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Hazard Assessment Of Health And Safety In Spining Industry

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ABSTRACT

The hazard analysis and management are vital in textile industry to avoid losing customers and wasting resources caused by the failures in production systems. Risk analysis is also very significant to decrease possible hazards and to avoid possible damage in production systems. In this study, an approach based on Failure Mode and Effects Analysis (FMEA) and Fault Tree Analysis (FTA) is proposed to analyze the ring spinning yarn production process in a textile industry. First, the possible hazards in the production line, yarn production system, in an integrated company operating in the textile sector are analyzed by FTA method. Then, FMEA is applied to ring spinning yarn production process in a textile industry to rank all possible risks corresponding to hazards in descending order with respect to both occupational health and safety. It is very important to remove all possible hazards in textile industry to decrease the number of risks related to occupational health and safety. Therefore, in total of 57 hazard root causes are determined in the yarn production department. Subsequently, the faults related to the hazard root causes are examined by FTA and then risk corresponding to these hazards are prioritized by FMEA. The results obtained from the proposed FTA-FMEA approach show that decision makers and engineers can easily decrease the number of hazards and risks with respect to both occupational health and safety in practice.

Keywords: Safety, Failure Mode and Effects Analysis, Hazard and Risk Assessment.

1. INTROUDCTION

A Hazard Identification and Risk Assessment (HIRA) assist emergency managers in answering these questions. It is a systematic risk assessment tool that can be used to assess the risks of various hazards. There are three reasons why a HIRA is useful to the emergency management profession:

It helps emergency management professionals prepare for the worst and/or most likely risks.

Allows for the creation of exercises, training programs, and plans based on the most likely scenarios.

Saves time and resources by isolating hazards that cannot occur in the designated area.

Risk is the unwanted consequence of an event or series of events. Risk occurs when multiple risk causing factors occur at the same time causing an accident manifesting in an event like a fire or explosion. Risk Assessment (RA) is a method that has proven its value as an all-round tool for improving the safety standards prevalent in every hazardous industry. With advancements in in-built and inherent safety systems, accidents rates have come down, but still persist at unacceptable levels for newer technology, new plants and chemical handling facilities. RA is a structured safety assessment tools designed for high hazard industries such as chemical, petrochemical, pesticides, pharmaceuticals, sea ports, etc.,

supplementing other safety systems tools such as HAZOP, safety audit, and regular incident analysis to identify the potential for incidents (near-misses, unsafe conditions) and to evaluate the necessary control measures.

2. LITERATURE REVIEW

HAZARD AND RISK ANALYSIS FOR RING SPINNING YARN PRODUCTION PROCESS BY INTEGRATED FTA-FMEA APPROACH NAZLI GULUM MUTLU, SERKAN ALTUNTAŞ - The hazard analysis and management are vital in textile industry to avoid losing customers and wasting resources caused by the failures in production systems. Risk analysis is also very significant to decrease possible hazards and to avoid possible damage in production systems. In this study, an approach based on Failure Mode and Effects Analysis (FMEA) and Fault Tree Analysis (FTA) is proposed to analyze the ring spinning yarn production process in a textile industry. First, the possible hazards in the production line, yarn production system, in an integrated company operating in the textile sector are analyzed by FTA method. Then, FMEA is applied to ring spinning yarn production process in a textile industry to rank all possible risks corresponding to hazards in descending order with respect to both occupational health and safety. It is very important to remove all possible hazards in textile industry to decrease the number of risks related to occupational health and safety. Therefore, in total of
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RISK ASSESSMENT AND EVALUATION OF BASIC HEALTH AND SAFETY FACILITIES (A REPORT OF TEXTILE INDUSTRY GUJRAT, PAKISTAN) (2014) - FAISAL HANAN, SABIHA JAVIED, UNIVERSITY OF GUJRAT - Hazard identification is fundamental to industrial safety management; unidentified hazards present the most unmanageable risk. This study presents the risk assessment and evaluation of welfare facilities available in textile industry. According the walk-through survey and also conduct interviews and to identify hazards, evaluating risk, give management plan of such hazards and assigning responsibilities for proper implementation. The main hazards were physical, chemical, biological, mechanical, psychosocial, and electrical hazards arising from industrial activities. Furthermore, questioners related to welfare facilities were filled which shown first aid, training of employees, fresh water and food, personal protective equipment's, fire extinguisher, toilets and washing facilities, 78%, 79%, 75%, 67%, 72% and 81% respondents satisfaction respectively. The study was finally concluded with fruitful suggestions that will beneficial to encourage researcher and competitive authority to work toward further betterment and contribute to manage safety system**.**

