



Investigation on the Performance in Tire Repair Operation – A Case Study for Semi Automation in MSMEs

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Abstract

This investigation involved Micro, Small, and Medium Enterprises (MSMEs) specializing in tire repair services. The conventional methods employed by tire patchers using manual tools with heating systems fueled by gasoline, kerosene, or spirit have raised concerns regarding safety, as they are prone to fire hazards. In response to these challenges, some tire repairs have adopted modern tire patching devices equipped with electric heating systems, which not only demand lower electric power but also offer enhanced safety features. The utilization of electric heating systems in modern tire patching devices not only addresses safety concerns but also contributes to the overall improvement of patch quality. The electric heating systems are designed to provide a controlled and measurable amount of heat, ensuring a more robust adhesion of tire patches and, consequently, a higher quality repair. The objective of this report is to advocate for the optimization of tire repair performance through the implementation of tire patching process semi automation. The result shows that by applying semi automation, MSMEs in the tire repair can enhance the efficiency of the patching process, and significantly reduce safety risks associated with traditional heating methods. This optimization contributes to a safer working environment but also leads to a more sustainable and higher in quality of tire repair service.

Keywords: Tire Repair Operation, MSMEs, Electric Heating Systems, Semi Automation, Safety and Quality

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1. Introduction

Motorcycling is no longer merely a means of transportation but has become a symbol of freedom, embodying the fusion of convenience, style, and the pursuit of autonomy. The contemporary motorcyclist is not just a commuter; they are a seeker of experiences, a navigator of urban complexities, and challenging the norms of conventional transport. In the vibrant modern life, motorcycles stand out agile companions, offering riders a unique perspective on the world around them. The surge in demand for motorcycles is not just a numerical increase but a cultural shift, a collective acknowledgment of the need for a mode of transportation that aligns with the fast-paced rhythms of contemporary living [1], [2], [3].

As the automotive landscape undergoes dynamic shifts and motorcycles cement their role as indispensable elements of daily commuting, the conventional techniques employed by tire repairmen are coming under increased scrutiny. These time-honored methods, predominantly reliant on manual tools and heating systems fueled by gasoline, kerosene, or spirit, are now deemed less than optimal, primarily due to emerging safety concerns. In the context of the contemporary urban lifestyle, where motorcycles play an integral role in facilitating swift and efficient transportation, the imperative for a tire repair process that is not only expedient but also technologically advanced and safe becomes ever more evident. The traditional manual

approach, while effective, carries inherent risks associated with flammable heating systems, posing potential hazards such as fire accidents in the workshop environment. Recognizing the evolving landscape and the growing prominence of motorcycles, the tire repair industry stands at a crossroads [4], [5], [6].

Motorcycles have become a canvas for personal expression, reflecting individual tastes, styles, and attitudes. As the number of motorcycles on the road continues to rise, so too does the imperative for complementary services, such as tire repair, to evolve and adapt to meet the unique needs of this dynamic and growing community of motorcyclists. The statistical landscape, as revealed by the Central Statistics Agency (BPS), mirrors the undeniable surge in motorized vehicles across Indonesia. With a staggering 136.32 million units recorded in 2020, the country is witnessing a transformative shift in how people choose to traverse their surroundings. In the face of the accelerated growth in the automotive industry, particularly the burgeoning use of motorcycles, the critical service of tire repair must undergo a parallel evolution to meet the increasing demand efficiently. This evolution is akin to the rapid advancements witnessed in the development of artificial intelligence (AI), where technology is continuously pushing boundaries and reshaping conventional practices. The demand for efficient tire repair services is not just a consequence of the surging

number of vehicles on the road but is also reflective of a societal shift towards a faster-paced and technology-driven world [7], [8], [9].

The demand for a tire repair process that aligns seamlessly with the fast-paced rhythm of modern life necessitates a paradigm shift towards modern methodologies. These methodologies, often characterized by semi automation, electric heating systems, and advanced tools, not only promise expedited and more straightforward repairs but also inherently embed enhanced safety standards within the tire repair ecosystem [10], [11], [12]. The transition towards modern methodologies is not merely a technological upgrade; it represents a conscientious effort to address the multifaceted needs of contemporary society. Beyond the quest for efficiency, the emphasis is on creating a safer working environment for tire repair professionals and fostering a sustainable approach that aligns with the burgeoning reliance on motorcycles for daily mobility. In essence, the call for modern methodologies in the tire repair industry is not just a response to the inadequacies of traditional methods; it is a proactive step towards ensuring that tire repairs evolve in tandem with the changing dynamics of transportation, becoming safer, more efficient [13], [14].

