AZCO INDUSTRIES LIMITED
Advanced Ozone Technology (since 1975)

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AZCOZON OZONATION SYSTEMS FOR WASTEWATER RECOVERY

AZCO equipment are utilized in fish hatcheries, fish farms, fish processing plants, single-family sewer systems, municipal and commercial sewer systems, food processing waste treatment, industrial toxic waste treatment, greenhouses…. In these applications AZCO ozonation systems provide wide range of support ranging from just a reduction of biological waste, to a complete purification and sanitation as required by the drinking water quality standards. Recovered water is suitable and often used for irrigation in farming and parks. In applications with biological sludge, even the sludge can be eliminated by oxidation in our systems, saving big money on long-distance hauling the sludge for ground-disposal.

For the best economical effect ozone must be applied in conjunction with a chain of other clean and environment-friendly techniques:

- **Rotating screens.** They are suitable for flows up to 460 m^3/h, with screens typically 15 – 100 um size. About 1% of the main flow is charged with ozone for continued backwash, if stickiness is a problem, this way the water for the backwash does not require any chemicals, and it does not have to be heated.

- **Sedimentation tanks** are very useful in some applications. Classic sedimentation tanks are used as primary fermenting tanks in sewer systems. In these tanks the black-water effluent pipe is positioned about 30-40 cm below the surface. This way the lighter material float up, and heavier drops down, and only dissolved organic (very little particles) make it out as so called black-water. Such is very suitable for further treatment thru biological processes or foam fractionation, as further described. Sedimentation tank may be needed in case a rotating screens does now provide desirable separation of small solids.

- **DAF cells** are suitable for the aeration of wastewater with very high organic content. In this process ozone oxidizes the surface of the tiny organic particles, creating tiny bubbles of carbon dioxide. Nitrogen gas from air provides further lift to the particles. Skimmers remove the resulting foam.

- **Foam Fractionators** work similarly to DAF cells, except that they do not need mechanical skimmers, and are better suited for smaller flows, or in case the space for much larger DAF cells is a problem. The foam overflows into a special compartment where it is collapsed by high-pressure mist, in case the foam is too light and not collapsing naturally. Foam fractionation systems from AZCO use MIC injectors for sucking ozone, and the wastewater is farther blasted with ozone thru intensive

cavitation-based static mixer, for maximum attachment of ozone molecules to the molecules of organic material. In that process typically one molecule of ozone (O3) oxidizes one molecule of Carbon from the organic molecule, and creates a micro-bubble of carbon dioxide (CO2), that makes the micro particle of organic material lighter thus rising up and evacuate the device in form of foam. In addition, also Nitrogen gas that comes to the injector will enhance the flocculation and formation of the foam.

- Flocculation process uses ozone to create flocks from otherwise dissolved organics, where also heavier materials are present, like iron, where therefore the particle is too heavy and not able to float up. A sand filter with automatic backwash further down the line filters these flocks out. In a foam fractionating device some of the flocculation may create heavier groups and drop down and come out with the water outlet. This effect is very unlikely to happen in organic materials separations, but only if some metals are involved, for example iron that converts to iron-oxides, possibly coming from the fresh water source on the location. If that is the case, also a sand filter may be required so to remove the heavy flocks. If makeup water that is rich with iron, manganese or other metals, it is recommended to have fresh-water treatment first, before used in the fish processing plant.

- Bio-filters are needed to pre-treat black water, where rotating screens are not possible or not practical, namely in smaller systems, or where the wastewater was already fermented and turned into black water with high BOD.

The effluent water from the above processes is further purified with ozone for final purification and sanitation, where it is desired. Such process uses ORP electrode that can be programmed as high as needed for reaching the drinking water quality standards. While generally such water is not being used for drinking purposes in human consumption, it is very much usable in close-systems for flushing toilets (by AZCO proprietary NSF tested systems), for industrial processes where very clean water is required, and for irrigation.

In more elaborate industrial wastewater treatment systems ozone is applied in a Ph-LOW process tank, followed by filtration, then in a Ph-HIGH process tank, followed by filtration, and further followed by a high ozone level treatment. In extreme cases such process can be assisted with hydrogen peroxide and/or UV radiation (PEROZONE). Such extreme process does not provide ORP -based proof of final treatment, thus a carbon filter can be used to filter out the oxides, followed by yet another ozone system with ORP-based control.

- Ozone also helps in oil separation and sedimentation.

- Aerobic and anaerobic digesters are suitable for pre-treatment, to be followed by ozonation.

- Ozonation of large lagoons provides a much more efficient bio-treatment, and usually includes a final disinfection stage utilizing ozone – see also the Lake Remediation process.

In most cases, not all of the techniques above need to be implemented at the same time. For the selection of proper technologies, many aspects must be evaluated, including:

- Water flow
- Wastewater content based on laboratory test results
- Space available, and the cost of the space
- Target water quality — anywhere between merely some reduction of organics, to compliance with the bottled water quality standards.
- Penalties for the discharge of water with BOD above allowable limits.
- Cost of regional water and estimated value of the recycled water.

AZCO is equipped to provide a wastewater treatment solution which meets all your requirements in the most economical way. For this purpose please answer the attached questionnaire to the best of your knowledge.

For specific projects, see the questionnaire below.

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CONFIDENTIAL QUESTIONNAIRE FOR WASTEWATER TREATMENT

Please answer only the questions which are relevant to your operation:

1. Name the project clearly for future reference.

2. What is the water flow to be treated? Please provide peak flow and daily average, along with the length of the working day, where applicable.

3. What is the target water quality and what is the desired usage for the treated water?

4. Provide a sketch of the layout and elevation of the present hydraulics.

5. If the discharge is under pressure, please specify this pressure.

6. Has any treatment been already applied? If so how effective was this treatment? If possible, please provide BOD levels prior to and after the existing treatment.

7. What is the primary source of the waste? Examples: Vegetable processing plant, Chicken processing plant, Municipality of 3,000 people, Cyanide removal from a chemical factory, hospital effluent.

8. Is a clean and dry room available, of what size?

9. Do you plan any future expansion?

10. Is there a source of dry oxygen on the site? If so, what kind (liquid, Airsep) and what flow would be available for ozonation?

11. What is the electrical power source available (voltage, current, frequency)?

12. Do you wish to interface the ozonation system into your system computer? If so, please indicate what functions you wish to monitor or control. Fully automatic systems with remote data logging are available.

Please call our Engineering Department if not certain about any of the questions.

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