*Sudan Academy of Sciences & Technology*
*Engineering Research and Industrial Technology Council*

# *Study on Implementation of Environmental Management System in Textile Industry in Sudan*

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*of requirements for Master Degree in Cleaner Production*

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## Dedication

*To my family, my lovely daughter*
*And all people are always in my heart*

# Acknowledgements

All praise and thanks to Allah , who blessed me with courage, patience and health for preparation and completion of this study and persons for their contributions that made this manual a possibility.

I wish thanks and express my gratitude to my supervisor Dr AbdelGhani A Hassan for his valuable guidance, continuous direction, during this research and much of his time, suggestion and help.

All persons who attended and contributed at the two workshop sessions for the development of the Manual that were held in October 2002 and April 2003 in Khartoum, Sudan; Ministry of industry staff in textile department ,Mr Abdel Fatah

# ABSTRACT

This study conducted from June to December, the main objective of this study is to formulate manual for textile industry in Sudan.

The data used in this study is secondary data from references, books manuals, web sites and reports. This is theoretical data can be executed practically.

The quality of life on Earth is linked inextricably to the overall quality of the Environment.

One of the major problems facing the industrial world today is the contamination of soil, ground water, sediments, surface water and air with hazardous toxic chemicals dumped by industries as waste.

While regulatory step have been implemented in the recent past to reduce or eliminate the production and release of these chemicals into the environment, significant deterioration of the environment has already occurred so far.

Conventional treatments have been used by some industries, but these can be both, expensive and inherently disruptive to the environment. Thus, economical and ecological management of industrial wastes has become a major concern these days.

Integrating both economical and ecological methods in waste management by implementation environmental management system in textile sector, to enable textile industry to establish waste minimization programmes, reduction of pollution and reduced environmental impact.

Effective waste minimization programmes an essential aspect of any EMS, Compliance with ISO14000, reduction in the risk of pollution reliability, enhanced international acceptability, competitiveness and trade, environmental sustainability and international and national acceptance to this are presented here, which can be used as a good database by the organizations which can put into use these approaches for the efficient ecological management of their industrial wastes.

The main objective of this to make Sudanese textile industry environmentally friend by establish manual for this

## المستخلص

هذه الدراسة تم إعدادها في الفترة من شهر يوليو الي ديسمبر وهي نتاج لمعلومات تم جمعها من المرشد البيئي لصناعة النسيج والكتب والتقارير والانترنت وكلها تصب في تطبيق مرشد الادارة البيئية لصناعة النسيج في السودان.

ترتبط الحياة علي كوكب الأرض ارتباطا لا فكاك منه بحالة البيئة. و احدي المشاكل الرئيسية التي تواجه العالم الصناعي اليوم هو تلوث التربة والمياه الجوفية والمياه السطحية بالمواد الكيميائية السامة الخطرة ملقاة من قبل الصناعات في شكل نفايات. في حين يتم اتخاذ الخطوات التنظيمية لخفض أو القضاء على إنتاج وإطلاق هذه المواد الكيميائية في البيئة

مع ذلك حدث تدهور كبير في البيئة بالفعل حتى الآن. وقد استخدمت المعالجات التقليدية من خلال بعض الصناعات، ولكن هذه يمكن أن تكون ، بطبيعتها مكلفة ومدمرة للبيئة.

وهكذا ، أصبحت الإدارة الاقتصادية والبيئية للنفايات الصناعية هي الهدف الرئيسي من هذه الدراسة ودمج كل الأساليب الاقتصادية والبيئية في مجال إدارة النفايات من خلال تنفيذ نظام الإدارة البيئية في قطاع الغزل والنسيج، لتمكين صناعة النسيج إلى إنشاء برامج الحد من النفايات ، والحد من التلوث وتقليل التأثير البيئي.

فعالية برنامج الحد من النفايات يشكل جانبا أساسيا من أي نظام للإدارة البيئية ،مع الامتثال لISO14000، انخفاض في خطر التلوث ، وتعزيز القبول الدولي ، والقدرة التنافسية والتجارة، والاستدامة البيئية والقبول الدولي والوطني، والتي يمكن استخدامها بوصفها قاعدة بيانات جيدة من قبل المنظمات التي يمكن أن تضع في استخدام هذه الأساليب لإدارة بيئية فعالة من نفاياتها الصناعية.

