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The Newsletter of the International Ozone Association



Japan Ozone Association Seminar on Ozone Technology

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- Aquaculture and aquarium water treatment



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Membership and Publication Information:

The International Ozone Association is a nonprofit educational and scientific organization dedicated to the collection and dissemination of information on, and to promote research in, any and all aspects of ozone and related oxygen species technologies. Membership is open to any individual, corporation, or organization having interest in the latest developments and advancements in ozone technology.

As a member of the IOA, you will receive bimonthly issues of the Ozone News newsletter, bimonthly issues of the technical journal Ozone: Science & Engineering (OS&E), and IOA's Publication Catalog which includes worldwide conference proceedings, monographs, and special reprints. In addition, members receive discounts on IOA worldwide publications and meetings.

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Willy Masschelein Prize

The IOA-EA3 Group is requesting candidates for the Willy Masschelein Prize 2019 to be awarded at the Nice World Congress. This 4,000 € prize is for a dissertation on any of the fundamental aspects of ozone technologies. Please see pages 24-25 for more information.

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INDUSTRY NEWS

TRUMP APPROVES COLORADO RIVER DROUGHT PLAN

U. S. President Donald Trump signed a plan on April 16 to cut back on the use of water from the Colorado River, which serves 40 million people in the U.S. West. The Colorado River drought contingency plan aims to keep two key reservoirs, Lakes Powell and Mead, from falling so low they cannot deliver water.



The details of the plan were negotiated for years among the seven states that depend on these reservoirs: Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. As populations grow and the climate changes, persistent drought has been common in the region.

State water managers and federal officials have cited a prolonged drought, climate change and increased demand for the river's flows as reasons to cut back on water usage. In the lower basin, Arizona and Nevada would keep water in Lake Mead when it falls to certain levels. The cuts eventually would loop in California if Lake Mead's level drops far enough. In California, the Metropolitan Water District will be bearing the brunt of California's cutbacks if and when they are deemed necessary.

Final approval, which is expected, requires signatures from the Interior Department and the seven states involved in the pact.

Source: www.wateronline.com

CDC TO STUDY PFAS HEALTH EFFECTS

The U.S. Centers for Disease Control and Prevention (CDC) has announced plans for a health study on polyfluoroalkyl substances (PFAS). These substances have been entering the public water supply with unknown health effects. In the absence of federal drinking water standards for PFAS, many states have enacted their own enforceable standards.

To examine the association between PFAS and health

outcomes, the study research will work to recruit at least 2,000 children and 6,000 adults from communities who have been exposed to PFAS-contaminated drinking water. The study will examine health effects including kidney disease, liver function and immune response but, due to the size of the study will not study a link between PFAS and cancer.

Several studies are underway to develop an effective process for removal of PFAs, with ozone and/or advanced oxidation being one of the processes considered. To date, no single process has been proven effective in removal. The solution may be a combination of technologies.

Source: www.wateronline.com

ALGAE TO REMOVE HORMONES FROM WASTEWATER

Researchers from the Desert Research Institute in Las Vegas have found that a common species of freshwater green algae, called *Nannochloris*, is capable of removing certain endocrine disrupting compounds from wastewater. EDCs are natural hormones that are also found in many plastics and pharmaceuticals and have been detected in trace amounts in wastewater.

During a seven-day laboratory experiment, the scientists grew *Nannochloris* algal cultures in two types of treated wastewater effluents: one treated with ultrafiltration and the other with ozone. They then measured changes in the concentration of seven common EDCs.

In the ultrafiltration wastewater samples, the algae grew rapidly and significantly improved the removal rate of three EDCs, with approximately 60 percent of each contaminant removed over the course of the week.

The algae didn't grow as well in the ozone-treated wastewater, however, and had no significant impact on EDC concentrations.

Source: www.waterworld.com

AQUA-AEROBIC SYSTEMS LAUNCHES NEW WEBSITE

Aqua-Aerobic Systems, Inc. has recently released a brand new, mobile-friendly website featuring the company's complete portfolio of products and systems, applications and aftermarket programs. The new site highlights the company's innovation, including its research and technology center and technical seminar program and includes a comprehensive resource library, calendar of events and the latest company news.

The new website offers customers a one-stop resource for total water management solutions including easy on-line design

Industry News (cont'd)

request forms and 24/7 customer service.

Aqua-Aerobic Systems, Inc. with its primary base in the United States is an applied engineering company specializing in total water management solutions in the areas of aeration/mixing, biological processes, cloth media filtration, oxidation/ disinfection, membranes and aftermarket services. The company, a subsidiary of METAWATER Co., Ltd (Tokyo, Japan) currently employs 160 individuals in administration, engineering and R&D, sales and marketing, operations and customer service. The METAWATER Group is a comprehensive engineering company engaged in the water and environmental business field with prominent presence in Japan's water and wastewater market.

Aqua-Aerobic also announced the acquisition of FUCHS Enprotec GmbH.

FUCHS Enprotec GmbH provides mechanical engineering processes and technologies for the treatment of municipal and industrial wastewater, sewage sludge and off-gas. The company manufactures a full line of aeration, mixing, biosolids treatment and odor control products with more than 3,500 installations in 60 countries.

For more information, visit www.aqua-aerobic.com

REBECCA GERNETZKE JOINS STATIFLO CORP TEAM



Rebecca Gernetzke, who is based in Cincinnati, Ohio, has been appointed technical sales and project manager for Statiflo Corp. She has joined Statiflo Corp from Metawater USA, where she spent nine years as a project manager and mechanical engineer.

Statiflo Corp is the US arm of UK-headquartered Statiflo, which is a world leader in the design and distribution of gas dispersion systems, static mixers and other process equipment. Rebecca, 37, has been involved in the design and launch of numerous ozone systems at water treatment sites across the US and Canada over the past nine years. In her new role she will manage Statiflo Corp projects and support the company's sales teams across the US, with a focus on its gas dispersion systems.

WHITE ROCK, BC WATER TREATMENT PLANT OPERATIONAL



White Rock, BC officials celebrated the successful commissioning of their new water plant which uses ozone for arsenic and manganese control

From the right: Gordie Hogg, MP, South Surrey-White Rock, Scott Kristjanson, White Rock Deputy Mayor, the Honourable Franciose-Phillippe Champagne, Minister of Infrastructure and Communities and Dr. Saad Jasim, Manager, Utilities who led the projects.