MODERN SAFETY AND TRAINING METHOD IMPLEMENTATION IN DIFFERENT TYPE OF TEXTILE SECTORS - K.P. KARUPANNAN, M. ARULARASU AND S.R. DEVADASAN - Textile manufacturing is a major industry. It is based on the conversion of fiber into yarn, yarn into fabric. These are then dyed or printed, fabricated into clothes. Different types of fiber are used to produce yarn. Cotton remains the most important natural fibre, so is treated in depth. There are many variable processes available at the spinning. In spinning industries spinning is a process in which we convert fibers by passing through certain processes like Blow room, Carding, Drawing, Combing, Simplex, Ring Frame and finally winding into yarns. These yarns are then wound onto the cones. Textile industry meet the many hazards like noise, Electrical, fire, Ergonomics, Psychosocial Hazards., In existing research work implemented several safety and training programs to avoid these type of hazards, In other hand these type of training is not sufficient to reduce the accidents in textile sectors, For the reason is in most of the industries the employers are uneducated and also 20% of employees are North Indians. Due to this they struggle to understand the training session and one of the major issues is language. To overcome these problems, in this paper, an efficient chunk training method is presented in textile industry. The performance of training is evaluated and results demonstrate that the proposed training method has attained good performance for textile sectors with state-of-the-art methods.

3. OBJECTIVES

Carryout a systematic, critical appraisal of all potential hazards involving personnel, plant, services and operation methods.

Identify the existing safeguards available to control the risks due to the hazards.

Suggest additional control measures to reduce the risk to acceptable level.

Prepare a Risk register that will help in continuously monitoring these risks, detect any changes and ensure the controls are effective.

4.1 STEPS INVOLVED IN HAZARD IDENTIFICATION AND RISK ASSESSMENT

IDENTIFICATION OF THE HAZARD - Hazard Identification is a critical step in Risk Analysis. Many aids are available, including experience, engineering codes, checklists, detailed process knowledge, equipment failure experience, hazard index techniques, What-if Analysis, Hazard and Operability (HAZOP) Studies, Failure Mode and Effects Analysis (FMEA), and Preliminary Hazard Analysis (PHA). In this phase all potential incidents are identified and tabulated. Site visit and study of operations and documents like drawings, process write-up etc are used for hazard identification.

ASSESSMENT OF THE RISK - Consequence Estimation is the methodology used to determine the potential for damage or injury from specific incidents. A single incident can have many distinct incident outcomes. Likelihood assessment is the methodology used to estimate the frequency or probability of occurrence of an incident. Estimates may be obtained from historical incident data on failure frequencies or from failure sequence models, such as fault trees and event trees. Risks arising from the hazards are evaluated for its tolerability to personnel, the facility and the environment. The acceptability of the estimated risk must then be judged based upon criteria appropriate to the particular situation.

ELIMINATION OR REDUCTION OF THE RISK - This involves identifying opportunities to reduce the likelihood and/or consequence of an accident Where deemed to be necessary. Risk Assessment combines the consequences and likelihood of all incident outcomes from all selected incidents to provide a measure of risk. The risk of all selected incidents is individually estimated and summed to give an overall measure of risk. Risk-reduction measures include those to prevent incidents (i.e. reduce the likelihood of occurrence) to control incidents (i.e. limit the extent and duration of a hazardous event) and to mitigate the effects (i.e. reduce the consequences). Preventive measures, such as using inherently safer designs and ensuring asset integrity, should be used wherever practicable. In many cases, the measures to control and mitigate hazards and risks are simple and obvious and involve modifications to conform to standard practice.