الهدف الرئيسي لهذه الدراسة جعل صناعة النسيج صديقة للبيئة باستحداث مرشد يتم تطبيقه لهذا الغرض.

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# Chapter one

## Introduction

## 1-1 Background

Sudanese industry accounted for an estimated 21% of GDP in 2009. The small size of the country's industrial sector is a result of chronic problems, including lack of skilled labor force, raw materials, and investments. These problems are most apparent in the textile and foodstuff industries, as well as in the production of sugar. If these problems were resolved, Sudan could dramatically reduce its reliance on imports.

### 1-1-2 Textile waste:

**Textile waste is broadly classified into four categories, each of having characteristics that demand different pollution prevention and treatment approaches. Such categories are discussed in the following sections:**

### 1-1-3 Hard to Treat Wastes

**This category of waste includes those that are persistent, resist treatment, or interfere with the operation of waste treatment facilities. Non-biodegradable organic or inorganic materials are the chief sources of wastes, which contain colour, metals, phenols, certain surfactants, toxic organic compounds, pesticides and phosphates. The chief sources are:Colour & dyeing operation◊metal preparatory◊Phosphates processes and dyeing◊Non-biodegradable organic materials surfactantsSince these types of textile wastes are difficult to treat, the identification and elimination of their sources are the best possible ways to tackle the problem. Some of the methods of prevention are chemical or process substitution, process control and optimization, recycle/reuse and better work practices.**

### 1-1-4 Hazardous or Toxic Wastes

**These wastes are a subgroup of hard to treat wastes. But, owing to their substantial impact on the environment, they are treated as a separate class. In textiles, hazardous or toxic wastes include metals, chlorinated solvents, non-biodegradable or volatile organic materials. Some of these materials often are used for non-process applications such as machine cleaning.**

### 1-1-5. High Volume Wastes

**Large volume of wastes is sometimes a problem for the textile processing units. Most common large volume wastes include-High volume of waste water -Wash water from preparation and continuous dyeing processes and alkaline**

**wastes from preparatory processes-Batch dye waste contains large amounts of salt, acid or alkali. These wastes sometimes can be reduced by recycle or reuse as well as by process and equipment modification.4. Dispersible Wastes:**

**The following operations in textile industry generate highly dispersible waste:**

**1- Waste stream from continuous operation (e.g. preparatory, dyeing, printing and finishing)**

**2-Print paste (printing screen, squeeze and drum cleaning)3-Lint (preparatory, dyeing and washing operations)4-Foam from coating operations5-Solvents from machine cleaning6-Still bottoms from solvent recovery (dry cleaning operation)**

**1-2 Objectives:**

**1-2-**1The main objective to make Sudanese textile industry environmentally sound

**1-3 Specific objective**

Specific Objectives can include commitments:

- To reduce waste and the depletion of resources
- To reduce the release of pollutants into the environment
- To design products to minimize their environmental impact in production, use and disposal
- To control the environmental impact of sources of raw materials
- To minimize any significant adverse environmental impact of new development
- To promote environmental awareness among employees and the community

**2-1 Waste management**

Is the collection, transport, processing, recycling or disposal, and monitoring of waste materials. The term usually relates to materials produced by human activity, and is generally undertaken to reduce their effect on health, the environment or aesthetics. Waste management is also carried out to recover resources from it. Waste management can involve solid, liquid, gaseous or radioactive substances, with different methods and fields of expertise for each.

Waste management practices differ for developed and developing nations, for urban and rural areas, and for residential and industrial producers. Management for non-hazardous residential and institutional waste in metropolitan areas is usually the responsibility of local government authorities, while management for non-hazardous commercial and industrial waste is usually the responsibility of the generator.

