

Air pollution in textile industry

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SUMMARY : The textile industry is plagued by air pollution problems which must be resolved. In particular, smoke and odor arising in the process require abatement. Air pollution is the introduction of chemicals, particulate, or biological material that cause harm or discomfort to humans or other living organisms, or damages the natural environment into the atmosphere. Oil mist and organic emissions produced when textile materials containing lubricating oils, plasticizers, and other materials that can volatilize or be thermally degraded into volatile substances, are subjected to heat. Processes that can be sources of oil mist include tentering, calendaring, heat setting, drying, and curing. Acid mist produced during the carbonization of wool and during some types of spray dyeing. Solvent vapours are released during and after solvent processing operations such as dry cleaning and volatile organic compounds from mineral spirit solvents in print pastes or inks. Exhaust gases emanate from polycondensation of melt spinning fibre lines. Dust and lint are produced by the processing of natural fibres and synthetic staple prior to and during spinning, as well as by napping and carpet shearing.

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Pollution is the discharge of unwanted material, residue and energy into the environment. Some of these residues are unconverted raw material, some are uncovered products and some are by products produced during the manufacturing or processing. In other words, pollution is a sign of inefficiency in industrial production and it can be considered as money that is going up the chimney, down the sewer and out of the plant in waste truck, thus causing loss to the manufacturer (Shinde) Textiles are among the basic needs of human being. Textile industries transform fibers into yarn and into fabrics or related products. In processing of textiles, the industry uses a number of dyes chemicals, auxiliary chemicals and sizing materials.

Pollution problems in textile industry :

The major operations performed in a typical textile processing industry are desizing, scouring, mercerizing, bleaching, neutralizing, dyeing, printing and finishing. Textile industries generate all three kinds of waste *i.e.* liquid effluents, air emissions and solid wastes. However, liquid

effluents are of utmost concern because of its high volume and pollution potential. Quantity and nature of waste generated depends on the fabric being processed, chemicals being used, technology being employed, operating practices etc. The important pollutants present in a typical textile waste effluent are colour, bio-chemical oxygen demand (BOD), chemical oxygen demand (COD), toxic heavy metals, residual chlorine, dissolved solids and non-biodegradable organics termed as refractory materials. The textile units may have utilities such as raw water treatment system, cooling towers, laboratory, workshop(s), fuel storage facilities, residential colony, administrative block, canteen etc. which generates utility waste water and domestic waste water. Main sources of air pollution are boilers(s), thermo pack and diesel generator(s) which generate gaseous pollutants such as suspended particulate matter (SPM), sulphur di oxide gas, oxide of nitrogen gas etc.

The nature of the problem :

The major air pollution problem in the textile industry occurs during the finishing

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stages, where various processes are employed for coating the fabrics. Coating materials include lubricating oils, plasticizers, paints and water repellent chemicals—essentially, organic (usually hydrocarbon) compounds such as oils, waxes or solvents. After the coatings are applied, the coated fabrics are cured by heating in ovens, dryers, tenter frames, etc. A frequent result is the vaporization of the organic compounds into high molecular weight volatile organic (usually hydrocarbon) compounds (VOCs). In terms of actual emissions, the industry must also deal with larger particles, principally lint.

Air pollution :

Most processes performed in textile mills produce atmospheric emissions. Gaseous emissions have been identified as the second greatest pollution problem (after effluent quality) for the textile industry. Speculation concerning the amounts and types of air pollutants emitted from textile operations have been widespread but, generally, air emission data for textile manufacturing operations are not readily available. Air emissions include dust, oil mists, acid vapours, odours and boiler exhausts. Cleaning and production changes result in sludges from tanks and spent process chemicals, which may contain toxic organics and metals (Modak, 1991).

Air pollution is the introduction of chemicals, particulate, or biological material that cause harm or discomfort to humans or other living organisms, or damages the natural environment into the atmosphere.

Air emissions can be classified according to the nature of their sources:

Point sources:

- Boilers
- Ovens
- Storage tanks

Diffusive:

- Solvent-based
- Wastewater treatment
- Warehouses
- Spills

Textile mills usually generate nitrogen and sulphur oxides from boilers. Other significant sources of air emissions in textile operations include resin finishing and drying operations, printing, dyeing, fabric preparation, and wastewater treatment plants. Hydrocarbons are emitted from drying ovens and from mineral oils in high-temperature drying/curing. These processes can emit formaldehyde, acids, softeners and other volatile compounds.

