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IMPLEMENTATION OF OHS SYSTEM IN GUM ROSIN PRODUCT TESTING AT PGT REJOWINANGUN LABORATORY

Eka Apriliyani Setiawati[1)], Lintang Anis Bena Kinanti[1)], Andik Iswara Yudha[2)]

[1]Management of Agribusiness, Politeknik Negeri Jember, Indonesia
[2]PGT Rejowinangun, Trenggalek, Indonesia
Correspondence email: lintang.anis@polije.ac.id

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ABSTRACT

Occupational Health and Safety (OHS) is crucial in every industrial activity, including in the non-timber forest product processing industry, such as that carried out at the PGT Rejowinangun. As Perhutani unit that processes pine resin into gum rosin and turpentine, PGT Rejowinangun has a laboratory that plays a crucial role in product quality testing. This testing not only ensures that products meet quality standards but also ensures their safety and effectiveness before export. A safe and controlled work environment ensures that testing processes run smoothly and without interruption, resulting in more accurate and accountable results. To support business sustainability, precision and accuracy in the testing process are essential. Therefore, OHP awareness is essential for all workers. However, this awareness is minimal among laboratory workers. This has significant impacts on the workforce. The research design used in this study was descriptive qualitative, with data collection through observation and interviews. The results are improved ventilation and air filtration systems in the laboratory, ensuring the use and routine replacement of complete PPE, conducting training and recruitment of qualified workers, designing standard operating procedures (SOPs) and procedures for mitigating chemical risks, rearranging the laboratory space to be more efficient and cleaner, and creating a chemical weighing checklist in accordance with SOPs for quality control.

Keywords: agribusiness; occupational health and safety; gum rosin; turpentine; risk management

INTRODUCTION

Occupational Health and Safety (OHS) is an effort to create a safe and comfortable working environment and achieve the goal of maximum productivity (Waruwu and Yuamita 2016). OHS is crucial in every industrial activity, including in the non-timber forest product processing industry, such as that carried out at the PGT Rejowinangun. The introduction should also be written in a way that is accessible to readers who may not be experts in the specific research area. Overall, this section should range between 750 and 1000 words and clearly demonstrate the research gap being addressed, as well as the importance of the study within the broader context of agricultural socio-economics and rural development (Ambarani and Tualeka 2017).

As a Perhutani unit that processes pine resin into gum rosin and turpentine, the Rejowinangun PGT has a laboratory that plays a crucial role in product quality testing. This testing not only ensures that the product meets quality standards but also ensures its safety and

effectiveness before export. Therefore, implementing OHS principles in the laboratory is crucial to protect workers from potential hazards that may arise during the testing process.

Beyond safety aspects, OHS implementation also contributes to improving the quality of product testing. A safe and controlled work environment ensures a smooth and uninterrupted testing process, resulting in more accurate and reliable test results. This is crucial, considering that gum rosin and turpentine products must meet strict quality standards to achieve market acceptance and support business objectives. Thus, OHS not only protects workers but also supports the achievement of product quality goals at the PGT Rejowinangun.

To support these efforts, precision and accuracy are required in the testing process. As with most testing, PGT Rejowinangun laboratory involves chemicals that are classified as hazardous to health. Therefore, OHS awareness is essential for all workers. However, this awareness is minimal among laboratory workers. This has significant impacts on workers. Excessive exposure to chemicals can cause various negative impacts on both humans and the environment. One aspect of this awareness is the use of personal protective equipment (PPE) that can protect against exposure to hazardous chemicals.

The purpose of this study was to determine and demonstrate the effectiveness of OHS implementation in laboratory activities to ensure worker safety and test quality. The study was conducted at the PGT Rejowinangun, located in Klampisan, Surodakan, Trenggalek District, Trenggalek Regency, East Java, Indonesia.