# Chapter Two

## Literature Review

### 2-1-2 Waste management concepts

There are a number of concepts about waste management which vary in their usage between countries or regions. Some of the most general, widely-used concepts include:

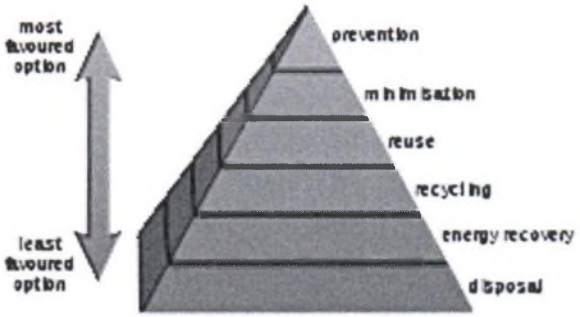


Diagram of the waste hierarchy.

- Waste hierarchy - The waste hierarchy refers to the "3 Rs" reduce, reuse and recycle, which classify waste management strategies according to their desirability in terms of waste minimization. The waste hierarchy remains the cornerstone of most waste minimization strategies. The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of waste.
- Extended producer responsibility - Extended Producer Responsibility (EPR) is a strategy designed to promote the integration of all costs associated with products throughout their life cycle (including end-of-life disposal costs) into the market price of the product. Extended producer responsibility is meant to impose accountability over the entire lifecycle of products and packaging introduced to the market. This means that firms which manufacture, import and/or sell products are required to be responsible for the products after their useful life as well as during manufacture.
- Polluter pays principle - the Polluter Pays Principle is a principle where the polluting party pays for the impact caused to the environment. With respect to waste management, this generally refers to the requirement for a waste generator to pay for appropriate disposal of the waste.(**Solid waste Management cours.Dr. Abdel Ghani Abdel Galil Hassan,)**

### 2-1-3 Industrial Waste Management

Industrial waste management has a lot of concern. It involves the collection, transport, processing, recycling and/or disposal of waste materials. It is basically carried out in order to reduce the effect of waste in the environment. If it's left unattended it can be hazardous to life of human beings. So, care should be taken to dispose industrial waste properly.

Some of our resource can be reused with the help of waste management. Recycled items are cans, glass jars, newspapers, plastic items which are better of when reused rather than being disposed in the environment. Each of these items should be disposed of differently, not all items are treated the same way, take utmost care of these things. These items to be disposed can be divided into solid, liquid, gaseous and radio active substances.

Landfills and incineration are the two types of disposal methods used. Usually, in case of landfills, objects are buried into the land. It should be carried out well. It is said to be hygienic and involves less cost. But, the hygiene depends on how well it is buried in the land. However, it can be dangerous; to bury carbon di-oxide and other gaseous material in case it breaks down. The other method known as incineration is the combustion of waste materials. Waste material is heated up and is then converted into gas, heat or ash. Medical waste of hospitals is usually treated with incineration. This is serious concern with environmentalists as with incineration, there is an emission of gaseous items.

Industrial waste can also be treated with recycling. Recycling is reuse of your old items or waste. Instead of disposing them, burying or incinerating, it is reused by creating a new product out of the old plastic item. Normally used procedures are biological reprocessing, energy recovery or physical reprocessing. These methods can be used safely and produces no harmful gas, or does not affect the environment.( **Recycling of industrial waste – PARISARA SOBAGU**)

### 2-1-4 Industrial Waste Management

Industrial waste is a major component of the waste stream. There are many ways to reduce waste in an industrial setting.

### 2-1-5 Waste Minimization Techniques

Waste minimization includes any source reduction and/or recycling activity undertaken by a waste generator (ie any business that produces waste through its operations). These activities reduce the output of waste and/or reduce the toxicity of the waste. Some examples of waste minimization techniques are listed below.

### 2-1-6Source Reduction Techniques

- Change the composition of the product to reduce the amount of waste resulting from the product's use.
- Reduce or eliminate hazardous materials that enter the production process.
- Use technology (including measuring and cutting) to make changes to the production process; equipment, layout or piping; or operating conditions.
- Purchase only what you need to avoid waste from unwanted materials (inventory control).

Good operating practices, such as waste minimization programs, management and personnel practices, loss prevention, and waste segregation also help to reduce waste at its source.

**Recycling Techniques**

- Return waste material to original process.
- Use the waste material as a raw material substitute for another process.
- Process waste material for resource recovery.
- Process waste material as a by-product.
- Engage contractors to collect/recycle waste material.
- Advertise waste materials (on-sell)
- Use packaging waste again (cardboard, bubble wrap or polystyrene).

