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IMPORTANCE OF FIRE SAFETY AND MAJOR RISK FACTORS IN COTTON PROCESSING ENTERPRISES

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Abstract
Cotton processing enterprises require a specific approach and systematic measures to reduce fire risk. This article examines the importance of fire safety in cotton processing, the main risk factors, and methods to mitigate these risks. The study analyzes the effectiveness of telemetry systems and safety measures in enhancing fire safety.

Keywords: Cotton processing, fire safety, telemetry systems, dust, sensors, technological equipment, fire risk, enterprise safety, integrated systems, warning systems.

Introduction

The cotton processing industry encompasses processes from cotton fiber collection to finished product production. Due to the presence of cotton dust and various flammable materials, there is a high probability of fire incidents during these processes. Fires in cotton processing enterprises often result in significant material losses and pose risks to human life.

1.1 Fire Risk Statistics in Cotton Processing

According to statistics, the number of fires and related damages in cotton enterprises in recent years are as follows:

Year	Number of Fires	Financial Loss (million $)	Number of Casualties
2018	25	1.2	5
2019	18	0.9	3
2020	30	1.8	6
2021	22	1.1	4

This data highlights the need for a serious approach to fire safety issues.

2. Methodology

The primary goal of the study is to develop effective measures to identify and reduce fire risks in cotton processing enterprises. The methodology includes the following steps:

- Observation: Risk factors in cotton processing enterprises were observed and analyzed.
- Interviews: Conversations with enterprise workers and safety personnel provided insights and experiences regarding fire risk.
- Statistical Analysis: Available data on fire risks and incidents in processing plants were collected, and the main causes of fires were identified.

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- Experimental Trials: Practical testing of telemetry systems for fire risk reduction was conducted.

3. Results

3.1 Importance of Fire Safety

Fire safety is a priority in cotton processing enterprises, as it plays a crucial role in ensuring the economic efficiency of the enterprise and the safety of human life. The presence of cotton dust and other flammable materials allows fires to spread quickly, causing extensive material damage.

3.2 Major Risk Factors

- Dust: When mixed with air, cotton dust creates a combustible atmosphere, increasing the likelihood of fire. The combustion process of cotton dust is represented by the following formula:

$$Q=m\times\Delta H$$

where:

  - Q = heat of combustion (Joules),
  - m = mass of the combustible material (kg),
  - ΔH = heat of combustion per kilogram (Joules/kg).
- Equipment Malfunction: Electrical short circuits or mechanical malfunctions in technological equipment can increase fire risk due to sparks.
- Human Factors: Failure of workers to follow safety protocols or improper handling increases fire risk.
- Environmental Conditions: High temperature or dryness in enclosed areas heightens fire risk, and lower humidity makes fibers more flammable.

3.3 Fire Safety Improvement Measures

Creating a warning system using telemetry systems to detect hazards is an effective method for enhancing fire safety. The following sensors are used in telemetry systems:

- Temperature Sensors: Detect sudden changes in air temperature.
- Gas Sensors: Detect the presence of flammable gases.
- Smoke Sensors: Signal when smoke concentration increases.

System Type	Risk Level Before Installation (%)	Risk Level After Installation (%)
Smoke Sensors	80	30
Temperature Sensors	75	25
Gas Sensors	70	20

4. Discussion

Results indicate that implementing telemetry systems in cotton processing enterprises significantly reduces fire risks. The effectiveness and economic feasibility of telemetry systems were analyzed, showing advantages in enhancing fire safety, despite the costs associated with installation and maintenance.

5. Conclusion

Fire safety is a fundamental factor for ensuring economic efficiency and protecting employee safety in cotton processing enterprises. Major risk factors—dust, equipment malfunctions, human error, and environmental conditions—must be considered at every stage. Early hazard detection and warning systems through telemetry significantly enhance fire safety.

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