Occupational Health and Safety (OHS)

Creating quality human resources requires attention to occupational health and safety. Occupational Health and Safety (OHS) is a program created by workers and employers to anticipate work-related accidents and occupational diseases by identifying factors that have the potential to cause accidents and occupational diseases and taking anticipatory measures if they occur (Yamin 2020). The goal is to create a comfortable and healthy workplace to minimize the risk of accidents and diseases (Komarudin, Kuswana, and Noor 2016).

According to the Ministry of Manpower, OHS is divided into four perspectives:

1. Philosophy: The primary value of OHS is maintaining the integrity and physical and mental health of workers, their work, and their culture, with the primary goal of improving the standard of living and human well-being, particularly in the workplace.
2. Science: OHS is both a scientific discipline and a practical application focused on preventing and controlling risks or accidents in the workplace to create a safe work environment.
3. Practical: Operationally, this effort aims to protect workers by ensuring their safety and health while working, as well as for other parties present or active in the work area, as well as users of products or services in the production process.
4. Legal: Various applicable regulations and provisions in OHS are designed to prevent workplace accidents, with the primary goal of protecting all workers so they remain safe and healthy in their work environment.

Risk Management

According to (Arta et al. 2021), citing Vaughan, in their book "Fundamentals of Risk and Insurances," risk is a condition in which there is the possibility of an adverse deviation from a desired outcome that is expected or hoped for. Risk is associated with the possibility of undesirable or unexpected consequences or losses. In other words, this possibility already indicates uncertainty. Risk arises from uncertainty. Likewise, uncertainty is a condition that gives rise to risk.

Risk management is a discipline that examines how an organization implements systematic and comprehensive steps to identify and manage various potential problems. This

involves a comprehensive set of policies and procedures implemented by the organization to manage, monitor, and control existing risks (Rahmanto and Hamdy 2022). In practice, risk management has two main objectives: before and after a risk occurs. Pre-risk objectives include managing economic and non-economic aspects, as well as fulfilling obligations to third parties outside the organization (Mahyudin 2025). Meanwhile, post-risk objectives are to protect the continuity of company operations, maintain revenue streams, support business growth, and consistently fulfill corporate social responsibility (Arta et al. 2021).

PPE (Personal Protective Equipment)

Personal Protective Equipment is defined as equipment used to protect workers from injury or illness caused by contact with workplace hazards, whether chemical, biological, radiation, physical, electrical, mechanical, or other hazards (Novianto 2015). PPE is a set of tools or clothing designed to protect workers from workplace hazards or injuries. Personal Protective Equipment (PPE) is one way to mitigate occupational risks. In the workplace, the use of Personal Protective Equipment (PPE) is essential, especially in work environments that pose potential hazards to worker health and safety (Yuliandi and Ahman 2019). The use of PPE is not merely a matter of complying with regulations, but rather an important investment in worker safety and health (Syahrit and Putri 2021).

There are several types of PPE, including (Novianto 2015):

1. Head Protective Equipment: this equipment serves to protect the head from blows, impacts, or head injuries caused by falling hard objects. It also protects the head from heat radiation, fire, chemical splashes, and extreme temperatures. Types of PPE for head protection include safety helmets, hats or hoods, and hair protectors.
2. Eye and Face Protection: This personal protective equipment (PPE) serves to protect the eyes and face from the dangers of chemical exposure, such as ammonium nitrate, gases, airborne or waterborne particles, splashes of small objects, heat, or steam. Eye protection that can be used includes special glasses or spectacles and goggles. Meanwhile, face protection is a face shield.

METHODS

The research design used in this study was descriptive qualitative, with data collection through observation and interviews. Descriptive qualitative research employs a case study method or approach. This research focuses intensively on a specific object and examines it as a case. Case study data can be obtained from all relevant parties, or in other words, data is collected from various sources.

