



Evaluation Of Temperature and Lighting in The Dani Bakery Bread Factory

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ABSTRACT

This research aims to determine the DANI BAKERY bakery's temperature and lighting measurement results based on Minister of Health Decree Number 1405/MENKES/SK/XI2002. And to find out whether the temperature and lighting measurements results at the DANI BAKERY bakery have met the standards set based on the Decree of the Minister of Health Number 1405/MENKES/SK/XI of 2002. Temperature and lighting levels are evaluated based on the established method. After obtaining data at each measurement point at the research location, the researcher processed and analyzed data. The results of the data analysis will be compared with existing regulations, namely the Decree of the Minister of Health Number 1405/MENKES/SK/XI2002 and also the Decree of the Minister of Health of the Republic of Indonesia NO 70 of 2016 concerning Temperature and Lightning. The evaluation results show that the temperature level measurement results have exceeded the threshold value, namely 33.09°C - 33.48°C. Meanwhile, the lighting measurement results are below the lighting threshold value, namely 66.89 Lux - 67.67 Lux.

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INTRODUCTION

Light is an essential factor in space design. A designed space cannot function properly without light entering the area. Illuminating a room will allow the occupants to see objects. If objects are not visible then activities in the room will be disrupted. On the other hand, if the light is too bright it can also interfere with vision. Therefore, it is necessary to adjust the light intensity to suit the visual needs of the room depending on the type of activity. The same goes for temperature issues related to internal temperature. The right temperature can improve employee productivity and health. The indoor temperature should be within acceptable quality standards, between 18°C - 28°C [1] [2].

Workplace lighting is a source of light that ends up on objects in the workplace. The lighting can come from natural or artificial lighting, various work objects and work objects or tools, as well as surrounding environmental conditions that must be seen by working neighbors. This is very important to avoid the possibility of accidents. Additionally, adequate lighting provides the impression of better visibility and a clean environment. [3]

The work environment must provide enough space for the body to move more freely and efficiently. This follows the ergonomics concept, which aims to improve physical and mental health, creating safe, comfortable, and healthy working conditions and environments to increase productivity and reduce the number of work accidents and fatigue [4]. Good lighting allows workers to see the objects they are working on clearly, quickly and without unnecessary effort [5]. Good workplace conditions influence employee work processes optimally, good room conditions will create a pleasant atmosphere, conversely if the room conditions are not good, then an unpleasant atmosphere will be made [6].

Temperature and lighting are work environments that can cause health problems for employees. This is because high temperatures and poor lighting have become problems in industrial environments and can cause health problems. This can cause work accidents and reduce work productivity [7]. Classrooms with good lighting influence the optimal teaching and learning process. Good lighting creates pleasant feelings, whereas poor lighting in the school creates unpleasant feelings [8].

Potential high risks in hot work environments must be monitored to maintain occupational safety and health protection. To prevent the abovementioned problems, the government has issued laws regarding occupational safety and health, especially in Employment Decree No. 13/Men/X/2011 concerning Threshold Limit Values for Physical Factors in the Work Environment. [9].

DANI BAKERY bread factory is located at Sorong Regency, West Papua. Making bread involves selecting ingredients, making dough, developing, filling, baking, cooling, and wrapping. With 17 employees, it can produce around 9,000 bread packs in one working day. DANI BAKERY bakery has one room or place in the bread-making process. Making bread, especially baking bread consists of a large oven. This bread factory has a suitable space and a lack of lighting in the workplace, so this will result in the temperature in the room tending to feel hot and stuffy.

The word "ergonomics" consists of two Greek words: Ergon, which means work, and Nomos, which means law. Therefore, ergonomics is interpreted literally as the science of work regulations. Ergonomics is an applied science that studies the study and solving of problems involving human factors in the production process. Ergonomics involves balancing the type of work and the work environment, or vice versa. This refers to using appropriate technology appropriate to the nature of work and supported by a safe, comfortable, and healthy work environment. [5].

One dimension of ergonomics is cognitive ergonomics. This refers to a person's mental processes, including Perception, memory and reaction. The result of human interaction when using system elements. The main topics of cognitive ergonomics include Workload, decision-making, efficiency, human-computer interaction, humans and work stress [10].

Ergonomics is a science that studies and studies the relationship between humans and other elements of a system, applying theories, principles, data, and methods to design systems that are optimal from the human point of view and their performance. Ergonomics contributes to designing and evaluating tasks, workplaces, products, environments, and work systems to be used harmoniously according to human needs, abilities, and limitations [11].