This report investigates into the imperative for a transformative evolution in tire repair services. By emphasizing the urgency of transitioning from conventional, potentially hazardous practices to contemporary, safer alternatives, the focus is on embracing electric heating systems and semi automation. This shift is not only poised to address safety concerns but is also expected to contribute significantly to the overall improvement of tire patch quality. As we navigate through the subsequent sections, we will uncover the benefits of semi automation, explore technological advancements in tire patching devices, and assess their potential impact on the overall quality and safety standards within the Micro, Small, and Medium Enterprises (MSMEs) tire repair sector.

2. Methodology

To gain a comprehensive understanding of the diverse tire repair methods employed within the industry, this study conducted in-depth interviews with key stakeholders from two distinct tire repair workshops, each representing a different approach to the tire repair process.

The first workshop under scrutiny is MSME Shop A, situated in South Labuhan Batu, North Sumatra. The owner of this workshop, a practitioner of manual tire repair methods, was interviewed to elucidate the intricacies of traditional tire repair processes. This interview aimed to uncover the step-by-step procedures, tools utilized, and safety measures

implemented during the manual tire repair at MSME Shop A. The insights from this interview provide a foundational understanding of the conventional tire repair practices that have been prevalent in the industry.

In contrast, the study also engaged with the employees of MSME Shop B, located at Simpang Tiga Ophir, West Pasaman, West Sumatra. Hafizh Tires is recognized for its adoption of a modern tire repair process. Through interviews with the workshop's employees, the researchers sought to unravel the specifics of the contemporary tire repair techniques implemented at MSME Shop B. This included an exploration of the use of modern tire patching devices, electric heating systems, and any automated processes integrated into their tire repair workflow.

The interviews were designed to be structured yet open-ended, allowing the participants to provide detailed insights into their respective tire repair methods. Questions revolved around the entire tire repair process, from initial assessment to the final quality checks. Special attention was given to safety protocols, the efficiency of the repair process, and the overall quality of the tire patches produced.

By employing a comparative approach through interviews with representatives from both tire repair workshops, this study aims to draw valuable insights into the operational disparities, safety considerations, and quality outcomes associated with these distinct methodologies. The findings from these interviews will contribute to the broader discussion on the optimization of tire repair services, particularly in the context of MSMEs specializing in tire repair.

3. Result and Discussions

Initially, we conducted an interview with a workshop worker from MSME Shop A. During this interaction, the worker comprehensively elucidated the sequential steps involved in manually patching a tire (Figure 1).

The following section defines the details of the manual tire patching process as detailed by the workshop personnel.

- Tire opening / Tire gouging
- Check for leaking tires
- The process of scraping the inner tube that you want to patch
- Patching punctured tires
- The process of heating the tire you want to patch
- Results after tire heating
- Installation of tires after patching
- Add tire air after patching



Figure 1. Manual operation of tire repair at MSME Shop A

Next in the investigation, we were engaged in an interview with an employee from MSME Shop B. During this insightful discussion, the employee provided a detailed walkthrough of the progressive stages involved in tire patching, utilizing advanced tools and machinery. Presented as the following are the meticulous steps undertaken in the tire patching process as narrated by the skilled worker.

- Remove the motorbike wheel
- Open the tire using a tire opening machine
- Search for leaks in the tires using water so they are easy to find
- Do the scraping using a hydraulic drill, so that the tire you want to patch sticks perfectly
- Then patch the tire using an electric heating machine so that the tire is patched more quickly
- Process of installing tires that are ready to be patched using a tip top machine
- The motor wheels are reattached to the motor

Building upon the survey conducted at MSME Shop B, an examination reveals the implementation of a contemporary tire patching process characterized by semi automation and the integration of advanced machinery (Figure 2). This marks a parting from traditional manual methods, signifying a forward-thinking approach to tire repair services within the micro, small, and medium enterprises (MSME) sector.

The subsequent sections provide a comprehensive explanation of the modern tire patching process observed at MSME Shop B. This exploration looks into the key components, operational nuances, and benefits associated with the adoption of semi automation and machinery in the tire repair procedures.



Figure 2. Semi automation operation performed at MSME Shop B

Embracing a modernized approach, MSME Shop B has strategically incorporated semi automation to streamline the tire patching workflow. This transition not only addresses the demand for efficiency but also underscores a commitment to staying abreast of technological advancements in the tire repair industry. The utilization of cutting-edge machinery in the patching process enhances precision, expedites turnaround times, and contributes to the overall quality of tire repairs.

The machineries employed in the tire patching process at MSME Shop B includes automated tools for tire removal, electric tire patch heaters, and semi automation tire opening presses. These tools collectively contribute to the expeditious and meticulous execution of tire repair tasks. The machineries include the following.