The data collection methods used in this study included:

1. Observation. The researcher was directly involved in various work activities at the company, specifically by participating in various activities carried out, particularly in the laboratory at PGT Rejowinangun Trenggalek.
2. Interviews. The researcher interviewed PGT Rejowinangun Trenggalek employees regarding the gum rosin product testing procedures at PGT Rejowinangun and directly observed the gum rosin product testing process.
3. Literature Review. The researcher conducted a literature review of previous research and searched for publicly accessible literature available on the Perhutani website.

RESULTS AND DISCUSSION

PGT Rejowinangun Laboratory serves primarily as a quality control centre, ensuring product quality meets standards at every stage of the production chain. These activities focus on three

crucial types of testing: first, quality analysis of pine resin raw materials and final quality verification of gum rosin and turpentine products. Testing of finished products is a crucial step before marketing. Finally, all test data is comprehensively reported, which is used to ensure product certainty and support the company's entire official reporting process.

Figure 1. Testing Flow

Pine Sap Testing

Pine sap testing is conducted at the PGT Rejowinangun laboratory to determine its quality as the main raw material, which directly affects the yield and quality of the final products, namely gum rosin and turpentine. The tests performed are as follows (BSN, 2016):

1. Visual Test
2. Laboratory Test

Gum Rosin Testing

Gum rosin testing is conducted to ensure that the solid product resulting from pine sap distillation meets quality standards, which is crucial because the quality of gum rosin determines its selling price and application in various industries. Prior to testing, gum rosin sampling is necessary.

The tests performed are as follows (BSN 2020):

1. Color Test. The color test is conducted to determine the clarity and color intensity of the Gum rosin, which is the primary determinant of its grade and selling price. The procedure begins by grinding the Gum rosin sample, which is then dissolved in the organic solvent toluene to a standard concentration of 50%. This solution is placed in a cuvette and read using a digital lycometer or visually compared with a series of standard glass plates (Gardner scale or K scale). The resulting color value will classify the Gum rosin, with the lightest color indicating the highest quality.
2. Softening Point Test. The softening point test aims to determine the temperature at which Gum rosin transforms into a soft phase, which is important for industrial applications in adhesives and paints. The test is conducted using the Ring-and-Ball method. The Gum rosin sample is melted, then placed in a brass ring and cooled. The ring containing the sample is placed in a vessel filled with distilled water, and a steel ball of standard weight is placed on top of the sample. The water temperature is gradually increased, and the temperature at which the Gum rosin softens until the steel ball touches the bottom plate of the vessel is recorded as the softening point.
3. Toluene-Insoluble Materials Test. This test measures the content of solid residue insoluble in toluene, which is an indication of the effectiveness of the Gum rosin filtration and purification process. The procedure involves weighing a sample of Gum rosin and completely dissolving it in toluene. The Gum rosin solution is then filtered through filter paper or a fine-pored crucible. The solid residue remaining on the filter paper is then dried and weighed. The result, expressed as a percentage, indicates the number of solid impurities that failed to be removed during the production process.
4. Volatile Fraction Test. The volatile fraction test aims to measure the percentage of volatile components remaining in the Gum rosin, which ideally should be very small. The standard

procedure involves placing a weighed sample in an oven at a specific temperature for a specified period of time. This heating will evaporate any remaining turpentine or water trapped in the product. After cooling, the sample is reweighed, and the difference in weight is expressed as the percentage of vaporized resin, which is important to ensure product stability during packaging.

5. Acid Number Test. The acid number test measures the number of milligrams of potassium hydroxide required to neutralize the free resin acids present in one gram of Gum rosin sample. This procedure is a titration in which the dissolved Gum rosin sample is titrated with a standard solution using an indicator. The acid number is an important indicator of Gum rosin's reactivity in industrial formulations; a high value indicates a high content of resin acids available for chemical reactions.

