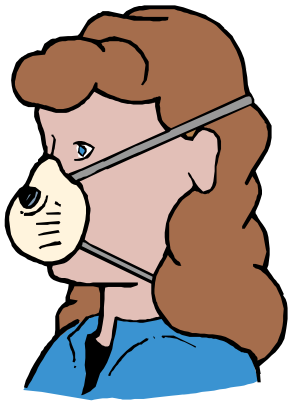
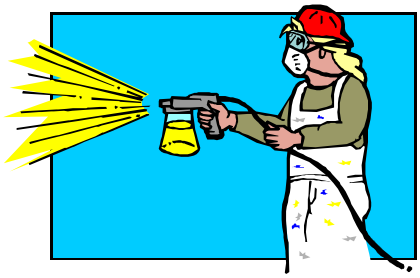
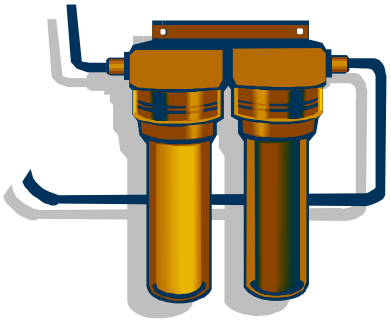


FILTRATION ….AIR & LIQUID





What is filtration?

Filtration is the separation of solid particles from a gaseous (Air) or Liquid suspension by passing the suspension (Air or Liquid) through a septum (or membrane) that retains most of the solids on or within itself. The septum (or membrane) is called a filter medium. The equipment that holds the filter medium and provides space for the accumulated solids is called a filter.

There are four classifications of separation:

- Solids ï Gasses (air) Separation
  (The separation of dust or other particles from a gaseous fluid. Our home filters are a good example of this type of separation.)

- Solids ï Liquids Separation
  (The separation of solid/semi-solid particles from a liquid. Drinking water filters are a good example of this type of separation.)

- Solids ï Solids Separation &
- Liquids ï Liquids Separation
  These last two classifications require very specialized equipment and are not pertinent to nonwovens media. Two examples would be separating sand from gravel or cream from milk.

Why do we use filtration?

We use filtration processes to weed out contaminants. Contaminants can be solids, semi-solids or even liquid or air particles. Solid contaminants may be responsible for your car breaking down if they were to get into your oil. Airborne contaminants may be the cause of your headache.

Other examples of contaminants are: Bacteria/Microorganisms/Virus; Tobacco smoke; Mold; Plant spores; Dust mites; Sawdust, chemicals in water; smoke from industrial smokestacks; car engine fumes; pollen; paint spray.

Where are filters used?

When most of us think of filters we think of home furnace filters, vacuum filters or car engine filters. There are actually hundreds of places filters are used that we never even think about. A few are:

Home: Swimming pool; vacuum cleaner; laundry; exhaust fans, furnaces & air conditioners

Food & Beverages: Bottled water; Edible/cooking oils; syrups (maple, corn); coffee, tea bags; etc.

Water Treatment: Desalinization; intake water

Pulp & Paper Industry: Filtered water for bleaching/pulping/washing

Pharmaceutical: Cultures/Growth media; opthalmics; vaccines; oral medications

Hospital/Medical: Face Masks; respirators

Your Body: Every day the glomeruli (gluh-mer-yuh-lie) in your kidneys filter about 2 quarts of waste & water from your blood and the waste becomes urine.

Likewise, the liver (the hardest working organ in the human body) also filters viruses, toxins, bacteria and poisons from the blood and eliminates them in urine.

What is Filtration Media?

The media in a filter is the physical mechanism used for ridding the air or liquid of contaminants.

The construction of the media and the configuration of the filter determine the efficiency of contaminant removal; its contaminant capacity (how many contaminants it can hold) and the pressure drop (the resistance/velocity to flow through the filter). Different variables in efficiency, capacity and pressure drop will determine a filterôs performance level.

The options for filtration media are endless. They range from sand, microporous plastics, mesh screens to threads, chopped paper, 100% cellulose or 100% man-made fibers and every conceivable combination in between. And there are just as many variations as to their lifetimes! A coffee filterôs lifetime lasts only a few minutes. Swimming pool filters may last up to a year or more.

The History of Nonwovens in Filtration

If you count wool felt and other fibers formed by various means into webs, it can be said that nonwovens as filtration media has been around for hundreds of years! Modern synthetic nonwoven filter media, however, started in the late 50ôs and early 60ôs with milk filters and disposable diaper cover stock. Manufacturers of diaper cover stock sold their over-runs as an alternative to paper for coolant and water filtration. Soon afterward, needlepunch and wetlaid processes created a number of filtration media uses. Because they were more versatile and less costly, these nonwovens soon became tough competition for paper, woven and wire cloth filtration media.

What Nonwovens Processes are used to make Filtration Media?

There are five different types of nonwoven processes that are used to make filtration media. The most widely used is Needlepunch followed by Wetlaid, Meltblown, Spunbond and Carded/Other. Each media has its own particular end-use:

Needlepunch: Because needlepunch media is 3D (it has length, width & depth), it is very good for trapping contaminants on both the surface and the interior. In air filtration applications it is used to filter exhaust from steel & metal production facilities; on paint spraying systems, in cement plants and in coal fired electricity generation stations. In these industrial applications, it is usually referred to as a bag filter. In liquid filtration, needlepunched media are used for filtering paints, cleaning intake water, sewage effluent, etc.

