to harness this efficiency. The feed gas, generation, and contacting must be controlled appropriately. The feed gas, which could be liquid oxygen vapor, compressed air, dried air, or concentrated oxygen, impacts the ozone production. They must be within specific standards (stated by the ozone generator manufacturer) and fed into the reactor cell at a specific flow rate and pressure in order to provide consistent and economic ozone production. After feeding and generation, contact must be monitored. A dissolved ozone monitor measures the dissolved ozone after contact and after application, and then determines the amount of ozone consumed. This is helpful for refining the process, leading to more efficiency.

Conclusion

Ozone is a powerful tool for bottled water manufacturers. With proper investment and maintenance, an ozone cleaning system can save time and money for manufacturers and customers. In the future, ozone controls will continue to grow in effectiveness and efficiency, leading to more value for all involved in the water treatment process.

Sources:
Ozone Controls for Disinfection System
Water Conditioning & Purification Magazine 2006

Use of Ozone in the Technology of Bottled Water
W. Schneider and H.H. Rump
Ozone: Science and Engineering, Vol. 5 pp. 95-101, 1983
Pergamon Press Ltd.