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Industry News (cont'd)

PENTAIR COMPLETES ACQUISITION OF AQUION

Pentair plc, a leading water treatment company, today announced that it has completed the acquisition of Aquion for \$160 million in cash, subject to customary post-closing adjustments. Headquartered outside Chicago, with approximately 170 employees, Aquion offers a diverse line of water conditioners, water filters, drinking-water purifiers, ozone and ultraviolet disinfection systems, reverse osmosis systems and acid neutralizers for the residential and commercial water treatment industry. Aquion is the parent company of ClearWater Tech, LLC.

Pentair had revenue in 2018 of \$3 billion and has approximately 130 locations in 34 countries and 10,000 employees.

CLEARWATER TECH LAUNCHES AEROUSNX™ OXYGEN CONCENTRATOR

ClearWater Tech, LLC, manufacturer of smart, sustainable ozone water and air treatment systems since 1986, announced



the launch of the new AEROUSNX™ Oxygen Concentrator. Engineered to create up to 95% dry oxygen at 15 SCFH.

Air preparation is critical for efficient ozone production. This newly designed, second generation AEROUSNX™ Oxygen Concentrator is designed to provide a reliable oxygen source for on-site commercial applications.

The new oxygen concentrator is more compact, lighter, easier to service, and operates seamlessly in high humidity environments. That's especially beneficial for customers in areas like FL and resort destinations.

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IOA News

MR. TAMURA APPOINTED JOA SECRETARY GENERAL



Mr. Tetsuya (Ted) Tamura joined the Japan Ozone Association on April 1st this year and has been appointed the Secretary General at the same time as the successor of Dr. Junji Hirotsuji. He completed the graduate school of Kansai university in 1987 and joined Kobe Works of Mitsubishi Electric Corporation. He performed pre-contract activities for ozonation systems in

water and wastewater treatment for thirty or more years and obtained the title of Professional Engineer Japan of water supply and sewerage.

He was working for Mitsubishi Electric Power Products Inc in Warrendale Pennsylvania USA from 2007 to 2010 and made proposals to municipalities and consultant engineers. After returning to Japan, he started making proposals to China and South East Asia.

Mr. Tamura also becomes the head of the IOA-Nippon Islands Group and will be attending IOA board meetings and conferences in the future. We look forward to having Mr. Tamura in our group and look forward to his advice and contributions.

IOA PRESENTS OZONE SEMINAR IN OTTAWA

On May 6m 2019, the IOA-PAG, in conjunction with the Ontario Water Works Association (OWWA), presented a half-day ozone seminar. Topics covered and presenters were:



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IOA NEWS (cont'd)

Fundamental Components and Operation of Ozone Systems

Bill Mundy, Halton Region

Ozone Applications to Resolve emerging Challenges

Saad Jasim, SJ Environmental Consultants

Lessons Learned: Operating and Maintaining Oxygen Gas Fed Ozone systems with a 1,200 MLG Plant

Liza Ballantyne, Region of Peel & Iman Hashemi, OCWA

Ozone System Costs for Municipal Treatment Applications

Bill Mundy, Halton Region

Update on Ozone Use at Water Treatment Plants in North America

Saad Jasim, SJ Environmental Consultants.

This seminar was very well received. Additional details will appear in the next issue of Ozone News.

36TH JAPAN OZONE ASSOCIATION SEMINAR ON OZONE TECHNOLOGY



The 36th Japan Ozone Association Seminar on Ozone Technology was held on Dec 10 and 11, 2018 at Shinjuku Green Tower Building, Tokyo. 45 people including engineers, researchers of companies and waterworks bureaus attended. 10 relevant specialists gave lectures on their R&D project. A half-day technical visit to the Sin-Misato Water Filtration Plant of



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IOA NEWS (CONT'D)

the Public Enterprise Bureau of Saitama Prefectural Government was also held in the afternoon of Dec 11.

LECTURES IN SEMINAR



Dr. Magara opened seminar

Dr. Yasumoto Magara, the President of Japan Ozone Association, opened the seminar and welcomed all attendees. And the following 10 lectures were presented:

1. Mr Takahiro Yanagida: *Control of Drinking Water Quality and Advanced Water Purification Technology*
2. Dr Shinya Echigo: *International trend of Drinking Water Quality Standards*
3. Mr Shinichi Kimura: *Evaluation of Cryptosporidium Inactivation in Water Purification Process Including Ozone Treatment*
4. Prof. Masaki Kuzumoto: *Basic Process of Ozone Production by Dielectric Barrier Discharge*
5. Dr Mozomu Takeuchi: *Utilization of the Ozone in Water Treatment using Plasma*
6. Assistant Prof. Takeshi Azuma: *Evaluation of Water Environmental Pollution by Pharmaceutical Product Ingredients and Development of Environmental Risk Reduction Technology*
7. Mr Masanori Nieda: *Certification System for Small Ozone Generator by Japan Ozone Association*
8. Mr Shinichi Watanabe: *Development of Washing Technology using Ozone Micro-Bubble for Cut Vegetables*
9. Assistant Prof. Hiroataka Naito: *Ozone Application to Aquaculture and Farm Products Preservation*
10. Mr Hisayoshi Utsugi: *Overview of Shin-Misato Water Filtration Plant of Public Enterprise Bureau of Saitama Prefectural Government*

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IOA NEWS (CONT'D)



Mr. Yanigada presents administrative actions for drinking water quality

Mr. Yanigada of Ministry of Health, Labour and Welfare lectured on the drinking water quality and mold odor, the influence of climate change to water quality and the ozone advanced treatment. As to the drinking water quality and mold odor, he introduced the administrative actions and the recent

bad smell outbreaks. As for the influence of climate change, he introduced the variations of air temperature and the precipitation amount in Japan and showed the possibilities of frequent occurrence of high turbidity in source water caused by heavy rain, and of bad smell damage caused by elevated water temperature. He also introduced the administrative actions such as the adaptation plan to the influence of the climate change. Finally, he introduced the purpose and present prevalence of ozone advanced water purification treatment in Japan.