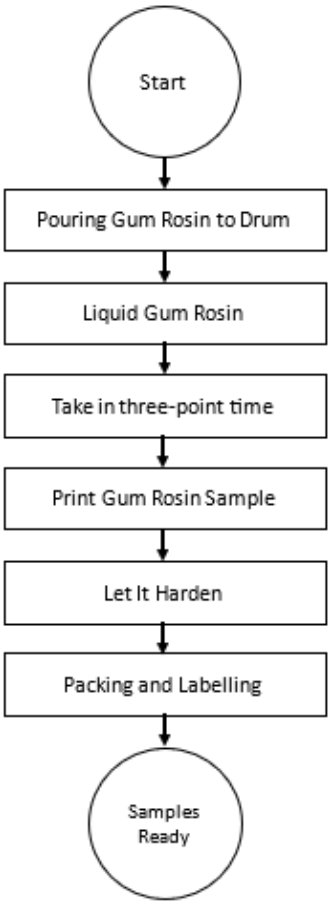

Figure 2. Gum Rosin Sampling Flow

Turpentine Testing

Turpentine oil testing is conducted after the distillation and purification process to verify its purity, composition, and physical properties. This testing is essential to ensure the product meets standard market specifications, especially for export purposes. This testing focuses on the physical and chemical characteristics that determine the quality of turpentine. The tests performed are (BSN 2020):

1. Odor Test
2. Color Test
3. Relative Specific Gravity Test

Implementation

Occupational Health and Safety (OHS) at PGT Rejowinangun is carried out seriously, providing Personal Protective Equipment (PPE) for all workers. Factory workers are provided with PPE, including safety helmets and work clothes, to protect themselves from potential hazards in the production area. Specifically, in the laboratory, personnel are provided with equipment including lab coats, gloves, and masks to protect them from chemical exposure and other risks that may occur during the testing process. The provision of PPE tailored to the type of work reflects PGT Rejowinangun's commitment to creating a safe and standards-compliant work environment.

The effectiveness of this OHS program is supported by a clear OHS structure within the company. This structure ensures that OHS policies and procedures are not only created but also implemented, monitored, and evaluated on an ongoing basis. The OHS structure at PGT Rejowinangun has also been established to ensure the effective implementation of safety and health standards in the workplace. This OHS structure demonstrates that occupational safety responsibilities are integrated across all levels of management, from policy formulation to field inspections. This is an important indicator that safety has become a systematically and systematically managed work culture, rather than simply a reactive response to accidents. This supports regulatory compliance and promotes proactive risk prevention. With a clear OHS structure, it is hoped that a safety culture will become an integral part of daily factory activities.

PGT Rejowinangun's employee protection is strengthened through the provision of three social security benefits. The first benefit provided by the company is occupational accident insurance, which provides protection for workers who experience accidents while performing their duties within the factory environment. Workers who experience an accident are entitled to reimbursement for medical expenses. Second, there is old-age insurance, provided to workers upon retirement as a form of savings or social security fund. Third, there is death insurance, provided in the event of a worker's death due to a work-related accident. These social benefits not only fulfil the company's legal obligations to employee welfare but also serve as important incentives that increase loyalty, reduce financial concerns related to health and the future, and overall support employee well-being.

A number of conditions found in the testing laboratory at PGT Rejowinangun are presented in the form of a fishbone diagram as follows:

