IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

A REVIEW ON OCCUPATIONAL HEALTH RISKS ASSOCIATED WITH THE EXTRACTION OF FIBER

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ABSTRACT:

This review explores the occupational health risks associated with the extraction of fiber from various sources which is a widely available but invasive species. This study aims to identify potential hazards during the fiber extraction process, including physical, chemical, and ergonomic risks to workers involved in manual and mechanical fiber extraction techniques. A comprehensive assessment of the work environment, including exposure to dust, sharp tools, and prolonged physical labour, was conducted to evaluate the risks of respiratory issues, musculoskeletal injuries, and skin conditions. Additionally, the review study examines preventive measures and safety protocols to mitigate health risks and improve worker well-being.

INDEX TERMS: Fiber, Ergonomic Risks, Mechanical Fiber, Respiratory issues, Skin Conditions, Preventive Measures

INTRODUCTION:

Occupational safety and health management in the Textile Industry emphasize the health and safety of the workers, Industry is one of the occupations which affect the health of workers, in fact, the objective of an occupational health service is not only to keep the workers physically healthy but also mentally and psychologically stable. Occupational health is perturbed by the health safety issue of work. The hazards revealed in the setting can harmfully affect human health. To prevent health issues for workers in industries it is essential that the workers be aware of the various occupational hazards in the industry. It is also necessary that the management should take the necessary steps to protect workers from potentially hazardous situation.[RAJ.J.A et al,2023]

Fibres are the smallest unit used as raw material for making yarns and fabrics. there are two types of fibres including natural fibres (derived from vegetables, animals or mineral fibres) like cotton, jute, linen, wool and silk; and man-made fibres (synthetic fibres) which are made synthetically in laboratories by using chemicals .[Lakshmi,v.2021]

The process of extraction of fibers from the plants through separation, dissolution and decomposition of pectins, gums and other muscle elements is called retting after extraction of fibers by any of these methods; all extracted fibers are washed away before drying. Proper drying is important as the moisture content in fiber affects fiber quality. Artificial drying results in higher-grade fiber than sun drying. The fibers were dried under a shade to avoid beaching by direct sunlight. Dry fibers and then combed, sorted into different grades and packed into bales.[Mohankumar,d.et al,(2021)]

TEXTILE FIBER:

A fiber is the smallest detectable component of any textile product. Textile fibers are the building blocks or fundamental unit of fabrics and textiles . As textile fibers are pliable, these can be spun into yarn or weaved into fabric. Fibers also play a crucial role in evaluating the properties and performance of produced textile goods. Choice of these fibers depends on various factors such as desired end-use, required properties, and sustainability aspects**.[**Tamta, M. (2024)]

NATURAL FIBER:

. Natural fibers can be obtained from various natural origins like plant, animal and minerals. Examples included cotton (cotton plant), silk (silkworm), wool (sheep, goat) and linen (flex plant). All the natural fibers have special properties of breathability, moisture absorption, thermal insulation and these making textile fibers suitable for various end uses.

SYNTHETIC FIBER:

Synthetic fibers created through chemical processing of raw materials like petroleum or plant based polymer. Most widely used synthetic fibers are polyester, nylon, acrylic, mod-acrylic, spandex and polypropylene. Synthetic fibers are best known for their excellent strength, durability and versatility. They can be created to have particular properties like moisture wicking, flame resistance, or flexibility**.[**Tamta, M. (2024)]

FIBER EXTRACTION PROCESS:

The process of extraction of fibers from the plants through separation, dissolution and decomposition of pectins, gums and other muscle elements is called retting. After extraction of fibers by any of these methods, all extracted fibers are washed away before drying. Proper drying is important as the moisture content in fiber affects fiber quality. Artificial drying results in higher-grade fiber than sun drying. The fibers were dried under a shade to avoid beaching by direct sunlight. Dry fibers and then combed, sorted into different grades and packed into bales. There are vary Retting, process employing the action of bacteria and moisture on plants to dissolve or rot away much of the cellular tissues and gummy substances surrounding bast-fibre bundles, thus facilitating separation of the fiber from the stem. Basic methods include dew and water retting ous methods of fiber extraction, which include mechanical decortications, water retting process and manual extraction method. The extraction of fibers involves the retting process which is followed by the decortication process. From the above various methods, a suitable extraction method is selected based on the parts of the plant from which the fiber is to be extracted. Choice of extraction method governs the characteristics and properties of composites fabricated out of it. [Mohankumar,d.et al, (2021)]

TYPES OF RETTING:

Dew retting:

Dew retting which is common in areas having limited water resources is most effective in climates with heavy night time dews and warm daytime temperatures. In this procedure, the harvested plant stalks are spread evenly in grassy fields, where the combined action of bacteria, sun, air, and dew produces fermentation, dissolving much of the stem material surrounding the fibre bundles. Within two to three weeks, depending upon climatic conditions, the fibre can be separated. Dew-retted fibre is generally darker in colour and of poorer quality than water-retted fibre.