Dr. Echigo lectures on international trend of standardization on water quality

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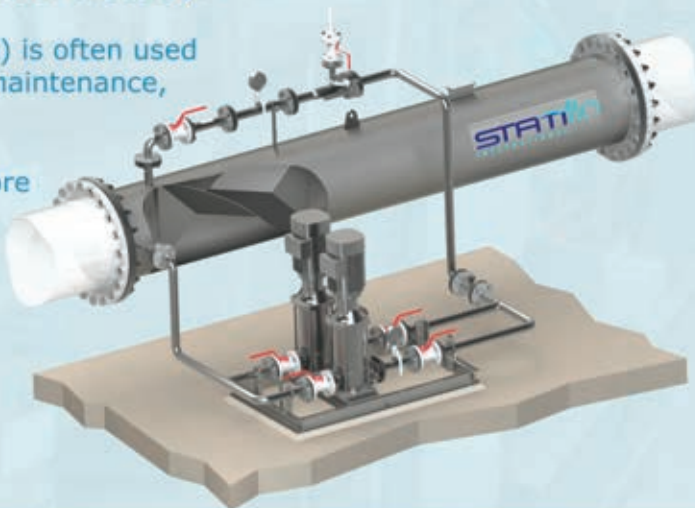
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IOA NEWS (CONT'D)

Dr. Echigo of the National Institute of Public Health lectured on the international trend of standardization on water quality, especially related to DBPs issue, i.e., the survey results on the chloric acid concentration originated from sodium hypochlorite, the evaluation of epidemiologic studies on health effects by DBPs and the availability of present standard item as a marker for non-regulated substances. He introduced that the standard value of chloric acid is 0.6 mg/L which is based on its TDI (Tolerable Daily Intake) value of 30 g/g/d, but WHO has changed the value lower to about 11 g/g/d in 2016. He stated that as several countermeasures such as pH control and temperature control at transportation and storage, and the reduction of chlorine demand are available, ozone treatment is an alternative method for the reduction of chlorine demand. He also introduced that the survey results of epidemiologic studies. The results showed that very few studies reported the clear relationship between health effects and DBPs, such as incidence of cancer, human development and reproduction except the relationship of incidence of male bladder cancer and DBPs. And he showed expectation of further epidemiologic study regarding ozonation because there was no relevant study in the survey. As to a marker for non-regulated substances, he

told that the fully utilization of the usually measured data may be important and the need of further systematic study on the effects by ozone treatment because it is insufficient except chloral hydrate.



Mr. Kimura discusses *Cryptosporidium* removal efficiency

Mr. Kimura of the Bureau of Waterworks of Tokyo Metropolitan Government presented the investigation results on the overall removal efficiency of *Cryptosporidium* and its risk assessment by QMRA (Quantitative Microbial Risk Assessment) method for both the Asaka Purification Plant and the Misato Purification Plant. Both plants have ozone treatment

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IOA NEWS (CONT'D)

processes. The removal efficiency at conventional processes was investigated for two years by using aerobic spore-forming bacteria which is smaller in size than *Cryptosporidium*. The inactivation efficiency at ozone treatment process was calculated by using the measured data of ozone concentration obtained at an actual ozone contactor, referring to the Toolbox Guidance Manual of USEPA. The *Cryptosporidium* concentration in raw water was determined from the 97.5 percentile value of measured data obtained at each plant for twenty years. Target value of treatment was set at 10⁻⁶ DARY according to the Guidelines for Drinking-water Quality, 4th Edition of USEPA. The *Cryptosporidium* concentration in raw water, the target value of treatment, the removal efficiencies at the conventional processes and the ozone treatment process for the Asaka Purification Plant were estimated about 8.4 organisms/L, 4.32 Log, 4.31 Log and 0.45 Log, respectively. For the Misato Purification Plant, these values were estimated about 5.5 organisms/L, 4.14 Log, 4.10 Log and 0.45 Log. He concluded that these results showed both plants stably supply drinking water which satisfies the treatment target.

Prof. Kuzumoto of Tokyo Institute of Technology lectured on the macro model of the basic process of ozone production by



Prof. Kuzumoto lectures on ozone generation

dielectric barrier discharge and future research issues including unexplained phenomena in dielectric barrier discharge. He explained the self-sustaining discharge voltage, the reduced field intensity, the averaged gas temperature in the discharged space which are relatively important parameters in the model, and also explained the ozone production model, i.e., the dissociation of oxygen molecules by the electronic collision and the binding reaction with oxygen atom and molecule, the ozone production efficiency and the characteristic analysis of

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IOA NEWS (CONT'D)

ozone production. In the lecture, he pointed out that (1) the ozone production efficiency of practical ozone generator is considerably lower than the theoretical value estimated from thermochemical equation, (2) the calculated values correspond reasonably with the experimental data by assuming the ratio of the consumption energy for ozone production and the discharge energy is 0.55, suggesting 45% of the discharge energy may be consumed wastefully at other reaction, e.g., the ion motion. He proposed the following as the future research issues: (1) study considering the interaction with electrode surface for the elucidation of ozone zero phenomena, (2) simulation study by the micro model for better understanding the ratio of the consumed energy for ozone production and the discharged energy, (3) study on the influence of moisture and negative ion, (4) measurement of collision cross section of ozone.



Dr. Takeuchi discusses utilization of ozone in water treatment using plasma

Dr Takeuchi of The National Institute of Advanced Industrial Science and Technology presented the effective utilization of ozone in water treatment using plasma. He is researching on direct production technology of OH radical by producing plasma at gas bubbles inside. Since oxygen gas is fed through the micro hole array installed at the bottom of reactor and electrodes are also installed at each hole, Oxygen bubbles that contain plasma inside can be produced continuously. The reactor can simultaneously produce hydrogen peroxide and ozone. The supplied power can be controlled by adjusting the capacity of ballast capacitor connected in tandem to a high voltage electrode. The experimental results showed the supplied power increases proportionately with the increase in frequency, and increases as the capacity of capacitor becomes large. The amount of ozone produced increased with the number of small capacitors, on the contrary, the amount of hydrogen peroxide produced increased with the number of large capacitors. As for the frequency dependency, the amount of hydrogen peroxide produced monotonically increases with

the frequency, but the amount of ozone produced becomes the maximum value around 8 kHz. As the experimental results of acetic acid decomposition suggested that the OH radical produced mainly in the bulk phase by the reaction of ozone and hydrogen peroxide, a gas-liquid reaction column was added and the exhaust ozone from the reactor supplied to the column and the acetic acid solution was circulated between the reactor and the column in order to improve the utilization efficiency of ozone. Both a reasonable decomposition rate and efficiency were obtained. He concluded that this technology may be suitable for the place where the transportation and/or the storage of hydrogen peroxide is relatively difficult, e.g., an offshore oil field.



Asst. Prof. Azuma lectures on environmental dynamics

Assistant Prof. Azuma of Osaka University of Pharmaceutical Sciences lectured on the environmental dynamics and treatment technology of medicine in water environment, and the future environmental risk. He introduced research results of medicine contained in the river water and the effluent from sewage plant at the Yodo river system : (1) the concentration of anti-influenza virus agent in water is closely related with the epidemic of influenza, and is ten times higher than that of overseas studies, (2) the mass balance of them suggested that decay in the river flow is relatively small, (3) the removal efficiency of anti-influenza virus agent by the conventional sewage treatment, i.e. biological treatment and chlorine disinfection, is 0 – 30%, and the biological advanced treatment is also insufficient to its removal, but that of the plant equipped ozone treatment comes up to 90%. Laboratory experiments using the plant effluent confirmed a rapid decomposition of anti-influenza virus agent. He told that both of the improvement of sewage treatment plants and the on-site wastewater treatment at medical institutions are needed, because his investigation results showed that the loading to the river system from medical institutions is relatively large. He finally concluded that ozone treatment and AOP can decompose medicine and further studies including their practicability and the cost performance are needed.