**Waste Auditing**

It can be

- define sources, quantities and types of wastes generated;
- identify where, when, how and why these wastes arise; and
- identify areas of wastage and waste problems; and
- Establish targets and priorities for waste reduction.

A waste audit can be used to:

- ensure external regulatory compliance;
- develop id-line data; and
- Compare alternative ways to minimize the waste of resources.

## 2-2 Cleaner Production

The term Cleaner Production was coined by the United Nations Environment Program (UNEP) when it launched the Cleaner Production Program in 1989.

### 2-2-1What is Cleaner Production?

Cleaner Production is the continuous application of an integrated preventive environmental strategy applied to processes, products, and services to increase overall efficiency and reduce risks to humans and the environment. (UNEP, 1989)

- For production processes - the strategy includes conserving raw materials and energy, eliminating toxic raw materials, and reducing the quantity and toxicity of all emissions and wastes.
- For products - the strategy focuses on reducing negative impacts along the life cycle of a product, from raw materials extraction to its ultimate disposal.
- For services - the strategy involves incorporating environmental concerns into designing and delivering services.

Cleaner production requires changing attitudes, responsible environmental management and evaluating technology options.

### 2-2-2 Benefits of Cleaner Production

- Economic benefits can include increased profits; improved marketability; lower expenditure on materials and resources; additional sources of income; increased quality and greater productivity;

- Social benefits include better customer service; and increased goodwill from being seen as a responsible member of the community.
- Environmental benefits include less pollution; less waste; more efficient use of resources;

**2-2-3 Key Factors in the Success of a Cleaner Production Program**

1. Commitment of Management and Employee Involvement - The involvement of all levels of an organization is vital to the success of a program.
2. Openness to Change - Overcoming perceived barriers such as "we've tried that before and it did not work" or "this is the way we have always done it", through group discussions and 'brain storming sessions', when all options and their feasibility are openly discussed.
3. Availability of Resources - It is important to establish at the start of a program, the economic constraints and availability of human and other resources.
4. Planned Approach - The complexity and detail of the planning process will depend on the project(s) and the availability of an organization's resources.
5. Potential Barriers - Before implementing a program, it is worth looking at some difficulties that may be faced, as usually the organization has some control over these barriers.

**2-2-4 Life Cycle Assessment**

Life Cycle Assessment aims to quantify all environmental impacts of a product during its entire life-cycle - from extracting raw materials, through manufacturing, distribution, use and disposal of the product.

There are five main components of Life Cycle Assessment including:

1. Goal definition - determine purpose and design of the assessment;
2. Collection of data - record all the inputs from and outputs to the environment;
3. Classification of data - convert inputs and outputs into contributions to environmental problems, to produce an environmental profile of the product;
4. Evaluation - consider the different elements of the environmental profile; and
5. Improvement analysis - determine how the product can be improved, to reduce the environmental impact that it has throughout its life cycle.

**2-2-5- The Importance of Industrial Waste Management.**

It takes a lot of valuable energy and materials to create and manufacture products and the resulting industrial waste can be difficult to manage. Many cities and countries have put new laws into place to heavily tax companies that produce excess amounts of waste or create potentially harmful effects on the air and ecosystem. The extra taxes help to offset the environment damage by going toward

environmental restoration, protection and spreading information to increase knowledge on these issues. People and companies need to educate themselves about the environment. Smog alerts in many cases result from not only harmful transportation emissions but also from the output of factories into the air we breathe.

Companies need to be responsible with their industrial waste management and specifically their hazardous waste. Many local governments provide counseling, consulting and recommendations to organizations on what they can do to better manage their waste and plan for a more environmentally friendly production processes. More than ever, there need to be consequences to companies that do not take waste management seriously. Part of this includes reducing harmful emissions into the environment over a period of time and correctly disposing of waste materials.

Countries have terms and conditions about what is acceptable in terms of waste management. Today, more than ever, industries know their impact of manufacturing on smog levels and the escalating cost of managing their waste. More industrial leaders are showing their accountability for the environment. Citizens need to support companies whose business practices include environmentally conscious and responsible conditions. Using energy more efficiently, reducing the hazardous waste they output into the air and to the landfills and practicing composting and recycling are key factors in improving the way waste is managed.