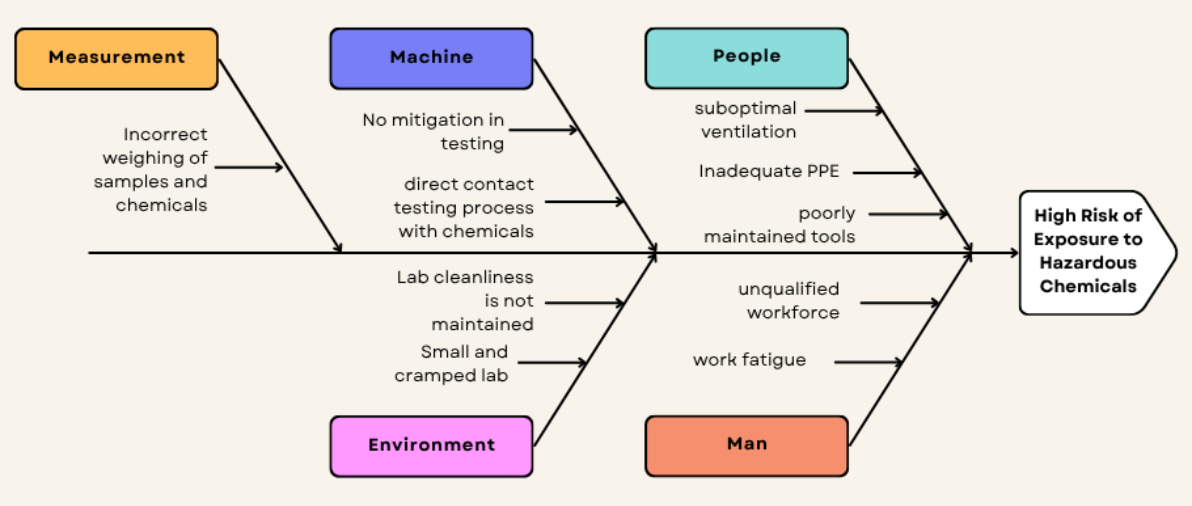

Figure 3. Fishbone Diagram

1. Machines. The Machine category includes all equipment and tools used in the testing process. Poor ventilation can lead to a high risk of respiratory exposure, as hazardous

chemical vapours or fumes released during testing are not removed and replaced with fresh air. Instead, they are trapped in the work area and inhaled by workers. Meanwhile, inadequate PPE, such as improperly fitted gloves, missing goggles, and infrequently worn lab coats, leaves workers without a last line of defence, allowing hazardous chemicals to come into direct contact with the skin, eyes, and respiratory system. Poorly maintained or damaged equipment also significantly increases safety risks. Damaged laboratory equipment and cracked beakers can lead to accidental spills, injuries to workers' hands, and uncontrolled reactions.

2. Man. Unqualified workers lack awareness and in-depth training regarding laboratory safety practices. Lack of technical competence leads to workers not understanding the hazards of the chemicals they handle or safe working practices. This increases the likelihood of operational errors and direct exposure to hazardous materials. Furthermore, fatigue can cause workers to become careless or engage in risky behaviour.
3. Method. One of the main problems with the method is the lack of specific mitigation measures in gum rosin testing, potentially exposing workers to direct contact with hazardous materials. Work processes that neglect safety aspects make workers more susceptible to chemical exposure, especially if adequate preventative measures or safeguards are not implemented. Furthermore, testing processes that require direct contact increase the risk of workplace accidents and contamination.
4. Environment. An unsafe work environment is also a major source of risk. Poor laboratory hygiene allows the accumulation of hazardous chemical residues, which can impact worker health. Poor hygiene poses an additional risk because chemical residues can stick to surfaces, floors, or equipment. This accumulation of residues has the potential to cause cross-contamination between samples and prolong worker exposure to hazardous chemicals. Furthermore, small and cramped laboratories result in suboptimal air circulation and limited space for personnel to move, increasing the risk of chemical exposure without adequate protection.
5. Measurement. Measurement problems are related to improper weighing of samples and chemicals. Inaccurate weighing can result in disproportionate amounts of chemicals used in the testing process, increasing the potential risk of exposure to hazardous chemicals for laboratory personnel. Furthermore, inaccurate test results can also lead to incorrect assessments of the quality of gum rosin and affect the overall product quality standards.