Mr. Nieda introduces JOA certification system

Mr Nieda, a member of the JOA Certification Committee, introduced the revised certification system for small ozone generator, i.e., its objective, outline and major revised points. The objective of the system is to supply the ozone generator having certain quality and safety to the general public. The major revised points, e.g., the reduction of the examination and registration fee, the delivery method of certification mark, are also introduced. As to the outline of the system, i.e., the manufacturing company approval and the type approval, the certification mark, the application and examination procedures and important points was explained. He stated that the users can select an ozone generator with a printed JOA certification mark without anxiety, and the certified generator can be differentiated from non-certified goods. Finally, he expressed the expectation that many companies join this certification system in order to make it to be an industry standard, because the standardization lead to improve the quality of ozone generator and expand the ozone market.



Mr. Watanabe presents ozone micro bubble washing of cut vegetables

Mr Watanabe of Lion Hygiene Corporation presented the sterilization by ozone micro bubble water formed by using triacetin solution and the quality of cut vegetable after washing.

He explained that triacetin was selected as surfactant because the micro bubbles are easy to break at the water surface and do not remain on the cut vegetables. The experimental results using *E. coli* showed that the sterilization efficiency by using small bubbles was higher than by using large bubbles. Furthermore, in case of ozone micro bubble washing, a small amount of ozone is enough to sterilize in comparison with by the conventional ozonated water washing. The experimental results of cut cabbage washing showed that the sterilization efficiency by using micro bubble water of 3 mg-O₃/L is nearly equivalent with the pH – NaClO solution (effective chlorine concentration: 50 mg/L, pH: 6.0) and the voluminous feeling after ozone micro bubble water washing is larger than that by the pH - NaClO solution. The fact that the cell damage after ozone micro bubble washing was not observed, suggesting that high quality of cut vegetable can be produced. Finally, he summarized that the sterilization technology can be alternative to conventional NaClO solution because of the advantages, i.e., high sterilization ability and high quality of cut vegetable after washing.



Asst. Prof Naito lectures on use ozone for aquaculture and vegetable preservation

Assistant Prof. Naito of University of Shizuoka lectured on the application of ozone to aquaculture and vegetable preservation. As to aquaculture, he presented the results of infection control for *Penaeidae* cultivation. By using White spot syndrome virus (MSSV) which has both high infectivity and high spreading velocity, *Penaeus monodon* and *Litopenaeus vanami* were reared by single breeding method under several Ct values of total bromide oxides formed by seawater ozonation. No development of infectious disease was observed under above the Ct value of 30 mg/L·min. According to the results, the designed Ct value for full scale plant was determined from 100 to 110 mg/L·min., considering safety margin. He introduced that the aquaculture plant, which treats seawater under at the initial concentration of bromide oxides of 1.2 mg/L and treatment time of 90 min., has not been damaged even when infectious disease occurs at surrounding of the aquaculture farm. Secondly, he introduced the application to vegetable preservation which keeps vegetables in low ozone

concentration atmosphere after washing by ozonated water. Bitter melon, cherry tomato, carrot, green pepper and eggplant were washed by ozonated water and kept them at 20 C for one week at the ozone concentration of 0.05 ± 0.01 ppm. The measured data of viable bacteria and water content after preservation showed that the number of bacteria were decreased and kept at low level by this combined method, that is, the washing by ozonated water at the first step and preservation in low ozone concentration atmosphere at the second step.

contactors are U-tube type in which ozonated air and water flow co-currently. The water depth is 41.5 m and retention time is about 6 min. The subsequent stage is a coal-based activated carbon filtration process which is spontaneous equilibrium and downward stream type. The designed values of the filtration rate and the retention time are 234.1 m/d and 15 min., respectively.

Reported by Dr. Junji Hirotsuji

HALF-DAY TECHNICAL VISIT



Mr. Utsugi introduces Sin-Misato Water Filtration Plant



All attendees visited Sin-Misato Water Filtration Plant of the Public Enterprise Bureau of Saitama Prefectural Government. Mr Utsugi, the vice president of the plant, briefly introduced the plant. The treatment capacity of the plant is 365,000 m³/d and the process flow are: coagulation and sedimentation, ozonation, biological activated carbon filtration, chlorination and sand filtration. The plant is equipped with two air-fed ozone generators and four ozone contactors. The ozone production capacity of generator is 12 kg/h each. The

Dr. Keisuke Ikehata has informed us that he is joining the new Civil Engineering Program at Texas State University in San Marcos, TX as an Assistant Professor on July 1, 2019. He will be relocating from the Los Angeles Area where he has served as an adjunct professor.

Many of you recognize Keisuke as the Technical Program chair for recent IOA PAG regional conferences. He has been a regular contributor to Ozone: Science & Engineering and his paper "*Degradation of Aqueous Pharmaceuticals by Ozonation and Advanced Oxidation Processes*" is one of the most frequently cited OS&E papers.

Keisuke can be reached at kikehata@txstate.edu. We wish him the best in his new adventure!



TONY'S COLUMN



In Shell Pasteurization of Eggs with Ozone

by Tony Sacco, Spartan Technologies

Salmonella can infect unbroken eggs inside the shell; the bacteria can originate in the hen's ovary or oviduct before the shell forms. The Centers for Disease Control estimates that 1 in every 20,000 eggs are contaminated with Salmonella.

Proper handling, storage and cooking of eggs minimizes the risk that salmonella in eggs will make people sick, but some uses of shelled eggs may not involve cooking to the level required to kill bacteria. Eggs can be pasteurized in and out of the shell. In 2017 less than 3% of eggs were pasteurized. In shell eggs can be pasteurized by various methods e.g.:

- Heating
- Irradiation by gamma rays
- Ozonation and mild heating

All the methods add to processing time and cost. Eggs are mainly pasteurized in hot water (130-140 degrees F). Thermal pasteurization can cause the egg whites to denature (cloudiness), color changes in the yolk and impact taste. Ozone

and mild heating pasteurization results in equivalent reduction in bacteria levels while maintaining more of the aesthetic qualities of unpasteurized eggs. The process gained regulatory approval in 2009. This makes ozone based "in shell" pasteurization as an excellent option.