4.2. HAZARD IDENTIFICATION

Identification of hazards in the proposed jetty is of primary significance in the analysis, quantification and cost-effective control of accidents and process. Definition of hazard states that, hazard is in fact the characteristic of system/process that presents potential for an accident. Hence, all the components of a system need to be thoroughly examined to assess their potential for initiating or propagating an unplanned event/sequence of events, which can be termed as an accident. The following two methods for hazard identification have been employed in the proposed Jetty Study:

Hazards during Construction Phase

Mechanical Hazards

Transportation Hazards

Physical Hazards

Storage and Handling of Hazardous Materials

Hazards during Operation Phase

Material Hazards

Handling Hazards

Hazards due to Natural Calamities

Earthquake

Tsunami

Cyclone/Flood

4.3 OCCUPATIONAL HEALTH AND SAFETY

Occupational health and safety issues during the construction of Jetty are common to those of most large infrastructure and industrial facilities and their prevention and control. These issues include, among others, exposure to dust and hazardous materials that may be present in construction materials, hazardous materials in other building components (e.g. mercury in electrical equipment), and physical hazards associated with the use of heavy equipment, or the use of explosives.

Specific occupational health and safety issues relevant to Jetty operations primarily include the following:

Physical hazards
Chemical hazards
Confined spaces

5. IDENTIFICATION OF RISKS

For identification of risk due to proposed project, it requires in depth study of

Raw material
Process Risk
Storages
Operations
Maintenance
Safety
Fire protection
Effluent disposal

5.1 RISK ASSOCIATED WITH STORAGE OF ALCOHOL

Safety Measure Recommendation
Storage and material handling area
Proper ventilation shall be provided
Area will be marked as “No smoking Zone”
Use of proper PPEs
Pressure relief valves shall be provided
Provision of Safety valves and rupture disk
Provision of fire hydrant system along with other portable fire extinguishers
Adequate distance between the storage Tanks
Provision of dyke wall to the Tanks
Proper earthing to the Tanks

5.2 HANDLING OF ALCOHOL

Keeping away from oxidizers, heat and flames.
Avoidance of plastics, rubber and coatings in the storage area.
Cool, dry, and ventilated storage and closed containers.
Leakage should be washed out and diluted.
Regular monitoring and maintenance to avoid leakages.
If major leakage in tanks can be mitigated by transferring the material to another tank.
Transfer the material to another tank.

Grounding of the container and transferring of equipment to eliminate static electric sparks. In case of any emergency following measures would be taken:
First Aid Measures

5.3 FORMAL HAZARD ASSESSMENTS

This type of assessment takes a look at individual tasks involved in carrying out every job within an organization, from office work to front line labor. Every position is broken down into separate tasks and analyzed to give a detailed assessment of the hazards and risks related to each of them.

Steps for conducting formal hazard assessment include: Identifying each position

Breaking it down into discrete tasks

Noting the hazards encountered in carrying out each task
Assessing the risks associated with each hazard
Recommending control methods for each hazard
Overseeing the implementation of these control measures
Periodically re-evaluating the hazards, risks, and controls
Regularly updating documents

5.4 SITE-SPECIFIC HAZARD ASSESSMENTS

Site-specific hazard assessments are more localized than its formal counterpart. They are concerned with identifying hazards in a particular area, at a particular moment. They are also known as field-level hazard assessment (FLHA). Site-specific hazard assessments ensure the ongoing safety of the workers. It is through these that new or unexpected hazards are encountered and the need for additional control measures are identified quickly.

5.5 HAZARD CONTROLS

Hazard controls are measures taken to eliminate or mitigate the risks associated with workplace hazards. A hazard assessment not only identifies the hazards that need to be controlled but also guide the selection of proper control methods. Safety professionals typically follow the hierarchy of control, which categorizes control methods, starting from the most effective to the least:

Elimination – Removing the hazard altogether. This is the ideal control method but it is often impossible to implement, since some hazards are essential features of a job (repairing power lines, for instance, must be done at heights).
Substitution – Replacing materials or equipment with less hazardous options. An employer might, for example, replace cleaning products that have a strong inhalation hazard with one that is more benign.
Engineering controls – Using equipment to isolate workers from a hazard. This could include installing barriers to reduce the risk of falling or making use of machine guards to prevent workers from accidentally coming into contact with a machine's moving parts.
Administrative controls – Changing the way people perform their jobs, such as allowing additional breaks for workers carrying out strenuous work or rotating work tasks to prevent repetitive stress injuries.
Personal protective equipment (PPE) – Providing adequate protective gear and fall arresting systems to keep workers safe. This is often considered the "last line of defense." When other control methods fail, proper PPE can prevent or reduce the severity of the injuries a worker suffers.