Companies who have no choice but to continue creating hazardous industrial waste due to the nature of their business need to ensure that they properly dispose of that material and are upfront an honest about the contents of their vehicles, their facilities and management of the waste. Environmental protection acts encourage and reward companies who do their part to more effectively manage waste and work with environmental agencies to maximize efforts to minimize the impact on the environment. Industrial waste producers need to pay for the disposal of their materials and in particular, need to take caution in the way they dispose of hazardous materials. There have been cases documented of companies mislabeling goods and of irresponsible practices leading to contamination of local watersheds. The more that citizens and government push for reform, the more companies will realize that they are accountable for their industrial waste.

**2-3 Hazardous wastes:**

Hazardous waste is waste that is dangerous or potentially harmful to our health or the environment. Hazardous wastes can be liquids, solids, gases, or sludges. They can be discarded commercial products, like cleaning fluids or pesticides, or the by-products of manufacturing processes.**( Essay by William Sanjour)**

Waste that have not been specifically listed may still be considered a hazardous waste if exhibits one of the four characteristics defined in 40 CFR Part 261 Subpart C - **ignitability (D001), corrosivity (D002), reactivity (D003), and toxicity (D004 - D043).**

1. **Ignitability** - Ignitable wastes can create fires under certain conditions, are spontaneously combustible, or have a flash point less than 60 °C (140 °F). Examples include waste oils and used solvents. For more details, see 40 CFR §261.21 . Test methods that may be used to determine ignitability include the Pensky-Martens Closed-Cup Method for Determining Ignitability (Method 1010A) (PDF) (1 pg, 19K) , the Setaflash Closed-Cup Method for Determining Ignitability (Method 1020B) (PDF) (1 pg, 17K) , and the Ignitability of Solids (Method 1030) (PDF) (13 pp, 116K).
2. **Corrosivity** - Corrosive wastes are acids or bases (pH less than or equal to 2, or greater than or equal to 12.5) that are capable of corroding metal containers, such as storage tanks, drums, and barrels. Battery acid is an example. For more details, see 40 CFR §261.22 . The test method that may be used to determine corrosivity .is the Corrosivity Towards Steel (Method 1110A) (PDF) (6 pp, 37K).
3. **Reactivity** - Reactive wastes are unstable under "normal" conditions. They can cause explosions, toxic fumes, gases, or vapors when heated, compressed, or mixed with water. Examples include lithium-sulfur batteries and explosives. For more details, see 40 CFR §261.23 . There are currently no test methods available.
4. **Toxicity** - Toxic wastes are harmful or fatal when ingested or absorbed (e.g., containing mercury, lead, etc.). When toxic wastes are land disposed, contaminated liquid may leach from the waste and pollute ground water. Toxicity is defined through a laboratory procedure called the Toxicity Characteristic Leaching Procedure (TCLP) (Method 1311) (PDF) (35 pp, 288K). The TCLP helps identify wastes likely to leach concentrations of contaminants that may be harmful to human health or the environment. For more details,

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**2-3-1Toxic waste:**

Is waste material that can cause death or injury to living creatures. It can be spread quite easily and can contaminate lakes and rivers. The term is often used interchangeably with "hazardous waste", or discarded material that can pose a long-term risk to health or environment.

As with most pollution problems, toxic waste began to be a significant issue during the industrial revolution. It usually is the product of industry or commerce, but comes also from residential use (e.g. cleaning products, cosmetics, lawn care products), agriculture (e.g. chemical fertilizers, pesticides), the military (nuclear weapons testing, chemical warfare), medical facilities (e.g. pharmaceuticals), radioactive sources, and light industry, such as dry cleaning establishments

**2-3-2 Toxic waste**

Toxic wastes often contain carcinogens, and exposure to these by some route, such as leakage or evaporation from the storage, causes cancer to appear at increased frequency in exposed individuals. For example, a cluster of the rare blood cancer polycythemia Vera was found around a toxic waste dump site in northeast Pennsylvania in 2008.[3]

Toxic wastes containing organic carcinogens can be destroyed by incineration at high temperatures, which is expensive. However, if the waste contains heavy metals or radioactive isotopes, these must be separated and stored, as they cannot be destroyed.