The process for ozone/heat involves placing the eggs first in a heat bath at 57 degrees C. The eggs are then transferred to a chamber where a vacuum is pulled and followed by pressurization with concentrated ozone, about 10 wt.%. The ozone is pumped out of the enclosure and destroyed. The eggs are removed from the chamber completing the process. The exact temperatures and timing are proprietary.(See Figure)

Perry et al. found that salmonella levels were reduced by >4 logs using the process described above. Kamotani et al. found that consumers acceptance of eggs treated with ozone/heat were comparable with to the untreated control.

The Ohio State University, Egg Tech Limited, Weaver Brothers Poultry, Hertzfeld Poultry Farms, Hemmelgarn and Sons, Xigent Automation Systems, and the Ohio BioProducts Innovation Center, received a grant of nearly \$3 MM for the ozone/heat pasteurization process in 2011. In 2017 the Ohio State University received a patent on the process.

A commercial scale plant is currently under construction. DeNora Capital Controls Ozone was selected as the supplier of the ozone related equipment.

References:

- Perry, J. J., Rodriguez Romo, L. A., & Yousef, A. E. (2008). Inactivation of *Salmonella enterica* serovar enteritidis in shell eggs by sequential application of heat and ozone. *Letters in applied Microbiology*, 46(6), 620-625.
- Kamotani, S., Hooker, N., Smith, S., & Lee, K. (2010). Consumer acceptance of ozone treated whole shell eggs. *Journal of food science*, 75(2), S103-S107.

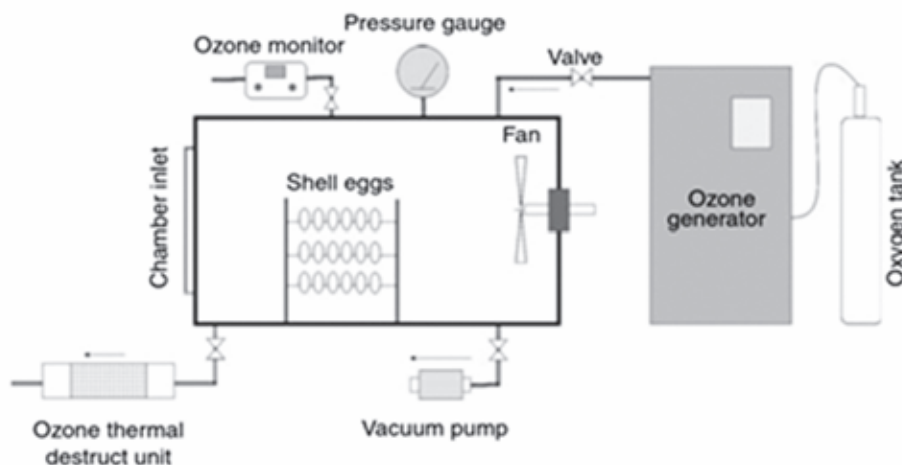


Figure 1 Representation of experimental setup used to treat whole shell eggs with gaseous ozone under pressure.

Ozone Biocidal Product Authorization under the European Biocidal Products Regulation

Dr. Bart Kerré, Dr. Kristin Van Gestel and Dr. Jaak Ryckeboer (EurO₃zon ivzw*);
Dr. Tim Pühmeier and Dr. Jörg Mielcke (Xylem Services GmbH, WEDECO);
Dr. Matthias Rothe (ProMinent GmbH); Dr. Matthias Hoffmann (BWT Wassertechnik GmbH);
Mr. Bernhard Paolini (SUEZ Ozonia), Chairman of EurO₃zon ivzw.

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Placing ozone biocidal products legally on the European market requires a two-step process

Authorization of ozone as a biocidal product (BP) under the Biocidal Products Regulation (BPR, Regulation (EU) 528/2012), requires two steps, the first step being the approval of ozone as an active substance (AS). Approval entails that ozone is included in the EU list of approved active substances, in which ozone is officially referred to as 'ozone generated from oxygen'. The second step is successfully completing a BP authorization. Overall, the requirements for a BP authorization dossier are similar to those for an AS dossier; physicochemical properties, efficacy, human health, environment,... are all part of such a dossier. However, at BP authorization level, individual product-specific authorization applications are required, resulting in complex data and high costs for applicants in case of authorization of multiple BPs with only small variations in composition.

Status of evaluation of the ozone active substance dossiers

In 2015, EurO₃zon submitted four ozone AS dossiers, i.e. for Product Types (PTs) 2, 4, 5 and 11, which are up until now still under review by BAuA (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin), the German evaluating competent authority (eCA). During the review process, several questions were raised, related to, amongst others, oxygen as precursor, efficacy, monitoring data of disinfection by-products and endocrine properties of ozone. Assessment of endocrine properties is the consequence of a new regulation which is applicable to all active substances, even if already approved. Currently, only issues with efficacy testing are still ongoing before ozone AS can be approved.

Authorization of multiple biocidal products: Biocidal Product Family

One way to deal with the BP authorization complexity and to

reduce costs for registration is grouping of several BPs under a single authorization, by creating a Biocidal Product Family (BPF) tree which is characterized by three levels (Figure 1). According to Article 3(1)(s) of the BPR, a BPF refers to a group of biocidal products having similar uses, the same active substances, similar composition within specified variations and similar levels of risk and efficacy, this is the first level. Within one BPF, BPs can be further arranged into several sub-families, the so-called meta-SPCs (SPC = Summary of Product Characteristics), this is the second level. BPs belonging to the same meta-SPC have a common set of Risk Management Measures and identical Hazard and Precautionary statements. The big advantage of such an approach is that the risk and efficacy assessment can be based on the "worst-case" scenario, thereby reducing redundant testing/costs. For example, the risk assessment for the product with the highest AS concentration within one meta-SPC ('maximum risk') will cover the risk of all other products within the same meta-SPC. Or, successful efficacy testing with the product with the lowest AS concentration within one meta-SPC ('minimum efficacy') will guarantee efficacy of the other products as well. The third level within the BPF concept is the level of the individual BPs.

