Optimizing Fume Scrubber Efficiency by the Application of Water Soluble Dispersants Part 2: Deposition / Bio-growth Control with OMEGA AQ-6122

Mark ANDRUS
Business Manager, Water Care
Tel: +1 (216) 351 1500
Cell: +1 (216) 780 4037
Fax: +1 (216) 351 5677

Coventya Inc.
4639 Van Epps Road
Brooklyn Heights, OH 44131
www.coventya.com
m.andrus@coventya.com

Abstract

An integrated manufacturing facility, utilizing scrubbers to neutralize and exhaust alkaline and acidic fumes from metal pretreatment, phosphating, and electroplating process applications, was experiencing poor removal efficiency and severe debris and biofouling upon internal piping and media. A chemical dispersant, OMEGA AQ-6122, was added to the scrubber process water to condition air scrubber induced debris loading and control biological growth of yeast, mold, and algae species. Scrubber efficiencies were increased, and waterside fouling of piping, probes, and distribution media was eliminated. By the application of this water soluble dispersant, maintenance activities were reduced, and scrubber efficiency remains within USEPA compliance guidelines.

Background

A manufacturing facility, involved in the cleaning, phosphating, and electroplating of metal and zinc die cast parts was experiencing debris plugging and biological fouling of air scrubber equipment [4 roof units]. The acid/caustic pretreatment and the process tank air scrubbers provide (1) ventilation to assure containment of acid/alkaline vapors and fumes away from worker exposure, and (2) provide adequate air quality to meet USEPA regulatory guidelines.

The ventilation system is exhausted to a roof cross-flow fume scrubber systems. Each scrubber system incorporates a packing distribution deck which utilizes water droplets to "scrub and neutralize" the acidic/alkaline fumes. (1) pH control assures efficient acid/alkaline neutralization with the use of sodium hydroxide or sulfuric acid, as required (2). (*See figure 1*)

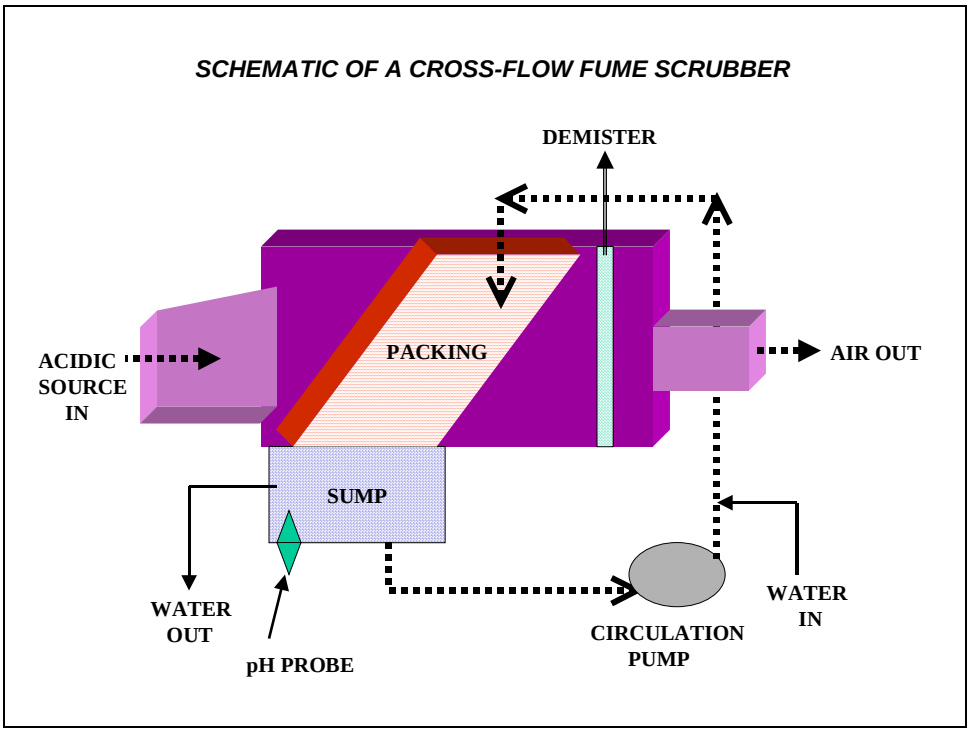

Figure 1.

Scrubber Operating Specifications

The cross-flow fume scrubbers operate at a pH range of 9 to 10 standard units. 95% efficiency of acid/alkaline removal is obtained at this pH level of operation. This 95% efficiency is required to meet compliance with USEPA (United States Environmental Protection Agency) regulatory guidelines.