Multiple types of control methods can be used to reduce the risks of any given hazard. For instance, an employer substituting a corrosive chemical with one that is less harmful might still need to equip workers with chemical resistant gloves.

The potential risks in production systems can be mainly caused by failures and hazards due to the material, human, production measurement method and machines/equipment. The risk analysis and evaluation methods with top-down or bottom-up approaches can be evaluated to reduce the risks in the systems. In the literature, hazard and risk analysis methods are used to define undesirable events and their status in production systems. What-If [21], Checklist [21,
22], Preliminary hazard analysis (PHA) [21, 23, 24], Fault tree and Event tree analysis (FTA) [22, 24], Subsystem hazard analysis (SSHA) [24], System hazard analysis (SHA) [24] are some of the methods used for hazard analysis. Furthermore, Failure Mode and Effect Analysis (FMEA) [6, 25, 26], Hazard and Operability (HAZOP) [6, 26], Human reliability analysis (HRA) [22], Probabilistic risk assessment (PRA) [24] are extensively used for risk Analysis in production systems.

FMEA method is one of the well-known methods and it is used for the identification of possible hazard types in various areas of the textile sector, taking precaution for eliminating hazards or reducing their effects to improve process performance in the literature. Beyene et al. [27] implemented FMEA to identify defects that led to production stoppages in a textile firm, found out that stoppage time can be reduced and the productivity can be increased.[28] identified the failure modes in the laying and cutting process in the clothing sector by using FMEA tool. Paired et al. [29] used the FMEA method to detect garment manufacturing defects and to develop a quality control system and then to analyze the optimization of production efficiency using a simulation-based optimization technique. Kumar et al. [30] analyzed the processing failures affecting the process by using FMEA method in addition to value streaming analysis and Kaizen tools to reduce the cycle time of T-shirt production. Kaewsom and Rojanarowan [31] conducted the FMEA study to reduce the failure of the broken filament in the direct

spinning process. Ozyazgan [32] conducted FMEA analysis and implementation in a textile factory producing woven fabric. Peddada [7] categorized risks as business risk, control risk, opportunity risk and personal risk and stated that they are used in FMEA method in the evaluation of the risks. In addition, Liu et al. [33] reported the major shortcomings of FMEA based on literature review.

6. MAIN SAFTY PROCESS

6.1 SPINNING PROCESS

Spinning is the process by which fibres are converted into yarn. Until the 1740s all spinning was done by hand using a spinning wheel. The Spinning process contain several units, process of spinning

6.2 BLOW ROOM

Blow room is the starting of the spinning operation. Where the supplied compressed cotton bale turns into a uniform lap of particular length by opening, cleaning, blending or, mixing is called blow room section. It is the first step of spinning. The section consist a number of different machines used in succession to open and clean the fibers. Opening- Opening of compressed cotton bales and cotton bales are made into small tufts. Cleaning- To eliminate dust, dirt, broken leaf, seed particles, grass and other foreign impurities from the fibre. Dust removal- To remove the dusts which are completely enclosed in the flocks. Blending/mixing- To produce a comparatively good quality cotton fibre by mixing different types of cotton together. Lap forming-(a) to convert the opened and cleaned fibre into a sheet of particular width and uniform weight/unit length is called lap. (b) To give a cylindrical shape to the pre-determined lap by winding it in the lap pin and to make it suitable for the next process carding.

