

PRÉVENTEX

AIR WASHERS IN THE TEXTILE INDUSTRY

POTENTIAL SOURCES OF AIRBORNE MICROORGANISMS

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The textile industry is characterized by high levels of ambient humidity varying between 50 % and 70 %. High humidity is necessary to ensure proper operation of many textile processes such as spinning or weaving and is often provided by air washer humidifiers that are integrated into the plant's general ventilation system.

Air washers are generally comprised of a water tank, a pump, piping and sprays (see figure 1). The water is pumped to the sprays and pulverized to the air flow, where it evaporates and is evacuated to the air distribution system. A retention device removes entrained water droplets from the treated air. However, this device is not 100 % effective and some water droplets are carried on the air flow, which means that they are evacuated into the workplace environment.



Typical air washer system

Source : On-site Expert / Nalco Chemical Company]

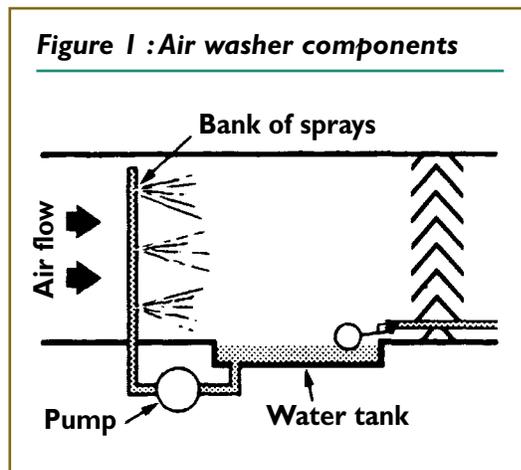


Figure 1 : Air washer components

AIR WASHER CONTAMINATION

The issue of microbial contamination of air washers is well-documented. Some industries such as textile, paper and printing are more likely to be affected by contamination because they involve the production of organic particles that feed the microorganisms entering the systems. The efficiency of the filtration system that treats air before it enters the washer affects the potential for contamination. The following factors contribute to the contamination of air washers:

- ◆ Stagnation of water
- ◆ Water temperature
- ◆ Presence of nutritive elements (organic substances) in the water

Air washer contamination
Health hazards
Detecting contamination
Controlling microbial contamination of air washers

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Maintenance practices can affect the health of employees who work in areas serviced by air washers and maintenance employees who clean contaminated air washers.

HEALTH HAZARDS

Humidifier fever is a flu-like disease caused by inhalation of water droplets emitted by air washers contaminated by microorganisms. Symptoms include fever, shivering, headaches, general malaise (aches and pain) and less frequently, respiratory symptoms (bronchial irritation, shortness of breath, etc.) Symptoms generally occur a few hours after exposure and last up to 24 hours, without long-term effects. Because the symptoms are short-lived and closely resemble those of the flu, victims rarely consult a physician.

In rare cases, inhalation of contaminated water droplets may also cause severe hypersensitivity respiratory diseases (allergies) like **asthma** and **allergic alveolitis** (hypersensitivity pneumonia).

It is generally agreed that contaminated humidifying devices can bring about the symptoms described above. Many types of microorganisms and associated toxins have been found in contaminated humidifiers (bacteria, endotoxins, mold, actinomycetes and amoeba). A causal link between specific microorganisms and diseases has not been established.

Humidifier fever should not be confused with **Legionnaires' disease**. Both are linked to contaminated water systems but symptoms and causal microorganisms are different. Legionnaires' disease is caused by inhalation of the *Legionella* bacterium and usually takes the form of pneumonia combined with high fever; it has a 10% mortality rate. *Legionella* is rarely present in air washer water because the optimal temperature for its growth and spread is 25°C to 42°C while air washer water rarely reaches above 20°C. However, all other factors contributing to the growth of the *Legionella* bacterium are present (stagnating water potentially containing sources of nutrition like rust or biofilms; aerosolization of water). Therefore, the risk of contamination by the *Legionella* bacterium is small but impossible to eliminate.

DETECTING CONTAMINATION

Apparent signs of microbial contamination include brownish sludge or slime deposits on the water surface or in the water and thin greenish films near the sprays or on the structure. These signs should not be ignored.