Wetlaid: In some respects, wetlaid nonwovens are similar to paper. However, because synthetic and/or micro fiberglass can be used instead of wood pulp and resin binders can be added during construction, the filter life is much better. Low cost coupled with random fiber structure and good consistency are the reasons that wetlaid nonwovens account for almost two thirds of all filtration media. Swimming pool filters, coolant oil filters, HEPA filters and coffee filters are examples of wetlaid media uses.

Meltblown: Because meltblown technology allows for uniform, microporous webs to be formed from very fine filaments, it is most often found in end uses that require the filtering of very fine particles. Particulates such as smoke, asbestos, lead dust and other airborne contaminants can be filtered through meltblown. It is used extensively in respirators; for face masks; household HVAC systems; automotive cabin filters é as well as a filter to catch the fine dust particles that are not screened out by paper or wetlaid media in disposable vacuum cleaner bags. In many of these markets, meltblown competes directly with wetlaid nonwoven media.

Spunbonded: Spunbonded filter media made of polyester, polypropylene or nylon are used as both air & liquid media because the synthetic resins will allow for molding, crimping, and/or thermal/electronic welding of the media to produce a filter. Heavier weight spunbond media is usually found in cartridge filters used for air filtration and lighter weight spunbond media is usually laminated to other media for added strength & support.

Carded & Other: Use of resin bonded or thermal bonded carded media, airlaid pulp and a small sector of spunlaced media which was used in filtering milk, cooking oils, coolant oil filters and in face masks has largely been replaced by the newer, more cost effective nonwoven processes above.

Emerging & Advanced Filtration Methods & Their Uses:

Microfiltration: Microfiltration is generally used in municipal drinking water treatment, biotechnology and food & beverage applications where sterile product is required. The fundamental difference between a microfiltration membrane and a regular filtration membrane is in the size of the particles it retains. A microfiltration membrane pore size range is from 0.1 to 10 micrometers.

Ultrafiltration: Ultrafiltration is primarily used in industry and research for purifying and concentrating macromolecular/protein solutions. Once again, itôs only differential is in terms of the size of the molecules it retains.

Nanofiltration: Nanofiltration is a fairly new membrane process that holds tremendous potential. In much of the developing world, clean drinking water is hard to come by and nanofiltration is a very inexpensive method of providing acceptable drinking water by filtering surface, ground and salinated waters found there. It is also becoming more widely used in food processing applications such as dairy. Like Reverse Osmosis, it works by using pressure to force a solution through a membrane and retaining the ñsoluteòon one side and allowing the pure solvent to pass to the other side.

(A solute is an additive that has been dissolved into another. One application would be separating chlorine out of pool water.)

Reverse Osmosis: Like Nanofiltration (process described above), Reverse Osmosis is used to desalinate brackish water (sea water to fresh water); purify household drinking water; purify wastewater from storm drains; concentrating food liquids such as fruit juices; dairy; wine; final vehicle rinse in car washes (to prevent spotting); maple syrup production (remove water from sap); for reef aquariums.

Green: The ñgreeningòof products has not escaped the filtration industry. Media is now available that is made with recycled polymers like PET bottle chips or biodegradable media.

How large is the worldwide filtration market?

At the end of 2007, the worldwide filtration market was worth approximately $44 Billion. This figure includes equipment materials, media and after sales. Approximately $21.7 Billion was attributed to media. Approximately 27% of this amount was attributed to nonwoven media ($5.86 Billiion).

The average growth rate for the entire filtration media market is 5.6%. There are significantly higher growth rates in some parts of the world.

How is filter media rated? Are there standards?

Presently, manufacturers test their own media. The standard method of establishing a filterôs rating or efficiency is to take particles of a known size such as glass beads or other materials and pass them through a test filter. The fluid is then measured to determine the number of particles there were before it passed through the filter and then the number that came through the filter. This process is called the Beta ratio. The higher the number of particles retained by the filter, the higher the Beta value. Efficiency tables are derived from this measurement. Unfortunately, although this is still the most widely used rating method, it is very difficult to compare efficiency values from one manufacturer to another.

HEPA & ULPA filters used in such critical places such as medical facilities are tested using the DOP Efficiency Test. DOP stands for Dioctylphthalate (die oct L thal eht)é a combustible, non-toxic, colorless, oily liquid that is heated to an aerosol state and then its presence is measured in the air after passing through a filter. ULPA (Ultra Low Penetration Air) filters must have an efficiency rating of 99.999% for 0.3 micron particles or better. HEPA (High Efficiency Particulate Air) filter media has an efficiency of 99.97% for trapping 0.3 microns.

The present standard test methods used by manufacturers to rate the efficiency of their filter media was developed by the American Society for Heating, Refrigeration and Air Conditioning (ASHRAE).

Who are the major nonwoven media producers/suppliers in the U.S.?

3M
Ahlstrom
DelStar
Donaldson
Elk Corporation
Fiberweb
First Quality
Freudenberg
Fybon
Hollingsworth & Vose
Transweb
Honeywell
Jacob Holm
Johns Manville
Kimberly-Clark
Lydall
Monadnock
Norafin
PGI
Polimeros
Toyobo

Filtration Societies & Associations

AFS American Filtration & Separations Society
The Filtration Society
ASHRAE
National Air Filtration Association
Filter Manufacturerôs Council
Society of Automotive Engineers
American Institute of Chemical Engineers