6.3 CARDING

The card is the machine which is used for carding. In the card we put lap from blow room and after carding we get carded sliver. This is second stage machine operation in conventional spinning line. Carding is a mechanical process that breaks up locks and unorganized clumps of fibre and then aligns the individual fibers so that they are more or less parallel with each other. Carding can also be used to create blends of different fibers or different colors. Carding plays a crucial role in all spinning cycles; it contributes a lot to the yarn quality. Opening to individual fibers: The blow room only opens the raw material to flocks whereas the card opens it to the stage of individual fibers. This enables the eliminations of impurities and good performance of the other operation. Elimination of impurities: Impurities are mostly eliminated in taker in and a small portion of it is eliminated by flat stripping. Modern card removes 80 – 90% impurities from lap and sliver contains only
0.05 – 0.3% foreign matter. Elimination of dust: Card is good dust removing machine. I t removes free dust as well micro particles by significant friction. Disentangling of naps: Blow room increase naps from machine to machine, but card reduce it to a small friction. The card does not remove naps but disentangles it by opening them. Closer spacing between the clothing, sharper clothing's optional speed of taker in, low doffer speed etc. Can improve the disentangling process of neps. Fibre blending: The card scarcely improves long term blending as the residence time of the material in the machine is too short. The card improves traverse blending and fibre with fibre mixing.

6.4 DRAWING

Drawing is the operation by which slivers are blended, doubled and leveled. In short staple spinning the term is only applied to the process at a draw frame. In drawing slivers are elongated when passing through a group of pair rollers, each pair is moving faster than previous one. This permits combing, drawing and elongating of several slivers to make them strong and uniform. Objects of drawing, to straighten the crimped, curled and hooked fibers, to make the fiber parallel to their neighbors, to improve uniformity of fibers by drafting and doubling. To reduce weight per length unit of sliver. To remove dust from slivers. To blend raw material of same hank perfectly. Drawing, also called Drafting, in yarn manufacture, Drawing reduces a soft mass of fibre to a firm uniform strand of usable size. This is the machine on which drafting & doubling are carried out. Carded sliver is that they are not even (uniform) enough to produce to good quality yarns. Therefore, usually all the carded slivers are subjected to Doubling & Drafting on a machine called "Draw Frame".

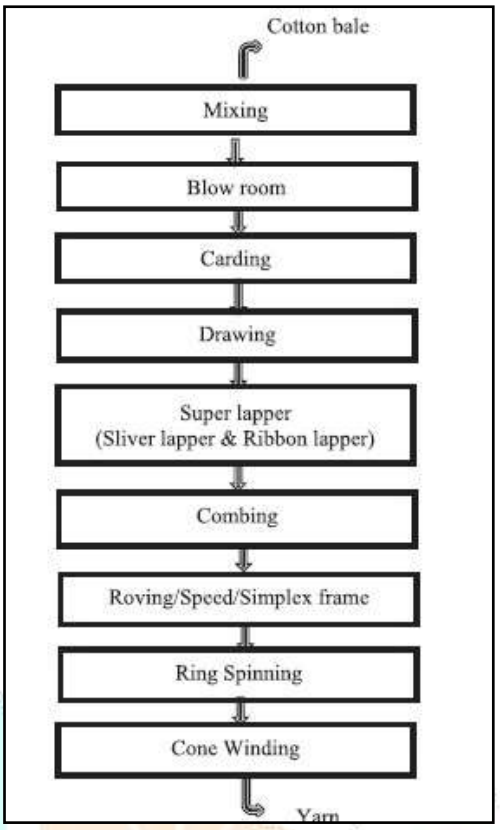


Fig: 1 Flow chart

6.5 COMBING

The process of straightening and parallelizing's of fibers and the removal of short fibers and impurities by using a comb on combs assisted by brushes and rollers is called combing. The combing process is carried out in order to improve the quality of the sliver coming out of the card. The process eliminates short fibers, it achieves better parallelization of fibers, it straightens curls, and it removes neps and residue impurities.