A. Ecological ergonomics

Environmental ergonomics refers to lighting, indoor air, interference, and vibration [5].

- **Lightning.**

There are several factors to consider when it comes to lighting, including light level (intensity) and glare. The method used in this research is:

1. **Light intensity.**

Some jobs require certain levels of light such as lighting. Jobs that require precision and precision, such as watch repair, need lighter.

2. **Light distribution**

The ideal setting is when light can be distributed evenly across the field of view. Lighting the work area with a higher light level than the surrounding area will cause eye fatigue after a specific time.

3. **Dazzling light**

Glare increases errors in detail work by 20 minutes. Apart from eye strain, dazzling light can also interfere with vision.

- **Room Air**

1. **Temperature**

Two factors that significantly impact workplace temperatures are the type of work performed and the length of time workers are exposed to extreme temperatures. In the mental and cognitive outcome of subjects working under the influence of lower temperatures. However, manual labour is generally more affected by freezing temperatures. However, when manual work is particularly demanding, most people feel more efficient and comfortable at temperatures where positive tasks can usually be performed efficiently [5].

2. **Debut**

For the dust content in the air of office workspaces to meet health requirements, the following efforts must be taken [5].

- A. Office workspace cleaning activities are carried out in the morning and evening using a wet mop or vacuum pump.

- B. Wall cleaning is carried out periodically two times/year and repainted once a year.

- C. Qualified range system.

- D. Workspace Design

B. Work Environment

Every day, people face different working conditions, and these other conditions significantly impact a person's abilities. A person can carry out their work well and achieve optimal results if the work environment is supportive. The work environment is a significant part of completing work tasks. Paying attention to a good work environment or creating conditions that motivate employees to work can influence employee morale. The work environment definition includes everything about employees that can affect them in carrying out their assigned tasks [12].

C. Physical Work Environment

The physical work environment is one of the elements that must be utilized in a company to create a sense of security and peace and improve good work results to improve employee performance. Several factors that influence the physical work environment include colour, cleanliness, air

circulation, lighting, and safety. Factors that influence work environment design include temperature, humidity, air circulation, lighting, distractions, mechanical vibrations and security [5].

D. Hot Work Environment

Workers in hot environments such as furnaces, ovens, boilers, ovens, or outdoors in hot sunlight can experience heat stress. When performing in a hot climate, the body automatically responds to maintain a constant environmental temperature by balancing heat from outside the body with heat lost from inside the body [13].

E. Physiological Effects of Heat Stress

Heat stress requires extra effort on the part of the body to maintain thermal balance [13]:

1. Vasodilation.
2. Heart rate gets faster.
3. Skin temperature increases.
4. The body's internal temperature first decreases, then increases, and so on.
5. Assessment of hot work environment

The best way to determine if workplace heat stress is causing health problems is to take an employee's body temperature. The average body temperature is 37°C, and heat storage and convection, conduction, radiation, and metabolic heat can easily exceed this value. If the worker's average body temperature is >38°C, it is suspected that the worker is exposed to hot environmental temperatures, which can increase body temperature. In addition, the temperature of the working environment must be measured. This study measured the working environment temperature with a digital room thermometer [14].

- 49 °C: Temperature that can be withheld for about 1 hour but well above the level of physical and mental ability.
- 30 °C: Mental activity and responsiveness begin to decline, and people tend to make mistakes at work, causing physical fatigue.
- ± 24°C: Optimal conditions.
- ± 10 °C: Extreme physical behaviour begins to appear.

This research concluded that the highest human productivity occurs at 24-27 degrees Celsius. Based on the Decree of the Minister of Health Number 1495/SK/XI/2002, "Health Requirements in Office and Industrial Work Environments", it is stated that the threshold value (NAB) or room temperature is 18-28 degrees Celsius.

F. Temperature

Temperature is one aspect of the work environment that must be managed on-site. Because temperature is directly related to workers or users. The working area temperature should not exceed a certain threshold (NAB). Temperatures that are too high in the work area can affect the physical condition of workers and reduce worker productivity. [15] (Triatmojo, 2015). A comfortable temperature for Indonesians is between 24 – 24 °C. Colder temperatures of, say 20°C (the most suitable temperature for sub-tropical residents) reduce work efficiency with complaints of lack of muscle coordination [7].