Pneumatic Grinding Tool for Tire Repair

The pneumatic grinding machine, a sophisticated tool in the realm of tire maintenance, operates with precision and efficiency to fulfil a critical role in the tire patching process. As it embarks on its task, the machine artfully abrades the inner tube, meticulously refining its surface to the finest detail. This intricate process is essential to the forthcoming patch, imparting a textured finish that goes beyond mere aesthetics.

Fuelled by the power of compressed air, a steady stream emanating from the dedicated compressor, this grinding machine epitomizes reliability and consistency. The synergy between the machine and its power source ensures a seamless operation, delivering a controlled and uniform abrasion that is paramount for the success of the subsequent tire repair.

The significance of the textured surface created by the pneumatic grinding machine becomes apparent in its impact on the adhesion and tautness of the tire patch. By intricately roughening the inner tube, the machine facilitates an optimal bonding environment for the patch, enhancing the grip and longevity of the repair. This textured foundation acts as a secure anchor,

preventing premature detachment and ensuring the patch remains steadfast under the rigors of road conditions.

In the tire maintenance, this precision tool plays a pivotal role in the overall efficacy and durability of the repair process. Its contribution extends beyond the immediate task of abrading; it becomes a linchpin in the chain of actions that culminate in a reliable, long-lasting tire repair. The pneumatic grinding machine stands as a testament to the marriage of technology and craftsmanship, emblematic of the tireless pursuit of excellence in the field of automotive maintenance.

Electric Tire Patch Heater

This cutting-edge tool revolutionizes the tire patching process, seamlessly blending efficiency, portability, and safety into a single, indispensable unit. Its lightweight design, a testament to modern engineering, allows for unparalleled mobility, empowering mechanics to carry out tire repairs swiftly and effortlessly across varied workspaces. As a portable powerhouse, this heater eliminates the constraints of traditional, bulkier alternatives, providing an agile solution that adapts to the dynamic demands of tire maintenance.

Operated solely on electricity, this heater transcends the limitations of fuel-based alternatives. The absence of combustible elements not only simplifies its usage but also contributes to a cleaner, more environmentally friendly workspace. With the flick of a switch, it comes to life, delivering consistent and controlled heat essential for the tire patching process. The elimination of open flames or flammable fuels marks a significant advancement in workplace safety, reducing the risk of accidents and ensuring a secure environment for technicians and their equipment.

Beyond its primary role in tire repairs, this electric heater introduces an element of convenience that resonates throughout the work environment. Its efficient heating capabilities translate into faster curing times for tire patches, thereby expediting the overall repair process. The tool's user-friendly interface and straightforward operation make it an accessible asset for both seasoned professionals and those new to tire maintenance, enhancing the overall efficiency of the repair workflow.

Moreover, the electric heater serves as a beacon of safety, addressing concerns associated with traditional heating methods. The absence of open flames or potentially hazardous fuels minimizes the risk of accidents, making it a reliable choice for tire repair stations and workshops committed to upholding stringent safety standards. As a result, the workplace

becomes not only more productive but also inherently safer, fostering an environment where technicians can focus on delivering quality repairs without compromising on their well-being.

In essence, this electric heater transcends its role as a mere tool for tire repairs; it becomes a symbol of progress in automotive maintenance. By seamlessly blending innovation, portability, and safety, it stands as a testament to the industry's commitment to embracing advancements that not only enhance efficiency but also prioritize the well-being of those working within its realms.

4. Conclusion

The conclusion drawn from this study are as follows. It is evident that the modern tire repair process, employing specialized machines, exhibits a notable increase in efficiency compared to traditional manual tire repair methods. The absence of damaged or scratched motorbike rims and consistently high-quality patch results underscores the precision and reliability of utilizing advanced machinery in the repair process. It is crucial to emphasize that despite the integration of machines, modern tire repair operations are not entirely automated. Human labour remains integral to the process, as exemplified by the tire removal stage where a skilled operator is essential to navigate the tire changer machine effectively. This symbiotic relationship between technology and human expertise highlights the collaborative nature of modern tire repair practices.

Advantages of Semi Automation Tire Repair

The semi automation tire repair system significantly accelerates the tire patching process, enhancing overall efficiency. This approach minimizes energy consumption, ensuring a more sustainable and resource-conscious tire repair operation. The semi automation system streamlines the tire opening process through semi automation, maintaining meticulous care to prevent cuts or scratches on the rims. Precision in Tire Heating: The results of tire heating achieved through semi automation methods exhibit a higher degree of precision, contributing to the overall quality of the repair.

Weaknesses of Semi Automation Tire Repair

In the event of a power outage, the automated tire repair machine becomes inoperable. To mitigate this vulnerability, tire repair shops are advised to have contingency measures such as an electric generator on standby. This ensures continuity of operations even in challenging power outage scenarios.

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