Water retting:

It is most widely practiced method; bundles of stalks are submerged in water. The water, penetrating to the central stalk portion, swells the inner cells, bursting the outermost layer, thus increasing absorption of both moisture and decay-producing bacteria. Retting time must be carefully judged; under-retting makes separation difficult, and over-retting weakens the fibre. In double retting, a gentle process producing excellent fibre, the stalks are removed from the water before retting is completed, dried for several months, and then retted again.

Natural water retting:

Natural water retting employs stagnant or slow-moving waters, such as ponds, bogs, and slow streams and rivers. The stalk bundles are weighted down, usually with stones or wood, for about 8 to 14 days, depending upon water temperature and mineral content.

Tank retting:

Tank retting, an increasingly important method, allows greater control and produces more uniform quality. The process, usually employing concrete vats, requires about four to six days and is feasible in any season. In the first six to eight hours, called the leaching period, much of the dirt and colouring matter is

removed by the water, which is usually changed to assure clean fibre. Waste retting water, which requires treatment to reduce harmful toxic elements before its release, is rich in chemicals and is sometimes used as liquid fertilizer.

Manual method:

In manual fabrication of fiber, the fiber gets collected from the river banks and the collected fiber is treated by water which is got stuck on the fiber for around 168 hours and then the fiber is dried in room temperature to minimize moisture in the fiber, thereby made into a fiber for textile use. The fiber is then removed from the plant tissues by manually peeling the fiber from the plant tissues. This allows the bundle of stems to be separated from the water that drains from it. The stems are then stripped separately. After the fibers are rendered into handfuls, the materials are then cleaned. The stems in the fiber are taken in hand and pounded on roads when the root ends are sufficiently crushed, they are broken off. The fibers that are loosely knotted are then able to be taken free from the rest of the stems. The fibers are then removed, sorted, and cleaned. Rub the skin of the plant gently until the outer skin is removed, which reveals the plant's fiber, which must be carefully dried and extraction of fiber can been to be made by hand manually.[Mohankumar ,d.2021]

HEALTH HAZARDS:

PHYSICAL HAZARDS:

In the initial conditions of workers in the process of extracting or removing of fibers do not pay attention to the work position that can cause the risk of injury.[Lakshmi,v.2021]

Muscle Fatigue:

The Muscle Fatigue Analysis was proposed by Rodgers as a means to assess the amount of fatigue that accumulates in muscles during various work patterns within 5 minutes of work. It can affect task performance, posture-movement coordination. This method for extracting fibre is most appropriate to evaluate the risk for fatigue accumulation in tasks that are performed for an hour or more and where awkward postures or frequent exertions are present. Based on the risk of fatigue, a priority for change can be assigned to the task.[Lakshmi,v.2021]

Work related issues:

Here, the study revealed that the work itself was creating health issues to the workers due to prolonged sitting position, bending and forwarding the back and neck, continuously repeating of particular task with both the hands without changing their posture for a longer Period. Findings on workers' perception levels on fibre extraction task revealed that the workers had to sit down on a normal floor without any cushioned floor mats and any chairs or stools. Due to prolonged sitting on the floor surface the worker felt that there is loss of feeling in both legs and palms, unable to raise their hands, loss of movement in shoulder and they could not bend forward at all.

When the workers performing different task at the workplace, they are experienced different Health issues

• While collecting and cutting the plant stalks they were injured with cuts and scratches On hands and legs.

• When soaked the smell which came from the plant stalks are very strong and bad –Unable to take a breath, chest tightness, vomiting sensation, headache, and coughing.

• When peeling castor stalks workers felt eye irritation, skin irritation and itching on *Hands.*

• When extracting the fibre from plant stalks, there is a loss of feeling on finger tips, eye Irritation sometimes they felt a double vision due to continuously keen sighted.

• When combing the fibre, the workers felt muscle pain and discomfort in palms, hands and shoulder due to constantly performing one single task [. Lakshmi,v.2021]

EXPOSURE TO DUST:

The micro dust comprises 50-80% fiber fragments, leaf and husk fragments, 10-25% sand and earth, and 10-25% water soluble materials. The high proportion of fiber fragments indicates that a large part of micro dust arises in the course of processing. Nearly about 40% of the micro dust is free between the fibers and flocks, 20-30% is loosely bound, and the remaining 20-30% is bound to the fibers.

