



**Cleveland Eastern
Mixers**
DIVISION OF
EMI INC. TECHNOLOGY GROUP

www.emimixers.com

Introduction

The static or motionless mixer has proven to be one of the most innovative and cost savings pieces of equipment introduced to the water and wastewater market over the last 20 years. Over 15 unit operations within a typical treatment plant have been enhanced through the use of static mixer technology. This paper will summarize the major unit operations where static mixing is most beneficial and will provide guidelines on how to size and apply them.

Static Mixing Technology

Specific benefits to the water and wastewater industry include,

1. Absolutely no moving parts or spare parts, virtually zero maintenance
2. Very low power requirements
3. Small space requirements, compact design
4. Installs as simply and quickly as a section of pipe
5. Provides excellent chemical savings potential due to better dispersion
6. Can be designed for gravity flow situations due to low head-loss
7. Eliminates electrical connections
8. Improves sampling and measurement capabilities

Ten Most Common Applications

1. Flash Mixing of Aluminum, Ferric Chloride

The static mixer, when utilized as a flash mixer of coagulants, insures the most efficient utilization of treatment chemicals. The mixer eliminates the practice of overdosing to compensate for poor mixing or short-circuiting associated with stirred tanks and open pipes. Flash mixing is by far the most common application of static mixing technology.

2. Raw Water Blending

Large diameter fiberglass reinforced polyester mixers are used in both industrial and municipal treatment plants for initial chemical treatment of raw water. The addition of pH adjustment chemicals and coagulant aids eliminates large mechanically agitated holding tanks.

3. Polyelectrolyte Dilution

Polyelectrolyte dilution and addition for water and wastewater treatment has been one of the most popular applications for the inline static mixers. Unlike the high shear rates generated at the impellers of dynamic mixers, the uniform low shear mixing in the Cleveland static mixer prevents breakdown of long chain polyelectrolyte molecules and thus eliminating, overdosing while achieving chemical savings.

4. Chlorination/Dechlorination/Ozonation

Chlorination and dechlorination with both liquid and gaseous chemicals has been shown to be more cost effective utilizing inline devices. Because of its in-line installation there is no short-circuiting of chemicals thereby eliminating variations in effluent quality. The enclosed design provides safe operation whether chlorine, ammonia or ozone is used. Two phase mixing is very efficiently performed because of the plug flow nature of the mixer which eliminates

5. Sludge Conditioning

The recent emphasis on sludge handling and management has provided a new application for the in-line static mixer. Mixing return activated sludge, secondary sludge, and primary sludge, has been shown to produce better dewatering characteristics and thus, providing optimum usage of the dewatering and thickening chemicals. The simple yet, efficient design of the mixing elements in the Cleveland Static mixer eliminates, plugging, even when used on municipal sludge or other biological waste containing high solids concentration and stringy fibers. The free space area within the Cleveland static mixer approaches 98% of that of an open pipe.

6. pH Control

The Cleveland static mixer is ideally suited for automatic chemical treatment systems. As optimum chemical usage and 100% mixing is guaranteed, automatic pH control systems are now commonplace, especially in the industrial segment where the elimination of operator attention is desirable. The in-line static mixer has also been used in conjunction with mechanically agitated tanks for two-stage pH control as a means to reduce agitation intensity required in stirred tanks; and for premixing of treatment chemicals or polishing of the effluent.

7. Dissolved Air Flotation

Sludge thickening utilizing dissolved air flotation presents a unique application for the Cleveland Static Mixer. When installed in line after introduction of air and coagulant aids, the static mixer provides uniform droplet size and very predictable air dispersion. The overall effect is enhanced solid/liquid separation, floc formation and reduced chemical consumption.

8. Inline Aeration/Post-aeration

In-line aeration of wastewater streams has been shown to enhance the performance of conventional activated sludge systems. As a post aeration device - prior to effluent discharge - the in-line static mixer can be used to increase dissolved oxygen levels in plant effluent with air or oxygen.

9. Flocculation

Because of the uniform, low shear capability of the Cleveland static mixer, it can be utilized as an inline flocculator to replace conventional floc basins. Floc settling is enhanced, chemical usage is reduced and energy requirements are almost eliminated.

Conclusion

The Cleveland static mixer is offered in a wide variety of materials of construction including carbon steel, stainless steel, PVC and FRP. Exotic Alloys and PTFE mixers are also available. This results in a device with no application restrictions based on the corrosive or abrasive nature of the water or wastewater being treated. This is especially important in industrial systems where wide pH variations or the presence of abrasive solids can be a problem for process equipment.

Application Guidelines for Static Mixers in the Water and Wastewater Treatment Market

Application	Optimum Velocity Range	# of Elements	Material of Construction
Raw Water Blending	1-3 fps	2-4	FRP
Flash mixing	3-5 fps	2-4	Stainless Steel, FRP, PVC
Chemical Premixing	1-3 fps	2-4	Stainless Steel, FRP, PVC
Polymer Dilution	3-5 fps	6-12	Stainless Steel, PVC
Polymer Addition	1-2 fps	6-12	FRP, PVC
PH Adjustment	3-5 fps	4-6	FRP, PVC
Chlorination/Dechlorination			
Liquid/Liquid	1-5 fps	2-4	Stainless Steel, FRP, PVC
Gas/Liquid	4-10 fps	4-6	FRP, Stainless Steel
In-line Aeration	8-10 fps	4-6	Stainless Steel, FRP
Dissolved Air Flotation	10-12 fps (60 psi)	4-6	Stainless Steel
Sludge Blending	1-3 fps	4-6	Stainless Steel, FRP