In situ generated substances versus biocidal product authorization

While the three levels of the BPF concept (family, meta-SPC, individual product) may be rather straightforward for traditional BPs, a debate is still ongoing within Europe for in situ generated BPs such as ozone. For some in situ generated BPs that are generated at the place of use for direct application, the in situ generated BP may be equipment-specific, i.e. the BP is generated by an in situ device of type X from manufacturer Y. In situ devices for generating ozone can take in various concentrations of oxygen from various sources (pure O₂, ambient air, water), delivering an output foreseen within the set range and within the frame of the BPF, and the result is an infinite number of ozone concentrations being generated. It is, therefore, at the moment not yet clear to what extent an applicant has to list all ozone BPs. Currently, EurO₃zon and other stakeholders are discussing this issue with the national

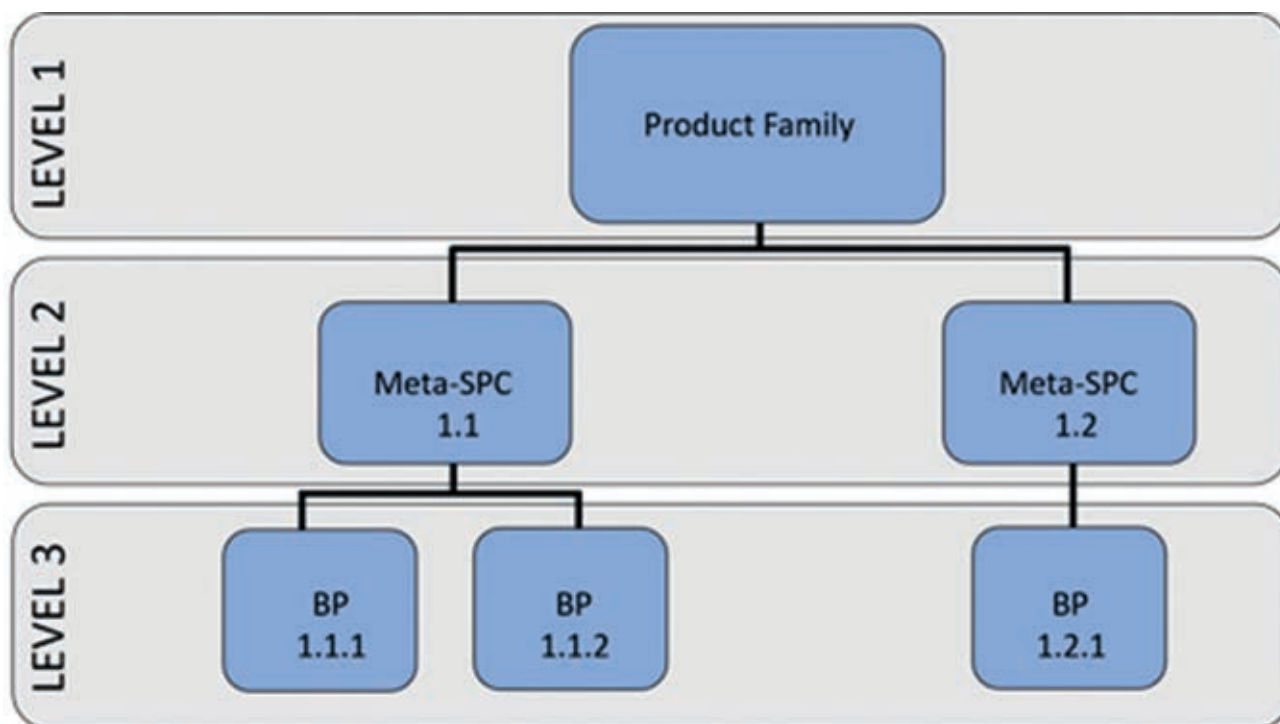


Figure 1. The three levels of the Biocidal Product Family (BPF) Concept. First level: creating a Product Family, a group of biocidal products with similar composition, similar uses, similar risk and efficacy. Second level: grouping of biocidal products in different Meta-SPC's, with biocidal products within the same meta-SPC having identical Hazard & Precautionary phrases. Third level: the level of individual biocidal products (BP's). This figure is only an example, more Meta-SPC's (= Summary of Product Characteristics, level 2) and BP's (level 3) are possible.

and European authorities regarding; to what extent is the third level of a BPF necessary, or how can the third level fit for ozone and other in situ generated products? A proposal that is actually under discussion by the Competent Authority (CA) meeting is that the authorization for ozone BPs will be granted at the meta-SPC level, i.e. characterization at the third level would not be necessary.

Union authorization

The BPR allows that BPs can be authorized at the European Union level, which is called a Union Authorization (UA). This UA provides the same rights and obligations in all the Member States as if they were granted by national authorizations, without needing a specific national authorization. In other words, one single authorization is valid for the entire European (EU/EEA) market. An important condition for UA is that the BPs have similar conditions of use across the EU, and some Product Types (PTs) are excluded.

A UA is possible for single BPs or entire BPFs. In practice, most UA applications up until now are for BPFs. Indeed, the

combination of the BPF concept and UA allows high flexibility (e.g. marketing strategy across the EU) and simplification (e.g. evaluation process and costs) for the applicant when authorizing multiple BPs.

Product authorization in EFTA member states

Three of the four EFTA (EFTA = European Free Trade Association) members (Iceland, Liechtenstein and Norway) accept the rules of the BPR, because they are also member of the EEA (EEA = European Economic Area). Additionally, even the fourth EFTA state, Switzerland, orientates its requirements for legal uses of BPs closely to the BPR. Switzerland requires a transitional product authorization for ozone, a so called "ZN-Übergangszulassung" (ZN-transitional authorization), until ozone is included in the EU list of approved active substances. The request for a ZN-transitional authorization had to be submitted by a Swiss company to the Swiss authorities by 2017. To keep ozone uses in Switzerland legal, EurO₃zon commissioned the Swiss consultant PAB Management Services GmbH (Steinmaur, CH) for preparing a ZN ozone dossier based on EurO₃zon's data, and for the

subsequent submission. By meeting the deadline, the legal use of ozone in Switzerland keeps ensured. In April 2019, PAB Management received the official ZN-transitional authorization for a first group of ozone uses, so that the legality of these ozone uses is now officially confirmed for the EurO₃zon members and their end users. The final, permanent authorization of ozone uses in Switzerland later on will be in line with the EU product authorization for ozone.

Efficacy testing

One of the most comprehensive sections of a BP authorization dossier is efficacy testing. At the stage of AS approval, efficacy testing requires demonstration of the efficacy of the AS itself, which implies that the AS should be at least sufficiently effective against one claimed group of target organism (e.g. bacteria, yeast,...). In case of the ozone AS dossier, it was agreed with the evaluating authority to show efficacy against bacteria for each Product Type including PT 2, 4, 5 and 11. At this stage, one simple screening test or laboratory study with one reference organism (e.g. *Staphylococcus aureus*) is usually sufficient. However, in case of the ozone AS dossier, also simulated use tests linked to practical conditions were requested due to the inappropriateness of the standard EN methods for testing the unstable, strongly oxidative substance ozone.