Types of Dust

▪ **Inhalable dust**: It is a term used to describe dust that is hazardous when deposited anywhere in the respiratory tree including the mouth & nose.

▪ **Thoracic dust**: It is defined as those materials that are hazardous when deposited anywhere within the lung airways and the gas exchange region.

▪ **Respirable dust**: Repairable dust is defined as that fraction of the dust reaching alveolar regions of the lungs. .[RAJ.J.A et al,2023]

ERGONOMIC RISKS:

RISK FACTOR:

1. Shoulder -The shoulder is extreme bent down with hand position closer to the chest and Knee level. Hence the score is high. Next, the repetition does exist. However, pause position during working does not exist as well, hence the score is high.
2. Wrist - Wrist are moderate bent up or bent down at about >150 in this process. The position is at the moderate working risk position. The repetition does exist in this kind of position at about 20 times per minute.
3. Back-The back is moderate bent to the front between 0-200 and 200-600. This position last For 9-12 minutes. Hence, this position is categorized as high.
4. Neck-The neck is extremely bent forward at about >200, and movement without pauses. Hence, this position is categorized as high.
5. Leg-The next position is leg. The worker's legs are extremely bent at about>600. This position last for one hour. This position is categorized as high working risk

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Hazards of Noise Pollution:

The eardrum is damaged when exposed to very loud and sudden noise. The pair.[RAJ.J.A et al, 2023]of calls in the inner ear are chronically damaged. Prolonged exposure to noise of certain frequencies pattern leads to hearing loss. According to KRYTER in 1970, noise causes heart output to decrease with fluctuation in arterial blood pressure and vasoconstriction of peripheral blood vessels.

Recently, the report indicates that blood is thickened by excessive noise. Eosinophilia, hyperglycemia, hypokalemia, and hypoglycemia are caused by the alteration in the blood due to noise. .[RAJ.J.A et al,2023]

CHEMICAL HAZARDS:

Side effects of the chemicals used in the textile fibre manufacture.

1. Sulphuric acid-Used in manufacturing process of rayon can cause skin rashes, itching, redness, dermatitis, necrosis and anorexia
2. Carbon disulphide- Emitted from rayon fabric can cause nausea, headache, vomiting, chest and muscle pain; and insomnia
3. Nitric acid-Used in rayon can produce injuries to the skin, eye, respiratory and gastrointestinal tract
4. Ethylene glycol-Used in manufacturing of polyester fibreit can cause dysrhythmias and heart failure
5. Hex methylene diamine- Used in manufacturing of nylon fibre can irritate skin, eyes, nose, throat and lungs; may also damage the liver and kidneys, infertility in men
6. Dimethyl form amide-Used in spinning process of acrylic fibre Causes skin rashes and liver damage
7. Formaldehyde-Used in spandex, acrylic, nylon and polyester fibres Causes skin allergies and eye watering
8. Barium sulphate-Used as antistatic substance in the finishing of polyester, nylon, spandex and acrylic fibres Causes hyper skin pigmentation, dermatitis, dizziness, headache and spine pain
9. Terepthalic acid-Used in manufacturing polyester fibre Carcinogenic
10. Acrylonitrile-It is used in manufacturing of acrylic fibre Carcinogenic and has bad effects on central nervous system [.Bhalla, S. (2017)]

SAFETY PRECATIONS TO IMPROVE THE SAFETY AND HEALTH CONDITIONS IN FIBER EXTRACTION:

- Lift by 2 persons.
- Keep your backbone straight while lifting the load
- Use Lifting Vehicle
- Workers should wear PPE.
- Increase the no. of Dust collector
- Proper House Keeping
- Wear proper safety gloves and equipment.
- Check the blood samples of the workers and advised remedial action.[RAJ.J.A et al,2023]

- Provide proper workstation and tools for workers to carry out the work to increase work productivity
- Provide protective measurements for workers to protect themselves from dust and other chemicals.
- Provide adjustable chair to sit and work without kneeling and bending.[Lakshmi,v.2021]

CONCLUSION

This study is to identify the occupational safety and health management hazardous effects and physical, chemical, ergonomic risks over people working in the textile industry. The purpose of working posture assessment is to provide act level toward worker body posture during activity task was not at all acceptable and there is a need to change the working procedure and to improve their posture immediately. The purpose is to avoid worker grievance on the body part in conducting a continuous work in a long term which can cause disorders to the worker's body part.

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