Solutions that can be implemented to improve the effectiveness of OHS implementation at PGT Rejowinangun are as follows:

1. Machines: Add ventilation systems, exhaust fans, and air filtration systems to ensure safe air circulation and quality during testing. Ensure the availability and mandatory use of personal protective equipment (PPE) during each test, such as masks, gloves, lab coats, and goggles, by regularly inspecting equipment and replacing it with more adequate PPE. Establish a regular schedule for checking laboratory equipment and establish a system for reporting equipment damage so that new equipment can be replaced promptly.
2. Man: Recruitment is carried out by adjusting specific qualifications in the laboratory field, ensuring that each employee is competent in accordance with the laboratory's technical and operational needs. Furthermore, the company provides regular training and certification for all laboratory workers to ensure their skills and knowledge are always updated and in line with the latest industry standards. Establish a reasonable shift system and working hours, monitor workloads, provide adequate rest periods for laboratory operators, and recruit additional laboratory workers to lighten the workload.
3. Method: Designing risk mitigation procedures must be done clearly and in detail to ensure safety during the handling of hazardous chemicals. One key step is to develop specific Standard Operating Procedures (SOPs) that comprehensively cover the handling of

hazardous chemicals, including detailed emergency evacuation instructions. Furthermore, testing techniques must be accompanied by specific methods to minimize direct contact between operators and the chemicals. Special techniques should be provided during testing, for example, using automatic pipettes, glove boxes, or special protective gear to prevent direct operator contact.

4. Environment: Establishing a structured cleaning schedule is crucial to ensure laboratory cleanliness is always maintained. Furthermore, it is necessary to create specific Standard Operating Procedures (SOPs) for laboratory cleaning, which must be carried out before and after each test. Rearrange the laboratory space to ensure a more efficient and unobstructed workflow. If necessary, propose expanding or renovating the workspace to ensure neat equipment placement and support operational comfort.
5. Measurement: Creating a checklist for the weighing process before testing serves as documented evidence that each testing stage has been carried out correctly and in accordance with applicable standard operating procedures (SOPs). This form ensures that weighing is carried out carefully and consistently, while also supporting accountability in testing. With this checklist, each weighing step, a prerequisite for testing, can be systematically recorded and verified, allowing it to be used as a reference or evidence, if needed, in audits or quality evaluations.

CONCLUSION

The gum rosin testing process at the PGT Rejowinangun Laboratory involves five stages to determine quality standards. These tests include colour testing, softening point testing, toluene insoluble matter testing, volatile fraction testing, and acid number testing. Occupational Health and Safety (OHS) principles are identified and rigorously implemented in laboratory activities to ensure worker safety and test quality. OHS implementation includes the use of appropriate Personal Protective Equipment (PPE), strict supervision, and a systematic OHS structure and procedures.

Key issues identified in the PGT Rejowinangun Laboratory include suboptimal ventilation, inadequate use of PPE, poorly maintained laboratory equipment, inadequately qualified workers, a lack of awareness of safety procedures, risky testing processes due to direct contact with chemicals, a small and cramped laboratory environment, and inaccurate chemical weighing. The solutions provided to overcome these problems include improving the ventilation and air circulation system in the laboratory, procuring and utilizing more complete and appropriate PPE, regular maintenance and checking of laboratory equipment, training and recruiting qualified workers, establishing clear risk mitigation procedures including the use of testing aids, rearranging the workspace and arranging the schedule for laboratory cleaning duties, and creating a chemical weighing checklist as a quality control for testing implementation.

PGT Rejowinangun can improve laboratory infrastructure by expanding the layout. With a larger laboratory, activities can be well-structured. This can make it easier for workers to carry out their work. Therefore, testing activities and analytical reporting are not carried out in adjacent areas. Improve the ventilation system by adding exhaust fans and air filters to maintain safe air quality from exposure to hazardous chemicals during testing. Develop specific SOPs for chemical risk mitigation, including emergency evacuation procedures. Conduct regular training to increase OHS awareness. Create a detailed chemical weighing checklist for quality control, ensuring each process is recorded accurately and according to standards. Implementing these suggestions will improve the safety, efficiency, and overall quality of gum rosin product testing.

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