**2-4 Textile Processes**

These will be looked at under the following broad categories:

- Sizing
- Preparation Department
- Batch Processing
- Dyeing

**- Sizing**

This would involve size selection, where the need to replace starch based sizes with synthetic sizes. This results in reduced pollution load as synthetic sizes have lower BOD levels and they can be recycled for reuse. Further strategies would include testing incoming raw materials for toxic compounds, purchasing size in bulk in drums rather than bags etc as this produces less solid waste and reduces the chances of spills due to breakages. Finally, there is need to ensure that only the minimum required sizes are added to the yarn as this reduces chemical consumption as well as the pollution load to drain during desizing.

**Preparation department**

The process of preparation includes desizing, scouring, bleaching and mercerizing. Desizing accounts for over 50% of the pollution load of preparation while scouring contributes between 10 and 25%. Good preparation is essential for subsequent processing, as any impurities remaining on the fabric will interfere with the dyeing and finishing processes.

**Batch processing**

There are a number of waste minimization options for batch processing. These include:

- Cascading multiple rinsing operations
- Reusing softening baths with reconstitution
- Reusing preparation baths
- Segregating coloured effluent streams from clean streams to ensure that only concentrated effluent is treated. This clean effluent may be used elsewhere in the factory
- Installing automatic shut down of water in overflow cooling when the required temperature has been reached
- Replacing outdated machines with high liquor ratios with more modern equipment
- Carrying out softening on a pad mangle

- Replacing batch wise rinsing with continuous rinsing with counter current flow
- General water, chemical and energy conservation measures.

**Dyeing**

Dyeing can be accomplished in one of either batch or continuous approaches. The selection of dyes is quite important. General waste minimization options for dyeing include the following:

- Operate at lowest possible bath ratio. This leads to a reduction in operating costs, water consumption, chemical use, energy use and less effluent discharge.
- Minimize stripping and do redyeing procedures
- Avoid shading additions
- Avoid the use of detergents to wash fabric after reactive dyeing; high temperatures are just as effective
- Minimize auxiliary use. Some auxiliaries interfere with dye fixation and should be replaced with alternatives or removed, as this will reduce the colour load of the effluent.

# Chapter Three
## Methodology

## 3-1 Detailed Measures to address Common Aspects in EMS

- There are a number of aspects that are common to most of the EMS issues. These are:
  - Reduction in Water Consumption
  - Reducing Chemical Consumption
  - Energy Consumption
  - Reducing Air Pollution
  - Reducing Solid Waste
  - Reducing toxicity
  - Reducing Noise pollution
  - Waste minimization in specific sectors, industries and processes

### 3-1-1 *Reducing Chemical Consumption*

The majority of chemicals applied especially in the textiles industry and in particular to the fabric are washed off and sent to the drains. Thus, the reduction of chemical consumption can lead to a reduction in effluent strength and therefore lower treatment costs, as well as overall saving sin chemical costs. Various options for the reduction of chemical usage are as follows:

- Recipe optimization
- Dosing control
- Pre screen chemicals and raw materials
- Chemical substitution
- Correct storage and handling
- Chemical recovery and reuse
- Process changes

### 3-1-2 *Improve scheduling Energy Consumption*

As with water consumption, reduction in energy use can result in substantial savings and lower emissions from boilers or generating plants. Some energy efficient options include the following:

- Compressed air
  - Optimize compressed air generation
  - Fix compressed air leaks
  - Optimize compressor sizing
  - Install compressor control systems
  - General housekeeping
- Refrigeration

- Reduce cooling loads
- Decrease condensing temperatures
- Increase evaporating temperatures
- Compressor control

o Stem Generation
- Boiler blow down
- Economizers
- Combustion air temperature
- Firing rate and load variation

o Steam Distribution and Use
- Insulation
- Flash steam recovery
- Good housekeeping

o Install Heat Exchangers
o Optimize Plant Environmental Conditions
o Shutting off of lighting, air conditioning etc