The degree of contamination can be assessed by analyzing air samples at outlet points but the interpretation of findings remains difficult since many types of bacteria are ubiquitous. Most of the bacteria usually present in natural environments are not health hazards and many are in fact essential to human life (on skin, in respiratory passages, in intestines, etc.) and the earth's ecological life. The risk of contracting bacterial diseases increases only if concentration of bacteria exceeds habitual levels. The lack of provincial, federal or American standards for exposure to bioaerosols makes the interpretation of samplings even more difficult. The lack of information concerning the causal link between dose and effect, as well as the impact of individual sensitivity levels on the effects of exposure partly explain the absence of standards.

Some manufacturers of biocides (the chemical products used for water treatment) evaluate bacterial contamination with direct measurement devices. Such data is useful but does not provide a complete picture of the air contamination situation because water taken from the surface of the tank is often less contaminated than the water that is near the pump and directed to the sprays, due to the degree of tank water contamination.

CONTROLLING MICROBIAL CONTAMINATION OF AIR WASHERS

The addition of biocides to the humidifier water is not recommended because it inevitably leads to exposure by workers to these toxic and irritating products. Careful dosage of biocides is crucial to achieve a compromise between microbial control and avoidance of irritation. Biocide manufacturers usually have the expertise needed to make appropriate choice and use of their products. A second argument against the use of biocides is that biocide products kill bacteria but do not eliminate endotoxins,

which are the toxic substances generated by the external membrane of negative gram bacteria.

Microbial contamination control is preferably achieved by using clean water, limiting stagnation time in tanks and periodical cleaning of water tanks. In environments where levels of air contamination by organic dust are high, the use of biocides may be inevitable. They should only be used when no other method is applicable.

The following suggestions can help reduce the proliferation of microorganisms in air washer humidifiers:

- ◆ Improving **filtration** prior to air intake, particularly where airborne dust particles are fine. The presence of organic dust in incoming air encourages microbial growth so improving the air filtration system before intake reduces microbial proliferation. Filters should be serviced regularly (cleaning or replacement).
- ◆ Continuous **purging** of tank water eliminates surplus solids, microorganisms and salts in the water. The rate of water changes can be automated or based on water conductivity levels. Frequency will be set according to the degree of water contamination (particles, dust or microorganisms) and the water temperature.
- ◆ Treatment of air washer water with **ultraviolet** rays, involving the irradiation of water with ultraviolet rays before it reaches the sprays to eliminate microorganisms. Many air washer manufacturers now integrate this technology to their products.
- ◆ **Frequent cleaning** of all air washer components (water tanks, baffles, spray nozzles, tank screens, etc.) and components of the ventilation system (fan blades, filters, piping, etc.)

The frequency of air washer cleaning depends on many factors: In very dusty environments, particularly where high levels of organic dust are present (cotton, paper, etc.), air washers may need to be drained and cleaned weekly to control bacterial and organic growth. Other factors are the quantity of accumulated particles in the tank, the water changing rate, the type of water treatment and the water temperature (higher water

temperatures foster the growth of microorganisms).

It must be noted that cleaning air washers that are severely contaminated by microorganisms can take several hours and require the use of detergents or disinfectants to remove all microorganisms. A solution of sodium hypochlorite (6% bleach) diluted 1:10 can be used. Workers cleaning contaminated air washers should wear personal protective equipment (individual equipment) to prevent contact with and inhalation of disinfectants or microorganisms. In addition, in the presence of hydrogen sulfide (H_2S), a toxic gas smelling of rotten eggs generated by the anaerobic disintegration of material by bacteria, workers should be adequately protected. Cleaning and maintenance of air washers that are washed and drained daily will require far less effort and time than servicing highly contaminated air washers.

- ◆ In every case, all humidifier and ventilation system components should be **inspected** regularly to make sure they are clean and detect any sign of bacterial growth.
- ◆ **Replacing** air washers with humidifiers, which are less likely to be contaminated by microorganisms because they do not operate with water tanks, may seem like an ideal solution but is not always possible if the new system is to be equally efficient in terms of humidification performance and remain affordable as regards installation, maintenance and operation costs.

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