Table 1 : Summary of the wastes generated during textiles manufacturing

Process	Source	Pollutants
Energy production	Emissions from boiler	Particulates, nitrous oxides (Nox) sulphur dioxide (SO ₂)
Coating, drying and curing	Emission from high temperature ovens	Volatile organic components (VOCs)
Cotton handling activities	Emissions from preparation, carding, combing, and fabrics manufacturing	Particulates
Sizing	Emission from using sizing compound (gums, PVA)	Nitrogen oxides, sulphur oxide, carbon monoxide.
Bleaching	Emission from using chlorine compound	Chlorine, chlorine dioxide
Dyeing	Disperse dyeing using carriers : Sulphur dyeing Aniline dyeing	Carriers H ₂ S Aniline vapors
Printing	Emission	Hydrocarbons, ammonia
Finishing	Resin finishing. Heat setting of synthetic fabrics	Formaldehyde Carriers - low molecular weight Polymers - lubricating oils
Chemical storage	Emissions from storage tanks for commodity and chemicals	Volatile organic components (VOCs)
Waste water treatment	Emissions from treatment tanks and vessels	Volatile organic components, toxic emissions

source: www.e-textile.org

Table 2 : Effect of pollutants on human being

Pollutants	Effects on human being	Sources
Sulphur di oxide	Irritates respiratory system and causes bronchitis	Boiler flue gas, rayon plant etc.
Aldehydes	Irritates all parts of respiratory system	Polyester plant
Chlorine	Causes lung irritation and also irritation in eyes	Processing house
Carbon di oxide	Deprives body cells of oxygen and cause unconsciousness by CO combining with haemoglobin	Boiler house

Residues from fibre preparation sometimes emit pollutants during heat setting processes. Carriers and solvents may be emitted during dyeing operations depending on the types of dyeing processes used and from wastewater treatment plant operations. Carriers used in batch dyeing of disperse dyes may lead to volatilisation of aqueous chemical emulsions during heat setting, drying, or curing stages. Acetic acid and formaldehyde are two major emissions of concern in textiles (Parvathi *et al.*, 2009).

Effect of dust

- Formation of dust film on every surface.
- Particles fall into moving parts of machinery.
- Dirty appearance of product.

Effect of dust - health hazards

- Cotton dust – biossinosis (lung disease).
- Asbestos dust – lung cancer.

Pollution control

Spinning mill

- Maintaining m/c parts.
- Maintaining hardness of rubber cots.
- Maintaining RH%.
- Using overhead pneumatic cleaners.
- Cyclone filters, cloth filters.

Wet processing unit

- Electrostatic precipitator.
- Scrubber.
- Oxidizer.

General control measures :

Height of chimneys:

Chimneys height should not be less than 30 meters and release the pollutants not in the vicinity of living organism.

Gravitational and inertial separator :

These are working on gravitational and inertial concepts of collecting, filtering etc. of the particulate matter. Eg. settling chambers, dynamic separator and wet cyclones and multiple cyclones.

Filters :

Woven or sintered metal beds of fibres, metal turning, fibrous mats and aggregate bed filter, paper filters and fabric filters are used for the filtration of particulate matter like dust, lint and fumes(Keith Slater, 2003).

Reducing air pollution

Some steps to reduce the emissions to air include:

- Decreasing emissions of organic solvents by changing to water-based products.
- Using scrubbers to collect particulate matter.
- Optimising boiler operations to reduce the emissions of nitrous and sulphur oxides.
- Pre-screening chemicals using the material safety data sheets to ensure that chemicals are not toxic.
- Identifying sources of air pollution and quantifying emissions.
- Designing and manufacturing products that do not produce toxic or hazardous air pollutants.
- Avoiding fugitive air emissions from chemical spills through improved work.

Conclusion :

Textile industry is one of the major sources in the increase of air pollution globally in general or in developing countries in particular. The textile industry is plagued by air pollution problems which must be resolved. In particular, smoke and odor arising in the process require abatement. Air pollution control technology is available today which will serve the textile industry well.

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REFERENCES

Keith Slater (2003). *Environmental impact of textiles: production, processes and protection*. Textile Institute (Manchester, England), Published by Woodhead Publishing, 2003.

WEBLOGGRAPHY

http://210.212.96.131/rpcb/Guidelines/textile_guidelines_final.pdf.

Modak (1991). Environmental aspects of the textile industry: A technical guide. Prepared for United Nations Environment Programme Industry and Environment Office. <http://www.miga.org/documents/Textiles.pdf>.

Parvathi, C., Maruthavanan, T. and Prakash, C. (2009) <http://www.indiantextilejournal.com/articles/FAdetails.asp?id=2420>.

Shinde, Laxman M. <http://www.fibre2fashion.com/industry-article/22/2195/pollution-and-its-control-in-textile-industry1.asp>.