7. PROCESS SEQUENCE OF SPINNING MILLS

In this section, Process sequence for 4 types ofspinning mills in Tamil Nadu &India, and remedial measures of Industrial hazards has been discussed. The process sequence of spinning mills and performance results of existing safety& training programmes

7.1 REMEDIAL MEASURES OF HAZARDS IN TEXTILE INDUSTRY

NOISE: Isolation of the machine and silencer must be kept, Inverted drive control noise in ring frame, proper maintenance lubricating control noise level can be lowered by the use of noise control enclosures, absorbers, silencers and baffles and by the use of Personal Productive Equipment (PPE), such as Earmuffs etc. Where technical methods are insufficient, noise exposure may be reduced by the use of hearing protection, by administrative controls such as limiting the time spent in noisy environment.

DUST: Causes respiratory problems and causes Byssinosis, a disease causede by cotton dust, to avoid these problems, some remedial measure taken towards the dust hazards, like Introducing Dust collector, proper housekeeping, Necessary PPE should wear by worker.
Light: Causes eye strain and glaring- overcome these problems Proper lightening conditions are maintained in work place. Lifting Heavy Weight-Causes Muscular Skeletal disorders- precautions taken against these issues, Theoretical and practical training are given to the workers such as, keep your backbone straight while lifting load, pull the load as close to the body, lift and carry loads with stht arms.

FIRE HAZARDS: Loss of life, damages to the equipment, Welding operation causes spark ignition is very dangerous due to avoiding weldinding problems, restrict unauthorized person to do welding and ACB (Air Circuit Breaker), MCB (Motor Circuit Breaker) are introduced at industries to avoid electrical hazards. Smoking causes major fire accidents in textile industry and also easily gets fire with cottons,

So, the management given awareness about causes of smoking, Safety signs and workers must aware of not using any ignition product.

ELECTRICAL HAZARDS: It includes Short circuits, Improper Earthing, Improper isolation, Moisture etc., To solve this problem Care about the things like avoid improper earthing and loose connections, all circuits to be enclosed in a proper circuit, Moisture to kept in control.

ERGONOMICAL HAZARDS: It includes continuous work and improper workstations due to this repetitive star in injuries (Wrist, neck, shoulder, Knee, leg, hands and angle), to solve this problem given proper working procedure to workers and importance to ergonomics.

PHYSIOLOGICAL HAZARDS: It includes personal problems, financial problems, the major source of physiological hazards is not interested to work, stress (production target).

8. EXISTING SAFETY AND TRAINING PROGRAMMES

Training of personnel in textile industry is one of the major services offered by SITRA. SITRA has been offering training services for the past 35 years, with more than 100000 personnel, comprising all levels, having benefitted out of it. While training programmed intended for the top and middle level management personnel are held both at SITRA and also offered as in-house programmed; for operatives, the hands-on training modules are conducted at the mill premises, To avoiding injuries, accidents at work place The training and safety programmed are necessary to the workers, SITRA is one of the institutions certified by the Govt. of Tamil Nadu to offer skill-based training programmed for the backward and denitrified communities in the areas of weaving and knitting. It gives the general training programs, etc.

