INJECTION OF OZONE BASICS

Venturi injectors are used for injections of ozone. Venturi works under negative pressure creating a vacuum at the venturi suction port that sucks the ozone into the venturi, and mass transfers the ozone into the water passing through the venturi. The mass transfer takes place under high temperature when ozone goes into solution. A well designed venturi will offer more than 90% efficiency of mass transfer. The mass transfer is further increased by the use of in–line static mixer or assembly of injection nozzles in the pipe known as pipe line flash mixers.

The negative pressure in the venturi is created by the high pressure flow water at the inlet and the differential pressure created at the outlet of the pipe. The injector outlet pressure will be the sum of the pipeline pressure plus the pressure loss of the mixer, pipe and valves (the back pressure provided by the static mixer, pipe and valves).

Injector installations are normally designed as a bypass of the main line. The amount of bypass water will depend on the factors, which includes:

- Pipe Line Pressure: The lower the pipe line pressure, the lower will be the bypass volume
- Concentration of Ozone (Ozone/Oxygen Volume): The higher the concentration, the lower will be the ozone oxygen gas volume and the lower bypass water required
- Ozone Gas Pressure: The higher the zone gas pressure the lesser the side stream water required

The lesser the side stream water you able to use for ozone suction, the lesser is the energy required. The lesser the pipe line pressure, the lesser is the energy required.

When we design a venturi system, the overall costs including the cost of injectors, injection pump, injection accessories and energy costs need to be considered.

What We Should Try to Avoid During Ozone Injections

First of all, ozone does not like three things: high gas pressures, high temperature and then shears forces (compression of gas). Putting ozone gas into a high pressure water pipe is similar to the use of a liquid ring gas compressor (shear force) and the result of compression is pressure and temperature. High temperatures created during ozone injections can also destroy ozone.

Pipe Line Injections – What are the challenges?

During pipe line injection by a venturi injector, a phase separation after a few pipe diameters of travel begins to take place. The extent of phase separation depends upon the velocity of the mixed flow, bubble size and rate of coalescence.

Eventually, during pipeline injections, gas phase separates to the top of the pipe, a water phase along the bottom of the pipeline and homogenous mixture at the pipeline's central core. The longer the pipe run, the more will be the phase separation. This phase separation takes place in the pipe line irrespective of the efficiency of the mass transfer, due to sheer velocity of the water in the pipes. So it is a challenge to keep the ozone retained in the water. Selection and careful installation of mass transfer accessories become very crucial.

It is noted, if the pipeline injections not handled well, may induce formation of gas slugs into the system and effects the performance of the nozzles, flash mixers etc. When gas slug flow occurs, pockets of gas enter the nozzles reducing the mass transfer of ozone to solution.

What We Should Try to Achieve During Ozone Injections

Pipe line injections are excellent if we are able to achieve the conditions like:

- Lower pipe line pressures
- Lower length of pipe travel;
- Lower velocity of water
- Lower temperature
- Smaller bubbles sizes to lower the rate of coalescence

Contributed By: V. Baratharaj

OZONE TECHNOLOGIES & SYSTEMS INDIA PVT. LTD.
Tel: +91 44 4211 8266,
E–mail: otsilozone@gmail.com
Website: **www.otsil.net**