At the stage of BP authorization, requirements for efficacy testing are much more demanding. Now, biocidal activity should be demonstrated by the BP itself and against all claimed target organisms, and in accordance with the use instructions (temperature, concentration, contact time, interfering substances, ...). In practice this corresponds to a minimum testing requirement of two different tests (laboratory suspension tests + simulated use tests) per reference test organism for that target group (e.g. *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Enterococcus hirae*), per claimed activity (e.g. bactericidal activity, PT 2). In some cases, additionally also in-use field studies are required, under actual use conditions on specific surfaces and in a real-life environment. It is clear that “worst-case” testing within the frame of the BPF concept can reduce redundant testing and, hence, limits costs considerably.

First EurO₃zon biocidal product workshop

Awaiting the AS approval date for ozone and the outcome of the BPF discussions with the authorities, EurO₃zon is currently initiating the preparations for the BP authorization dossier, of which EurO₃zon will be authorization holder. This BP authorization will include all interested LoA customers, with the intention to share/reduce costs for all consortium members. In this perspective, EurO₃zon organized a one-day workshop (April 4th 2019, Heidelberg, Germany) with its current LoA-

customers in order to present the above-mentioned issues related to ozone BP authorization while giving an update on the progress of the AS approval dossier. The main goal of this workshop was to align with the LoA-customers on the BP authorization process. This included reflecting on the number of BPFs needed for ozone, and on the proposed claimed uses and target organisms; is the addition of a claim justified by the associated additional costs for efficacy testing? Once agreed between the different LoA-customers on this technical level, an efficacy testing plan can be developed. The workshop was perceived as a success by the LoA-customers and EurO₃zon members. More workshops may take place in the near future to finally agree on submitting one or more mutual ozone BP authorization dossiers are considered.

Please check BPR news section on www.euro3zon.org for further updates.

IOA-PAG ATLANTA CONFERENCE, AUGUST 27-29, 2019 TECHNICAL PROGRAM SUMMARY

The technical program has been summarized for the Atlanta conference, with approximately 45 presentations given in two parallel sessions. The session topics are listed below. For the complete technical program visit the conference website, www.ioa-pag.org or see them in the next issue of Ozone News.

Tuesday, August 27, 2019

Session 1 - Ozone Design and Operation (3 papers)
Session 2 - Reuse and Contaminants (3 papers)
Session 3 – Ozone Applications in Georgia (3 papers)
Session 4 – Biofiltration (3 papers)
Round Table Discussions and Poster Session (7 or more)

Wednesday, August 28, 2019

Session 5 – Cyanobacteria Treatment (5 papers)
Session 6 – Reuse and Contaminants (5 papers)
Session 7 – Ozone Design and Operation (6 papers)
Session 8 – Advanced Oxidation Processes and Contaminants (6 papers)

The Round Table Discussions are a continuation of the successful implementation of them at the previous Las Vegas conference. Industry experts will focus on a specific topic in time-limited sessions in a one-on-one experience with a few attendees. This can allow for more in-depth discussions and ability to respond to specific questions or issues. If you were unable to attend these in the Las Vegas conference, you should consider participating at this one.

NEW IOA MEMBERS

The International Ozonation Association takes great pleasure in welcoming our new members!

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Upcoming IOA Meetings

2019

June 20-21, 2019 *28th Japan Ozone Association Annual Conference*, Tokyo Metropolitan Waterworks, Tokyo, Japan. **Information:** www.j-ozone.org

August 26-29, 2019, *IOA Pan American Group Regional Annual Conference*, Buckhead Marriott Hotel, Atlanta, GA. **Information:** www.ioa-pag.org. **Conference and Hotel registration is open**

October 20-25, 2019, *IOA 24th World Congress and Exhibition*, Hyatt Palais de la Méditerranée, Nice France. **Information:** www.ioa-ea3g.org/congress. **See call for abstracts in this issue.**

2020

August 17-20, 2020, *IOA Pan American Group Regional Annual Conference*, South Point Hotel and Casino, Las Vegas, NV. **Information:** www.ioa-pag.org.

2021

August 30- September 3, 2021, *IOA 25th World Congress and Exhibition*, Caesars Windsor Hotel and Casino, Windsor, Ontario, Canada. Future information will be available in Ozone News or www.ioa-pag.org

Upcoming Meetings of Other Organizations

2019

June 9-12, 2019, *AWWA Annual Conference & Exposition (ACE 19)*, Colorado Convention Center, Denver, CO. **Information:** www.awwa.org

June 16-20, 2019, *12th IWA International Conference on Water Reclamation and Reuse*, Berlin, Germany. **Information:** www.iwa-network.org

June 19-20, 2019, *PFAS Management, Mitigation and Remediation Conference*, The Point, Westerville, OH. **Information:** www.ngwa.org

July 29 – August 1, 2019, *WEF-EESS Conference: Advancement in Water & Wastewater Treatment and Reuse*, Singapore. **Information:** www.wef.org/events

September 3-5, 2019, *Aquatech Mexico*, Mexico City Mexico. **Information:** www.aquatechtrade.com/en/mexico

September 8-11, 2019, *34th Annual WaterReuse Symposium*, Marriott Marquis San Diego Marina, San Diego, CA. **Information:** www.watereuse.org

September 11-14, 2019, *Association of Water Technologies Annual Convention and Exposition*, Palms Springs Convention Center and Renaissance Hotel, Palm springs, CA. **Information:** www.awt.org

September 21-25, 2019, *Water Environmental Federation Annual Technical Exhibition and Conference*, McCormick Place, Chicago, IL. **Information:** www.weftec.org

October 2-4, 2019, *WaterSmart Innovations Conference and Exposition*, Las Vegas, NV. **Information:** www.watersmartinnovations.com

October 16-18, 2019, *World Aquatic Health™ Conference*, Williamsburg Lodge, Williamsburg, VA. **Information:** www.thewahc.org

November 3-7, 2019, *AWWA Water Quality Technology Conference*, Sheraton Dallas Hotel, Dallas, TX. **Information:** www.awwa.org

November 5-7, 2019, *National Pool|Spa|Patio Expo*, Morial Convention Center, Las Vegas, NV. **Information:** www.poolspapatio.com

November 5-8, 2019, *Aquatech Amsterdam*, Amsterdam, the Netherlands. **Information:** www.aquatrade.com/amsterdam/

November 10-15, 2019, *AICHE Annual Meeting*, Hyatt Regency Orlando, Orlando, FL. **Information:** www.aiche.org

2020

March 8-11, 2020 *2020 IUVA Americas Conference*, Disney Coronado Springs, Orlando, FL. **Information:** www.iuva.org

May 4-8, 2020, *IFAT Munich*, **Information:** www.ifat.de

June 23-26, 2020, *8th International Ozone Applications Symposium*, Varadero, Cuba. The conference will focus on ozone research, ozone therapy, ozonized vegetable oil, veterinary medical applications and applications of ozone in food and pharmaceutical industries. **Information:** www.8simposio-ozno@cnic.edu.cu

The International Ozone Association
is pleased to invite you to take part in the

24th World Congress & Exhibition

20 - 25 October 2019, Nice, France

Ozone and Advanced Oxidation

Leading-edge science and technologies

This event continues a long series of successful congresses organized worldwide to provide an international forum for all concerned with fundamental, engineering and applied aspects oxidation techniques involving ozone and advanced oxidation systems.