G. Lighting

Lighting is defined as the amount of light falling on a surface. The lighting level in a room is defined as the average brightness level in the work area. The work area in question is an imaginary horizontal plane located 0.75 meters above the floor in each room. Light has units of lux (lm/m²), where lm is lumens and m² is the unit of area. Light can affect the environment. Good lighting can enable people to see the object they are working on clearly [15]. According to the Ministry of Health No. 1405 of 2002 concerning health requirements for the work environment. According to the Minister of Health Regulation No. 1405 of 2002 concerning Health Requirements for Office and Industrial Work Environments, it includes the amount of light needed in the work area to carry out activities. Good

lighting allows workers to see their work objects quickly and without unnecessary effort and helps create a comfortable and relaxed work environment [15]. The following factors determine good lighting:

- Distribution of lumens in the visual field
- Prevention of glare
- Setting the direction of the beam
- Use of colours used for lighting
- Use light sources that do not or minimally cause heat to the environment

Workplace lighting is a source of light that ends up on objects in the workplace. The lighting can come from natural or artificial lighting, various work objects and work objects or tools, as well as surrounding environmental conditions that must be seen by working neighbours. This is very important to avoid the possibility of accidents. Additionally, adequate lighting provides the impression of better visibility and a clean environment [3].

- **Lighting System**

There are 5 lighting systems in the room, namely [3][16]:

- a) Direct Lighting
- b) Semi-direct Lighting
- c) General Diffuse Lighting
- d) Semi-indirect Lighting
- e) Indirect Lighting
- f) Factors Affecting Lighting Intensity
- g) Good lighting
- h) Effects of poor lighting

RESEARCH METHODS

In collecting this data the author used the following data collection techniques:

1. **Primary data**

Primary data in this research are:

- A. **Measure temperature.**

This measurement is taken at each location of the work process and measured using a digital thermometer.

- B. **Lighting level.**

These measurements are taken at predetermined data collection points and measured using a digital lux meter. Lighting measurement points are determined based on the area of the room, namely:

- Room area 15m x 13m square to cut horizontal lines the length and width of the room at a distance of every 3 (three) meters, and capture lighting data
- as many as 9 points.

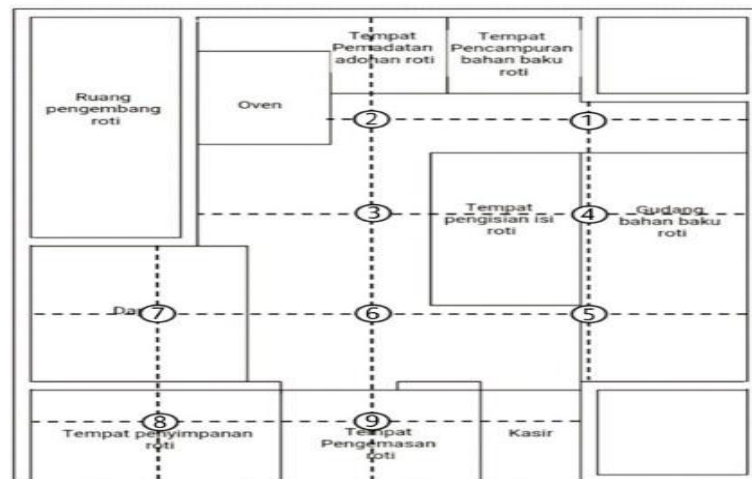


Fig 1. Lighting data collection points

2. Secondary Data

Secondary data was obtained through several sources, namely books, journals, theses and internet sites related to the research on temperature levels and lighting.

Research stages

In collecting data in the Roti Dani Bakery factory room, the researcher used a quantitative type of research, the method used observation method (observation) and direct measurement using a lux meter to measure the light intensity in the room while measuring temperature using a thermometer, taken at the time of measurement and measurement points that have been determined previously, for temperature levels the researchers took them at the production process site and for lighting the researchers chose the data collection points, namely 9 points. After obtaining data at each measurement point at the research location, the researcher processed and analyzed data. The results of the data analysis will be compared with existing regulations, namely Regulation of the Minister of Health of the Republic of Indonesia Number 1405/MENKES/SK/XI2002 and Decree of the Minister of Health of the Republic of Indonesia Number 70 of 2016, so from these results conclusions and solutions will be obtained to resolve existing problems.

RESULTS AND DISCUSSION

The results of temperature measurements at the Dani Bakery bakery on the first day of the production process areas ranged from 32.26°C – 33.34°C.

So, it can be said that the temperature in the Dani Bakery bakery room does not comply with the temperature or temperatures recommended by the Decree of the Minister of the Republic of Indonesia Number 1405/Menkes/SK/xi2002 concerning Health Requirements for Office and Industrial Work Environments, namely exceeding the predetermined value. Meanwhile, the threshold value for workspaces based on Indonesian Ministerial Regulation Number 70 of 2016 concerning Work Environment Health Standards and Requirements is 28.5°C. This value EXCEEDS the Threshold Value.