The pH is monitored and controlled via an analyzer/controller; this controller activates an acidic or alkaline feed pump, depending upon the nature of the process .

The water scrubbing media is gravity flow returned from the packing to a collection sump. From the collection sump, a circulation pump routes the water back up to the packing media. The make-up water volume is controlled at an average of 7.6 LPM (liters per minute.)

A blow-down conductivity controller adjusts the total dissolved solids (TDS) of the water to a specific level. Water TDS is a critical factor in the absorption of acidic/alkaline gas fumes. As a general guideline, the scrubber water TDS should not exceed 15,000 mg/l, or 22,500 mmhos of conductivity.

The characteristics of the make-up water are an important factor that affect the ability of the recycle water to remain soluble without creating hardness deposition by-products of calcium and magnesium salts (3). In addition to hardness salts, air scrubbed debris (possible iron particulate, [or other airborne debris, including: (pollen/road & land particulates/process particle debris)] are to be kept 'fluid' and not inhibit water or air flow.

In this case, debris loading of particulate of a non-harness nature (pollen/ dust / oxides of iron) was creating a build-up upon the packing distribution decks of the 4 units. Biological growth was evident in the form of algae (green layering) and yeast & mold growth was also identified via a biological assay. This combined bio/growth-debris was fouling the air distribution and decreasing water flow upon the packing material. Frequent cleaning of the water spray nozzles was required on a weekly basis. The bio/growth was also considered a health hazard for return air units into the facility from cross-contamination of the roof based air intakes.

A water make-up meter/controller sends a 4-20mA (milliamp) signal to a chemical feed pump, which activates a chemical dispersant. The chemical dispersant, OMEGA AQ-6122 is utilized to suspend debris by-products and to control biological growth. In this specific case, keeping the spray headers clean from bio/growth was a primary objective along with bio/growth elimination. (*See figure 2.*)

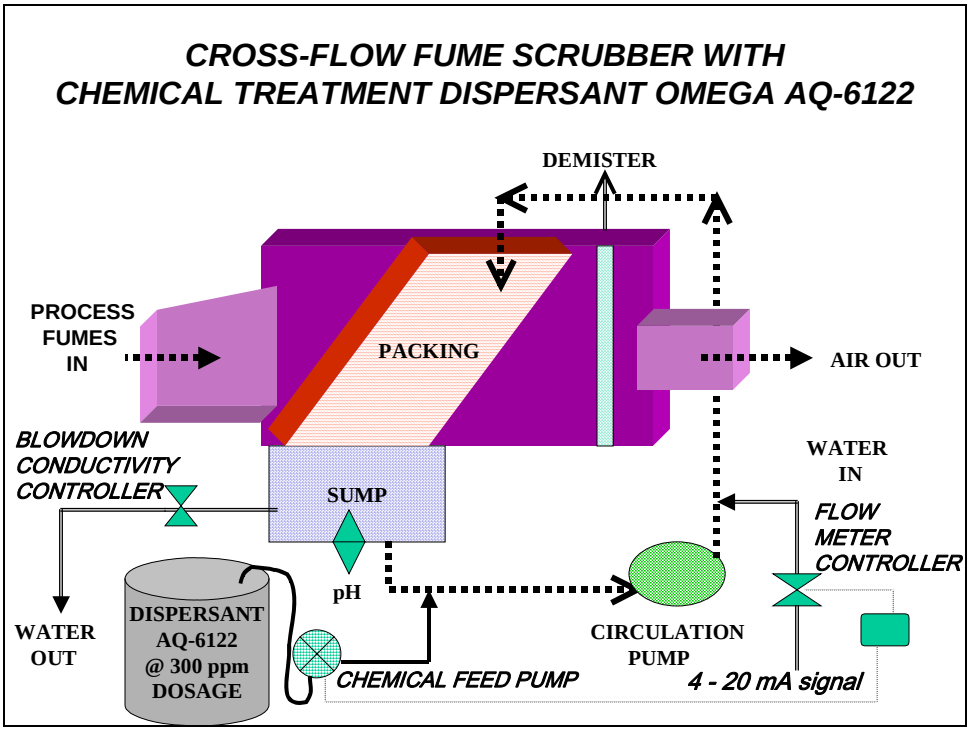

Figure 2.

As a typical operation, most fume scrubbers are installed without a chemical additive (dispersant.) Make-up water quality, airborne debris loadings, and biological growth potential will vary from application to application, and in fact, will vary in different regions of the country (4).

In summary, the scrubber became a maintenance burden and an on-going air discharge compliance concern.