SCOPE

The upcoming congress will host experts from all over the world to present and discuss the latest advances in knowledge and technology for development and application of processes based on ozone or any advanced oxidation system for:

- Environment preservation and human health protection: water, gas, soil and waste purification, water reuse and recycling, recovery of valuables
- Industrial manufacture and conditioning: pulp and paper, agri-food, electronics, chemicals, oil&gas, ...
- Medical therapy.

OBJECTIVES

The IOA wishes to continue to offer the world the unique opportunity:

- To interface with scientists, researchers, students, engineers, users, technical experts,
- representatives of leading organizations from various disciplines,
- To share the latest information on research topics, current issues, technologies under development, new applications, full-scale experiences and equipments and products,
- To consider and discuss directions able to deliver innovative, competitive and sustainable solutions which address current and next challenges.

PROGRAMME

The congress will feature:

- Three concurrent scientific and technical sessions including keynote lectures, oral communications, short oral presentations with connected poster exhibition and discussions (21-23 October),
- Exhibition of Industry's technologies, products and services (21-23 October),
- Technical visits of full-scale application plants (24-25 October),
- Social and cultural events for delegates and their guests: tours, congress dinner

ANNOUNCEMENT

CALL FOR PAPERS AND EXHIBITORS





CALL FOR CANDIDATES

Willy Masschelein Prize 2019

Prize for Research of the European-African-Asian-Australasian Group of the International Ozone Association

This prize was created in 1985 to encourage further developments in the field of ozone and its application. It is usually awarded during the IOA World Congress. Its name, formerly "Jean Hallopeau Prize" was changed in 2004 into "Willy Masschelein Prize" as recognition of the outstanding work he has made for the Association.

The European African Asian Australasian Group of the International Ozone association offers this prize with the aim to encourage further developments in the field of ozone and advanced oxidation systems.

This award is presented after examination by a Scientific Board of papers on a level similar to a thesis or a dissertation for a Doctorate degree.

Recipients of the Prize are:

1985	Dr. Johannes Stahelin	<i>Switzerland</i>
1987	Dr. Claus Heuser	<i>France</i>
1989	Dr. Coscun Yurteri	<i>USA</i>
1993	Dr. Mohammed Siddiqui	<i>USA</i>
1995	Dr. Charles Labatiuk	<i>Canada</i>
1997	Dr. Bernhard Etrich	<i>Germany</i>
2001	Dr. Franck de Smedt	<i>Belgium</i>
2005	Dr. Barbara Kasprzyk-Hordern	<i>Poland</i>
2007	Dr. Marc-Olivier Buffle	<i>Switzerland</i>
2011	Dr. Pierre Mandel	<i>France</i>

REGULATIONS

Objective

The Willy Masschelein Prize is an award for original research revealing some unprecedented knowledge on any of the fundamental aspects of the industrial generation and the applications of ozone and advanced oxidation systems.

This award will be given in 2019 during the 24th IOA World Congress at Nice (France) and will be presented to one of the candidates whose papers must be submitted before 15th June 2019.

Value of Prize

The value of the Prize is 4,000 € (four thousand Euros). This sum covers the costs incurred by IOA-EA₃G for the organization of the winner attendance at the 24th World Congress to receive the Prize i.e. the full registration dues and the costs for travel and stay. The winner will receive the rest.

The Prize cannot be divided among several candidates.

I.O.A. - EUROPEAN-AFRICAN-ASIAN-AUSTRALASIAN GROUP

IOA-EA₃G Secretariat - 7 rue Marcel Doré - 86000 POITIERS - France

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Contributions

Dissertations submitted must be a thesis or dissertation accepted by a University or by a public research institution for a Doctorate degree. Prospective candidates should fill an application form available at IOA-EA₃G Secretariat upon request and return it with a PDF file of the dissertation by 15th June 2019.

IOA-EA₃G Secretariat – 7 rue Marcel Doré – 86000 POITIERS – France

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The material must be the work of one person. Joint papers will not be accepted. The texts of dissertation must be a thesis submitted to a University or to a public research institution during the four years preceding the IOA World Congress. Former publication of the results of the thesis in full or in part will not disqualify candidates from competing, providing it is duly established that the thesis is related to research by the candidate.

The winner makes a commitment to attend the World Congress in order to receive the Prize and make a presentation on the thesis content except special circumstances.

Official Languages

The thesis can be submitted in English or French. If any other language is used, a 10,000 words abstract must be provided summarizing the purpose and the aspects of the research. This abstract must be submitted in one of the two official languages referred to above.

Candidacy

The competition is open to University graduates regardless of their nationality. Candidates must have been enrolled at a University during the period when the research for the thesis took place.

Examining Board

The examining board will be chaired by the President of the European-African-Asian-Australasian Group of the I.O.A. acting in an advisory manner. The examining board will comprise four members appointed by the Board of the European-African-Asian-Australasian Group. Supervisors of research works submitted will be excluded. If necessary, the examining board can engage expert linguists for the assessment of dissertation – thesis if written in a language other than English or French. The decision of the examining board will be taken as final. If the examining board cannot reach a clear decision the President of the European-African-Asian-Australasian Group can be asked to vote with the examining board.

The notification about the outcome of the selection process will be made before 30th July 2019.

Circulation

These Regulations are circulated by the I.O.A.

Publication

If necessary, the I.O.A. will assist candidates to get their research work published in scientific journals in order to ensure the widest possible diffusion. Such assistance will only be given at the candidate's request. Publication will not necessarily have to be confined to the text of the Prize-winning thesis.

Competency

The Board of Directors of the European-African-Asian-Australasian Group of the I.O.A. will settle, without further appeal, all matters arising that are not covered by these regulations.

I.O.A. - EUROPEAN-AFRICAN-ASIAN-AUSTRALASIAN GROUP

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Announcement



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