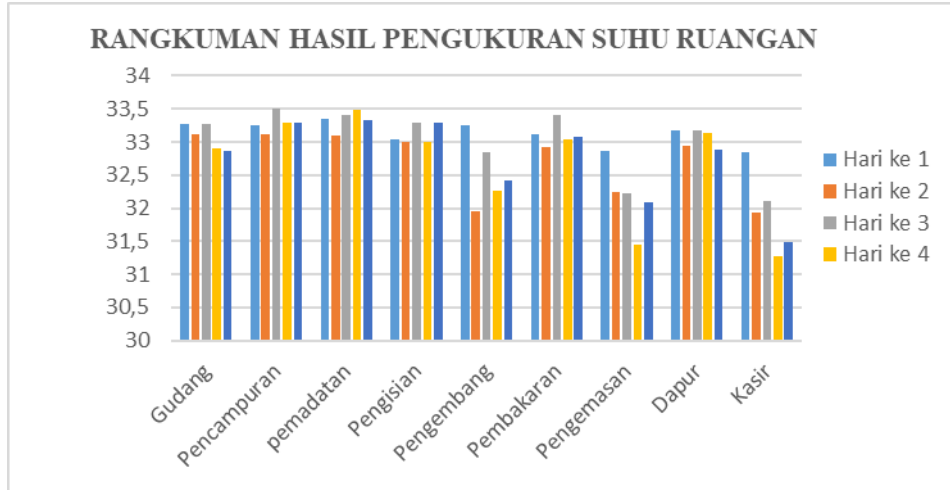


Fig 2. Graph of room temperature measurement results

Based on the measurement results at each time, the lighting measurement at each point is known to be between 47.89 Lux-67.00 Lux, still below the minimum lighting standards set by the Decree of the Minister of the Republic of Indonesia Number 1405/Menkes/SK/xi2002 concerning Environmental Health requirements Office and Industrial Work is 100 Lux.

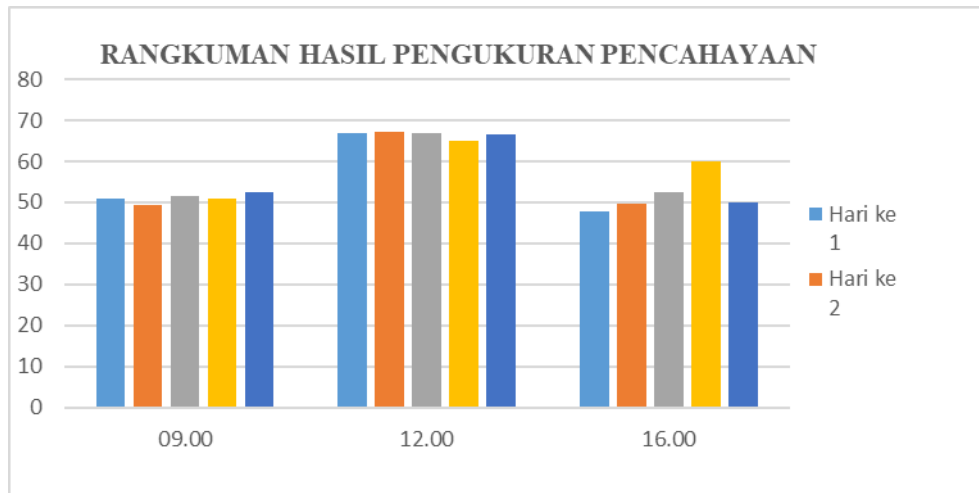


Fig 3. Graph of lighting measurement results

CONCLUSION

Based on the research results, it can be concluded:

1. The known temperature measurement results at the bread factory and bakery exceeded the threshold value on the first to fifth days in the production parts, which ranged between. 33.09°C-33.48°C. and the light level measurement is known to be below the Threshold Value, on the first day to the fifth day, it ranges from 66.89 Lux – to 67.67 Lux.
2. The results of temperature and lighting measurements at the Dani Bakery bakery are not by the Decree of the Minister of Health of the Republic of Indonesia Number 1405/MENKES/SK/XI2002 concerning Health Requirements for Office and Industrial Work Environments.

There is a need to re-implement the Ministerial Decrees that have been stipulated to maintain the work health and safety of employees on the factory premises.

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