

The Shape
Of Things
To Come

SLOT INJECTOR



Tower Biology Installation, Bushy Park, SC



K₁a Testing Facility

Evolution

Ejectors

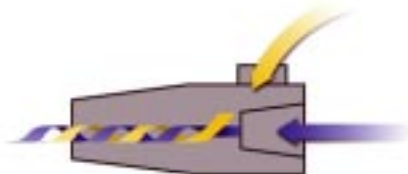
Jet aeration was originally based on the ejector method of contacting gases and liquids. Ejectors are devices that use pressurized motive fluid to perform various tasks. The motive fluid, known as the primary stream, is converted to a high velocity, low-pressure stream by the primary nozzle. This normally draws a vacuum in a secondary inlet, pulling secondary fluid into combination with the primary flow. The combined stream is then converted to a lower-velocity, intermediate pressure stream. In 1947, the first ejector aeration system was installed at a WWTP, treating 12 MGD of chemical wastewater. The BOD removal capacity of the process exceeded 100,000 lb/d.



During the next 20 years, some of the world's largest chemical companies applied ejector aeration technology to their biological processes. Over the course of time, two major application challenges emerged. The ejectors did not have a high oxygen transfer capacity on a per-unit basis, therefore large quantities of individual ejectors were required to meet the system's oxygen demand. Also, because the inner nozzle of the ejectors had an 8-mm. (0.63-in.) diameter opening, the ejectors were prone to plugging due to the occasional presence of trash in the process. When the ejectors were plugged, oxygen transfer performance quickly deteriorated.

Jet Aerators

The mid-1970s marked the beginning of the massive build-out of America's wastewater infrastructure. Ejectors evolved into what is currently known as jet aerators. The larger opening and simple geometric shape of the jet aerator made it less costly to



manufacture and more suitable for domestic wastewater applications. While jet aerators proved to be an economical oxygen transfer and mixing system, the development of the flushout system was a key factor in increasing the technology's acceptance. During the next 25 years, several companies expanded the use of jet aeration technology on a global basis, and established a broad range of applications such as deep tank biological processes, CLR, ASB, SBR and ATAD.

Slot Injectors

European chemical company Bayer AG was one of the earliest users of American-made aeration ejectors. In the 1960s, the company installed ejector aeration systems in its wastewater treatment facilities.



During the next 15 years, Bayer studied the ejectors' improved oxygen transfer results. The company's plan was to develop a device that could be used in its next generation of treatment plants in order to meet more stringent environmental regulations. Research focused on aerator design and configuration, reactor geometry, and oxygen transfer under process conditions, resulting in the development of a deep tank-activated sludge technology named "Tower Biology." Tower Biology consisted of using cylindrical reactors that were typically 15 to 20 meters high.

The ejector system (known as the "8/14 Injector") was the heart of the process, demonstrating high oxygen transfer efficiency, excellent mixing and reduced off-gas. Because the 8/14 injector had only an 8mm (0.63-in.) diameter inner nozzle, Bayer experienced the challenges associated with small injector openings. The company set forth



K_La Slot Injector System



Slot injector



on a precise scale-up, concentrating on maintaining key performance characteristics of the injector, while minimizing the documented decline in oxygen transfer efficiency resulting from the increased size of the jet openings.

In 1979, Bayer introduced the Slot Injector, which had four times the oxygen transfer capacity of the 8/14 Injector. The Slot Injector is dimensionally similar to a modern jet aerator, but uses a slot-shaped configuration to achieve higher efficiencies.

The slot-shaped nozzle and mixing chamber provide a greater shear surface for mass transfer than a circular jet opening of identical area. The diverging change in shape allows the gas/liquid plume to retain more of its kinetic energy as it exits the device, resulting in more effective gas dissolution into the bulk liquid.

The Slot Injector aeration system has operated successfully for more than 20 years in some of the largest industrial biological treatment plants in the world.

K_La Systems

K_La Systems is the Licensee for Bayer's Slot Injector technology. With more than 20 years of experience with jet aeration technology, K_La is uniquely positioned to introduce the Slot Injector System as a superior oxygen transfer system for today's biological treatment processes.

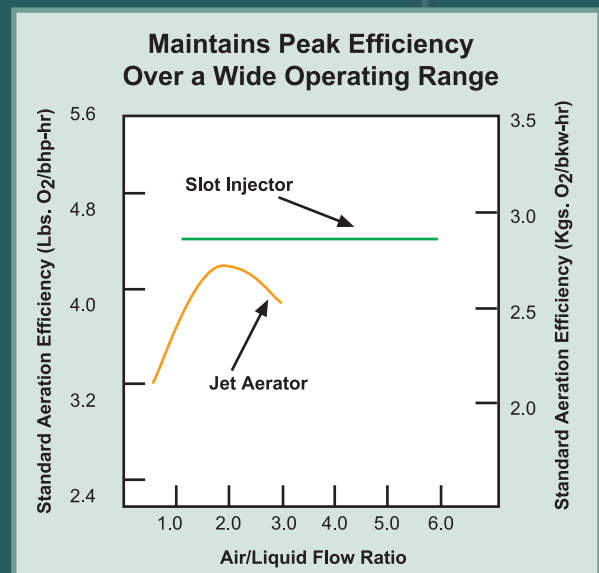


ADVANTAGES

- Lower Operating Cost
- Lower Capital Cost
- Maintains Peak Efficiency
- Superior Liquid Recirculation System
- Advanced Process Control

APPLICATIONS

- High Rate Processes
- Membrane Bioreactors
- Deep Tank Reactors
- Continuous Loop Reactors
- Pure Oxygen Systems
- Self Aspirating Systems





Over 20 Years of Success

Bayer AG's Leverkusen, Germany, production facility has successfully used Slot Injector aeration technology in its "Tower Biology" treatment plant since 1980. Four bioreactors — each 26 m. diameter by 26.5 m. SWD — with a total oxygen capacity of 180,000 t/d serve as the first biological treatment step. The second stage occurs in a mechanical aeration plant, which also serves as the domestic wastewater plant for local communities. Through its Technology Center and its Licensees, Bayer has successfully used the Slot Injector system at many industrial facilities during the past 20 years.



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For more information

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