### 3-1-3 *Reducing Air pollution*

- Air pollution is a menace to a number of industries. Some steps that can be taken to reduce the emissions to air include the following:

o Decreasing emissions of organic solvents by changing to water based products
o Using scrubbers to collect particulate matter
o Optimizing boiler operations to reduce the emissions of nitrous and sulphur oxides
o Pre screening chemicals using the Material Safety Data Sheets to ensure that chemicals are not toxic
o Identifying sources of air pollution and quantifying emissions
o Designing and manufacturing products that do not produce toxic or hazardous air pollutants
o Avoiding fugitive air emissions from chemical spills through improved work practices

### 3-1-4 *Reducing solid waste*

This is in some industries quite high, and for example, in the textiles industries is the second largest waste stream after liquid effluent. There are a number of waste minimization options available to reduce solid waste, and these include the following:

- Reducing the amount of packaging material by improved purchasing practices such as ordering raw materials in bulk or returnable intermediate bulk containers (IBCs). This reduces spillages, handling costs, exposure of workers to chemicals and the amount of storage space required
- Purchasing chemicals in returnable drums. If vendors will accept unwashed drums, this will reduce the wastewater generated in the factory.
- If possible, ordering chemicals in IBCs rather than bags as these are easily broken, causing spillages
- Purchasing reusable plastic cones rather than cardboard cones
- Reducing seam waste through effective training programmes.
- Selling used pallets to a recycler

### 3-1-5 *Reducing toxicity*

The reduction of toxicity is a suitable approach to cleaner production. For example, in the textile industry, compounds that contribute to the aquatic toxicity of textile effluent include salt metals, surfactants, toxic organic chemicals, biocides and toxic anions. Some methods of reducing the use of these compounds are to:

- Reduce metal content through careful pre screening of chemicals and dyes for metal content and using alternatives where possible
- Eliminate galvanized plumbing as reactions with brass fittings can take place in the presence of acids, alkalis or salt and lead to the release of zinc
- Reduce the amount of salt in the effluent by optimizing recipes, using low salt dyes, reusing dyebaths and optimizing dyeing temperatures
- Use biodegradable surfactants such as linear alcohol ethoxylates
- Replace chlorinated solvents with unchlorinated alternatives
- Replace the use of biocides with ultraviolet light as a disinfectant for cooling towers
- Carefully pre screen chemicals for their toxic nature using MSDS.

### *3-1-6 Reducing noise pollution*

The following steps can be taken to reduce noise pollution

- Install screens and sound baffles on fans
- Regular maintenance of machinery
- Fit anti vibration mounts on machines, and
- Fit walls with sound absorbing materials

### 3-2 Waste Minimization in specific sectors, industries and processes

The whole concept of waste minimization is critical for the success in environmental sustainability. Thus, it should where possible be part and parcel of the whole process in the EMS cycle.

Clearly, each sector will have specific strategies and measures to minimize waste. For this presentation, the example techniques for various waste minimization in specific textile processes are presented. This should guide other sectors to prepare such for implementation in their sector specific industries.

### *3-2-1 Specific Example: Textile Processes*

These will be looked at under the following broad categories:

- Sizing
- Preparation Department
- Batch Processing
- Dyeing

**-Sizing**

This would involve size selection, where the need to replace starch based sizes with synthetic sizes. This results in reduced pollution load as synthetic sizes have lower BOD levels and they can be recycled for reuse. Further strategies would include testing incoming raw materials for toxic compounds, purchasing size in bulk in drums rather than bags etc as this produces less solid waste and reduces the chances of spills due to breakages. Finally, there is need to ensure that only the minimum required sizes are added to the yarn as this reduces chemical consumption as well as the pollution load to drain.

**-Preparation department**

The process of preparation includes desizing, scouring, bleaching and mercerizing. Desizing accounts for over 50% of the pollution load of preparation while scouring contributes between 10 and 25%. Good preparation is essential for subsequent processing, as any impurities remaining on the fabric will interfere with the dyeing and finishing processes.