Scrubber Operating With Dispersant OMEGA AQ-6122 Program Implemented

Quaternary-based dispersants have been widely used by the water treatment industry to inhibit debris build-up and to assist with biological control (5). A quaternary dispersant treatment program, OMEGA AQ-6122 was implemented on the scrubber system in June of 2006. A dosage of 300 ppm, as dispersant, was determined to meet the debris and bio/growth demand in this system. As the make-up water flow was two gallons per minute (2880 gallons per day,) a total daily dispersant dosage of 0.8 gallons (or 3000 milliliters) was set for administration by the chemical feed pump. (*See figure #3*)

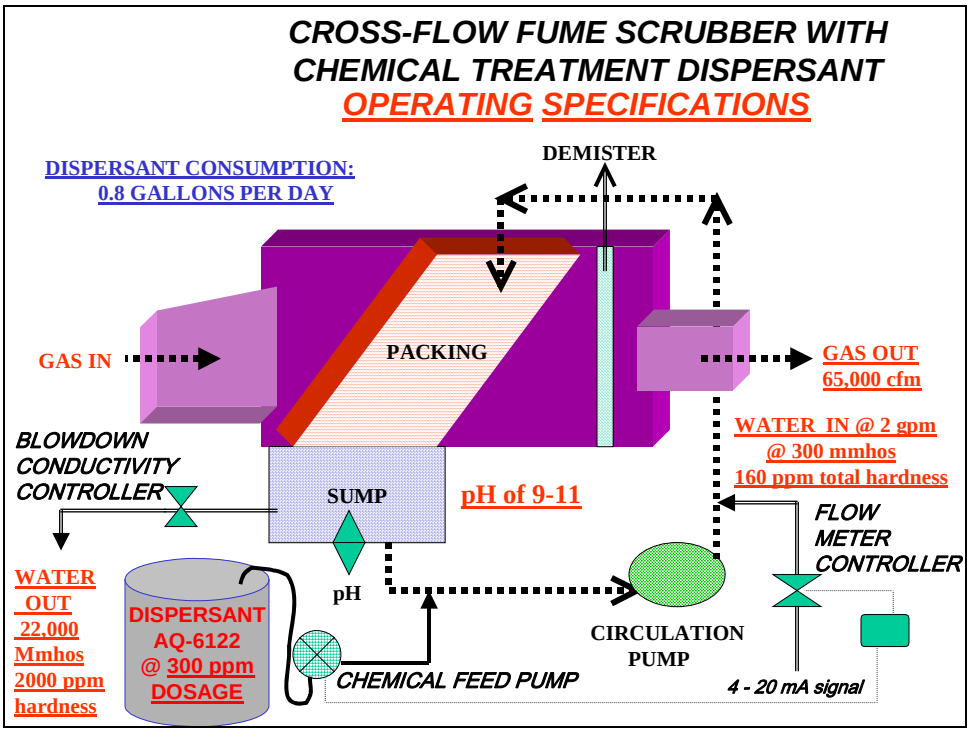

Figure 3.

Operating Results: A One-Year Evaluation

The dispersant application demonstrated improvement within 30 days after implementation. After 30 days, the debris formation upon the packing material was minimal. Biological growth was significantly reduced as no algae growth was observed. A biological assay of yeast, mold, and bacterial species indicated growth rates at less than 10^2 bacteria per milliliter. Scrubber efficiency maintained 95%+ as compliance was routine versus the previous erratic operation.

Chemical demand for the dispersant, OMEGA AQ-6122 was minimal, at a dosage of 0.8 gallons (3,000 milliliters) per day, per scrubber unit. 15-gallon dispersant drums (56 L) were located below the penthouse level of the roof scrubbers (4 of them are in use), and pumped up to the roof via liquid metering pumps.

Each dispersant drum lasts for 18 factory operation days. The cost associated with utilizing a dispersant was justified, based upon reduced maintenance and on-going compliance.
After one full year of operation the full benefit of the dispersant application was noted, as follows:

- No debris or biological growth was observed upon the plastic distribution media or on the spray nozzles.
- Water flow to each unit was uniform and this increased scrubber efficiency.
- Media replacement was no longer required. No deposition was observed upon the internal media or distribution piping of the scrubber unit.

Summary

The use of quaternary-based dispersants to assist fume scrubbers is not common for most facilities in the metal processing and finishing markets.

Dispersant chemistries are available to improve fume scrubber efficiency, reduce debris fouling and control biological growth build-up. The use of OMEGA AQ-6122 will minimize routine maintenance, and reduce a facilities overall cost of meeting air compliance concerns. Coventya WaterCare supplies OMEGA AQ-6122, specialty dispersant, for this application.

References

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