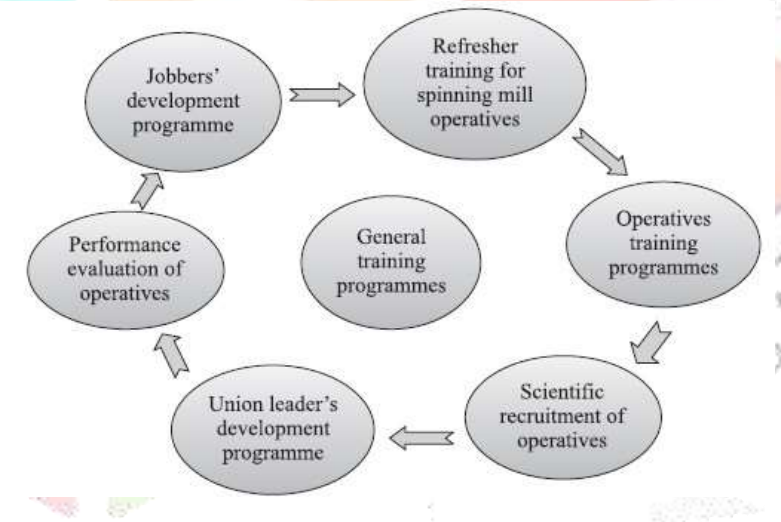


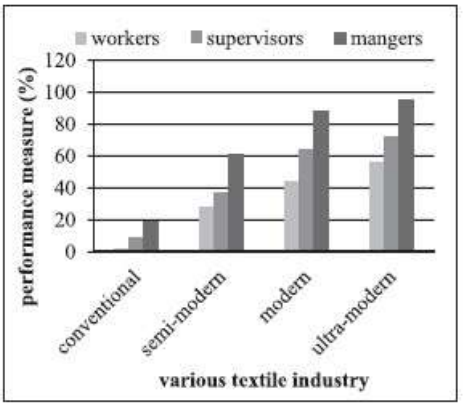
Fig :2 Existing Safety

9. PROPOSED MODERN SAFETY & TRAINING METHOD

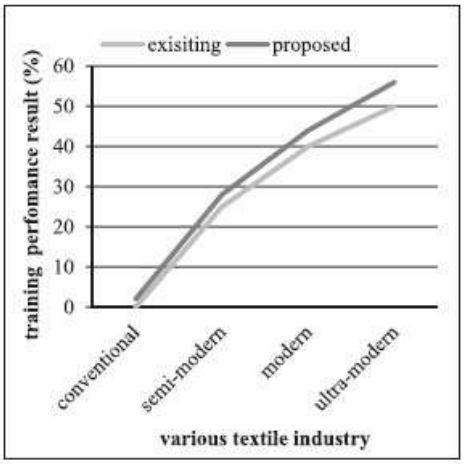
In this section, a Modern safety & training method is implemented along with existing training method, For the reason, In textile industry the safety and training programmed are do not conduct weekly basis and regularly it is offers only yearly basis, due to this the workers are forget the things quickly, which is learned in safety &training sessions, Most of the employers in textile industry are uneducated, they can't remember every think about safety programmed, It creates major accidents and injuries to the workers at textile industries. To overcome this problem the chunking training method is introduced in this work. Chunking is one strategy that can be used to improve a person's short-term memory. Chunking is the process of breaking down instructional materials into smaller, "bite-sized" pieces and then arranging them in a sequence that makes it easier for your learners to learn the material. For example, at the time of training session the information cannot given like paragraphs, because the listeners(employers) cannot understand or quickly forget it, so make it simple split into keywords and trained up the workers, Thoughts chunking have three important parameters such as pause, keywords and pacing to speech. Using this modern safety & training method provide some slogans related to how to handle such type of machineries Do's and Don'ts in textile industries, etc., In this modern safety training programmed conducted for weekly basis in textile industries located around Coimbatore.

10. PERFORMANCE RESULTS

In this section, the performance results of Modern Safety & Training programs for workers, Supervisors, Managers has been showed. The result shows effective improvement of safety awareness for workers, supervisors, Managers when compared to existing methods of training.



The graphical repres ing methods performance evaluation for various textile industries such as conventional, semi-modern, modern and ultra-modern. It shows the performance evaluation for workers, supervisors and managers.



The performance result of workers in various textile industries, the performance is compared with existing method. Its shows effective results among the workers awareness in spinning manufacture the performance result of supervisors in various textile industry, To avoid the hazards in textile industry, safety & Training program given to the workers is not sufficient, It's gives to supervisors also, Because in textile industry Most of the workers are uneducated, they need proper guidance to handle some machineries or equipment, For that reason this training program is necessary to the supervisors in textile industries. The performance result is compared with existing method. Its shows effective results among the supervisor's awareness in spinning manufacture.

11. CONCLUSION

This research paper presented Modern safety and training program for workers in textile industry, the major cause of accidents at workplace is lag of awareness about safety and training. The modern safety and training are more effective when compared to existing training program, because this training includes different way of teaching process, the result is it's very easy to memorize the training sessions for workers even if they are uneducated. The performance evaluation of Modern safety and training program for workers, supervisors and managers in several types of textile industries are studied and compared with existing results. The benefits of the Safety and training programme Health Management System could be observed and studied. However, in future needs to enhance the safety and training programmes in textile industry. This development is used to protect the workers from the harmful hazards.

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