**- Batch processing**

There are a number of waste minimization options for batch processing. These include:

- Cascading multiple rinsing operations
- Reusing softening baths with reconstitution
- Reusing preparation baths
- Segregating coloured effluent streams from clean streams to ensure that only concentrated effluent is treated. This clean effluent may be used elsewhere in the factory
- Installing automatic shut down of water in overflow cooling when the required temperature has been reached

- Replacing outdated machines with high liquor ratios with more modern equipment
- Carrying out softening on a pad mangle
- Replacing batch wise rinsing with continuous rinsing with counter current flow
- General water, chemical and energy conservation measures.

**- Dyeing**

Dyeing can be accomplished in one of either batch or continuous approaches. The selection of dyes is quite important. General waste minimization options for dyeing include the following:

- Operate at lowest possible bath ratio. This leads to a reduction in operating costs, water consumption, chemical use, energy use and less effluent discharge.
- Minimize stripping and do redyeing procedures
- Avoid shading additions
- Avoid the use of detergents to wash fabric after reactive dyeing; high temperatures are just as effective
- Minimize auxiliary use. Some auxiliaries interfere with dye fixation and should be replaced with alternatives or removed, as this will reduce the colour load of the effluent.

# Chapter Four

## Result &Discussion

**4-1Results**

**Suggested Mitigation Measures for Textile production process.**

| Potential Negative Impacts | Mitigation Measures |
|---|---|
| 1. Water pollution from discharge of liquid effluent. | Laboratory analysis of effluent to include: TSS, BOD, COD PH and heavy metals such as Cr, Pb and Mn.<br>- Maintain pH level of effluent discharge between 6.0 and 9.0<br>- Pre-screen chemicals and raw materials<br>- Chemical recovery and re-use<br>- Reduce metal contamination through careful pre-screening of chemicals and dyes for metal content. |
| 2. Gaseous emissions of $SO_2$, $NO_x$, $H_2S$ etc. | Control by scrubbing with water and alkaline solutions incineration. |
| 3. Accidental release of potentially hazardous solvents, acidic and alkaline materials. | Maintain storage and disposal areas to prevent accident release<br>Provide area storage or double wall tanks if possible. |
| 4. Noise | Use other noise elimination procedures |
| 5. Occupational health effects on workers. | Facility should implement a safety and health programme such as provision of safety training. |
| 6. Solid waste problem due to inadequate on-site storage or lack of disposal facilities. | Plan for adequate on-site disposal areas and ultimate disposal facilities. |
| 7. Water wastage | Water consumption in factory:<br>- Repair leaks, faulty valves, etc.<br>- Turn off running taps.<br>- Turn off machines when machines are not running<br>- Optimize process water use.<br>- Recycle cooling water |

**4-2 Discussion:**

1-Provide the procedures / work instructions for specific operations or activities for:

- Waste management
- Wastewater and waste treatment
- Air mission control
- Operation of specific lines / activities

2- To ensure success, an early step in developing or improving an EMS involves commitment from the top management of the organization to improve the environmental management of its activities, products or services. This needs to be ongoing.

3 -An organization should define its environmental policy and ensure commitment to its EMS, and the organization should then begin where there is obvious benefit, for example, by focusing on regulatory compliance limiting sources of liability or by making more efficient use of materials.

4- Implementation of any policy is the most difficult thing. For this to be effective, capabilities and support mechanisms necessary to achieve its environmental policy should be developed by the organization.

5- Environmental management system is not applicable

# Chapter five

## Conclusion &Recommendations

## 5-1 Conclusion

The study concluded that there is opportunities for improving environmental performance of textile industry determined in to environmentally sound activity in particularly carry out the following activities:

- Reduction in water consumption
- Reducing chemical consumption
- Reducing energy consumption
- Reducing air pollution
- Reducing solid wastes
- Reducing toxicity
- Reducing noise pollution
- Waste minimization in specific processes in textile industry.

## 5-2 Recommendations

- Use of non-renewable resource: water depletion and energy usage
- Establishment of the cleaner production center for monitor all industries
- Awareness-raising and training in quality, environmental matters and apply environmental management system.
- Provides assistance to the government by promoting orderly behavior of the private sector and facilitating policy formulation for industrial development
- Establishes communication channels between the government and the private sector and addresses private sector issues to government as well as issues certificates of origin
- Provides guidance and awareness to farmers on seeding, use of fertilizers, cultivation and irrigation practices.
- Improvement of the working condition.

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