of contaminants which vary widely in size and structure. Some are dry and relatively non-adhering while others are oily and tend to adhere tightly to various cold and warm metal surfaces. Those creating major problems in poultry houses are feathers, list (the hair-like fibers removed from the feather rib), skin flakes, powdered feces, and dust from feed and litter. Among other livestock, hair would replace feathers in the list of contaminants.

Just as the types of contaminants in poultry house air varies widely, so does the total amount of airborne dust. The amount of dust varies with bird population density, bird size, degree of bird activity, type of litter, and the relative humidity of the air. Very little information is available concerning this filtration load. One test result[36] is available and is cited as an example only. An automatic-feed, dry paper filter of 11.5 sq ft filter area was installed in a poultry house where dry, partially-decomposed corn cob litter was used. Restricting the filter pressure drop to 1.0 in. of water while filtering air at the rate of 1600 cfm, resulted in dust collection at the rate of 0.7 lb per day. Applying these figures to a minimum ventilation rate for a minimum laying hen population density and cold weather, this would amount to a filter load of approximately 1.0 lb of dust per day from a 10,000 sq ft house. Using the same figures for maximum warm weather ventilation and maximum laying hen population density, about 15 lb of dust per day would come from a 10,000 sq ft house.

In present usage, many installations have throw-away glass fiber filters. Usually, the useful life of these filters is too short for them to be used in connection with air conditioners or dehumidifiers. An automatic-feed, dry paper filter has been used successfully to protect heat exchangers operating above the air dew-point temperature. In this situation the fine dust passing through the filter paper and depositing on the fins of the heat exchanger did not greatly interfere with the heat exchange performance as long as the leading edge of the exchanger was not fouled. Operation below air dew point with this filter was more troublesome and subsequent cleaning of the heat exchanger was very difficult. Dust accumulating in the presence of intermittent condensation stuck very tightly.

Where greater filtration is required, electronic air cleaners are suggested. However, a pre-filter at least as good as the two types previously mentioned should be installed ahead of an electronic air cleaner.

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CHAPTER 30

AIR CONDITIONING FOR PHOTOGRAPHIC MATERIALS

Manufacture, Storage of Unprocessed Material, Processing and Printing, Storage of Processed Film

THE manufacture, processing, and storage of sensitized photographic products requires that the temperature and humidity of the air be very precisely regulated, and in many of the operations, since scrupulous cleanliness is essential, clean air is necessary.

MANUFACTURE

Sensitized photographic film consists of a transparent flexible support called the *base* which is coated with a gelatin emulsion containing salts of silver. Most film base is cast from cellulose esters dissolved in solvents, although some base is now made from synthetic polymers cast from a melt. To form a film base of the required uniformity by the solvent-casting method requires very careful control of temperature and solvent vapor concentrations in the coating machine. The coating wheel must be maintained at the correct temperature to facilitate the proper evaporation of the solvent and to obtain the proper casting of the base. Air in the drying and curing sections of the coating machines must be at the correct temperature and humidity and must be moved at a rate such that the concentration of volatile solvents removed from the film base does not reach a dangerous level. The film base must be stored in properly conditioned rooms, so that the characteristics of the material remain constant during storage and are satisfactory for subsequent operations.

In the preparation of the sensitive photographic emulsion, gelatin and one or more salts of the alkali halides are dissolved in water. Then silver nitrate and other chemicals are added to this solution at a definite temperature. Some of the desired characteristics of finished photographic emulsions are obtained by the temperature of the initial precipitation, and by the temperature and length of time the emulsion is allowed to ripen subsequent to precipitation. After several more operations, most of which require close temperature control, the emulsion is ready to be coated on the film support.

In the preparation of a typical emulsion, it is allowed to ripen for 20 min at 70 C (158 F); then it is cooled quickly to 45 C (113 F). More gelatin is added, and the emulsion is stirred for 20 min at 45 C (113 F). The mixture stands overnight in a cold room to allow it to gel, after which it is shredded, washed, and then remelted at 42 C (107.6 F). After the addition of more water and gelatin, it is allowed to after-ripen for 30 min at 60 C (140 F). It is then ready for the coating operation.

The emulsion, held accurately at the proper temperature in a liquid state, is coated onto the film base and is passed directly into a chilling chamber where the gelatin is solidified as quickly as possible at 10 C (50 F) or below. From the chilling chamber, the emulsion coated film goes into a drying alley where it hangs in loops from rods. Temperature, humidity, air purity, and time of drying are controlled with great care to insure a high quality product. As soon as the film has assumed the correct moisture content, it is wound in rolls and subsequently slit and cut into various sizes for packaging.

A 35–40 F chilled water system can best be utilized for room conditioning purposes in open or closed type conditioners where temperatures above 32 F and dew points above 40 F are required.

A brine system employing either calcium or sodium chloride is highly satisfactory where lower temperature storage facilities are required, or where process room conditions must be maintained below 30 F and dew points below 40 F. Brine systems using calcium or sodium chloride can be specified to temperatures of −25 to −35 F. Chromates and caustic soda should be used in brine systems to control *pH* and corrosion.

In the drying process of film base manufacturing, it becomes important economically to recover the solvents that are driven off. Temperatures of −85 F are being employed for this purpose, using a circulating medium such as methylene chloride with a freezing point below −85 F. In the case of low temperature application, metallurgy becomes extremely important. Alloy steels with a percentage of nickel are being used and have proven satisfactory. Insulation is critical, and at −85 F it reaches 6 in. in thickness when using cork and the equivalent thickness for other insulation materials. See Chapter 22 of the 1961 GUIDE AND DATA BOOK.

STORAGE OF UNPROCESSED PHOTOGRAPHIC MATERIALS

Virtually all photosensitive materials deteriorate with age, but the rate of deterioration is dependent to a large extent upon the storage conditions. The rate of deterioration is increased by both high temperature and high relative humidity,