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Comparative Study of Assembled LED Lights with NEON Lights toward Energy Consumed

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Abstract

This article contains an assembled LED light technology with Neon lights which are used as one of the fishing aids on the boat chart. The research was carried out at the Mechanical Laboratory of the Faculty of Engineering, University of Gorontalo- Indonesia. The research aims to test innovation in designing and developing alternative energy-efficient LED lamps. The research method used is a quantitative method in the form of an experiment by looking at several research variables such as (1) independent variable, namely type of lamp and shape of lamp, (2) control variable, namely Lamp power, voltage and current, lamp brand, lighting space, LED lamp design and assembly, and (3) bound variable that is lamp power, such as LED Lamp Assembly Test, lighting intensity. The experiments have resulted in 2 (two) types of modified LED lamp circuits, namely: LED Lamp Assembled Type HPL (High Power Lamp) and LED Lamp Assembled Type SMD (Surface Mounted Device). The results of the lumens measurement show data on the comparison of the number of lumens in 45 Watt Neon lamps and 30 Watt HPL LEDs. The highest lumens at a distance of 0.50 m are found in 30 Watt HPL LED lamps with a total lumen of 1746 lm, while the lowest at that distance is a 45-watt fluorescent lamp with a total lumen of 193 lm. Measurement of Voltage and Current in LED and Neon Lamps shows that the amount of currency issued to turn on HPL LED lamps is 0.06, SMD LED is 0.07, and Neon is 0.09. The HPL LED lamp is the light that requires the least electric current or the most energy-efficient in its use, especially as a fishing tool on the boat chart.

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1. Introduction

The Ponelo Islands are one of the sub-districts in North Gorontalo Regency- Indonesia, where the livelihoods of most of the people are fishing. Some types of fishing gear that are commonly used by fishermen are gill nets, hand lines and charts. Fishermen in the Ponelo Islands are still interested in the operation of catching lift nets. This is due to a large number of fish caught and has a fairly good selling value. Bagan boats also have several advantages. They are technically easy to operate with affordable investment costs by the community and absorb a lot of labour (Sudirman et al., 2011). Fishing technology using light is widely used in fishing activities such as lift net and purse seine, but the use of light for other fishing gear has not been widely used or popular in Indonesia (Baskoro et al., 2011). The method of catching fish using light aids is also called light fishing. The light serves to attract the attention of light-loving fish (positive phototaxis) to gather around the fishing area. The light sources used range from torches, petromax (kerosene press lamps) to electric lamps (Wisudo et al., 2002).

In fishing operations, fishermen still use neon lights as a fishing tool. The use of this lamp has the disadvantage that it requires a very large amount of electrical energy with high operational costs (Arif et al., 2015). Types of incandescent, fluorescent, and mercury lamps are generally widely used with electrical energy sources coming from generators. However, its use is also starting to cause problems because its fuel consumption is quite high, and the ultraviolet rays and heat energy produced can pollute the air (Choi et al., 2009; Matsushita and Yamashita 2012; Shen et al. 2013). LED, or stands for Light Emitting Diode, is an indicator light in an electronic device that has a function to indicate the status of the electronic device. For example, on a computer, there is a Power LED and an indicator LED for the processor, or on a monitor, there are also power and power LEDs *saving* (Nayomi et al., 2013). Along with the development of the use of LED lighting technology in fishing today, it has been introduced, underwater LED lights can increase catches (Sulaiman 2015), but the use of LED lights during fishing operations for fishermen on Ponelo Island has not been widely used in increasing catches. This results in a loss of time and energy. Besides that, there is still a lack of knowledge of fishermen in terms of the advantages of using LED lights. Therefore, it is necessary to experiment with innovation to design and develop alternative power-efficient LED lamps compared to the fluorescent lamps used by fishermen so far.

2. Materials and Methods

This research is a type of R&D/Research And Development research. The population in this study is an alternative LED lamp compared to the Neon lamp brand commonly used by fishermen. This research method contains research steps and experimental steps, which will be explained below.

1. Research variable
    a. Independent variable: Type of lamp and shape of the lamp

b. Control Variables: Lamp power, voltage and current, lamp brand, lighting room, LED lamp design and assembly
   Lamp Power
c. Dependent Variable: Assembled LED Lamp Test, Illumination Intensity

2. Tools and materials
   a. The lamps are of three different types and three different shapes as follows:



Figure 1. 45 Watt Fluorescent Lamp



Figure 2. 30 Watt HPL LED

   b. Digital stopwatch
   c. Research Room for trial LED lamp assembly.

3. Data analysis

Lumen Calculation

Luminous flux (ϕ) is the total number of light watts in lumens, abbreviated as lm. Light intensity (I) is the luminous flux per unit angle of space emitted in a certain direction which is measured in candela (cd) units (Poling, 2018).

Flux calculation uses the following formula:

Illumination Intensity $$I = \frac{\Phi}{\omega}\ cd$$

The intensity of illumination or illumination or lighting intensity is the light flux that falls on a plane or surface, so the unit of illumination intensity is lumen/m2 or Lux (Lx).

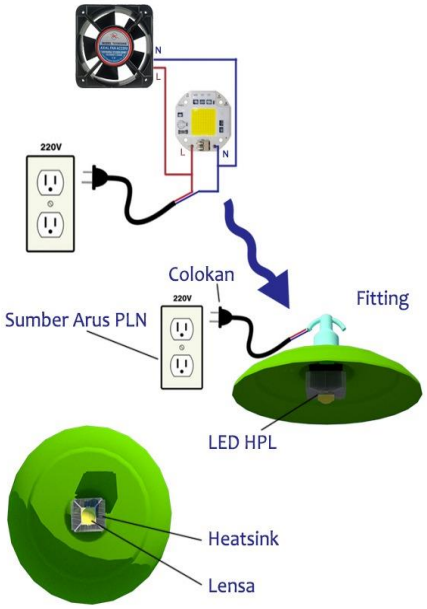
3. Results and Discussions

Based on the research that has been done shows the following results:

$$E_p = \frac{I}{r^2} \text{ lux}$$

LED Lamp Assemblies

a. LED Lamp Assembled Type HPL (High Power Lamp)



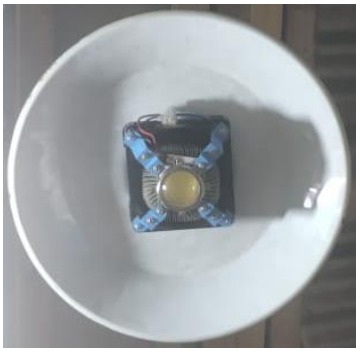


Figure 3. The circuit of the HPL LED Lighting system

Based on Figure 3 above, the BP5132H SOP8 PWM Driver Chip is a device that can control the input voltage that works in the circuit; C1 serves to store current, R1 serves to lower the voltage, 74 pcs x 3watt COB LEDs, AC Connector to connect AC current with a network.

b. LED Lamp Assembled Type SMD (Surface Mounted Device)

For SMD Type Assembled LED Lamp (Surface Mounted Device), shown in (Figure 4) below, The L pole on the AC connector is routed to the LED in series (74 x 3 = 222) while the N pole of the connector is channelled to R1, C1 in parallel and then flows to the semi-conductor before being fed back to the LED circuit in series. This flow pattern will continue until one power is removed.

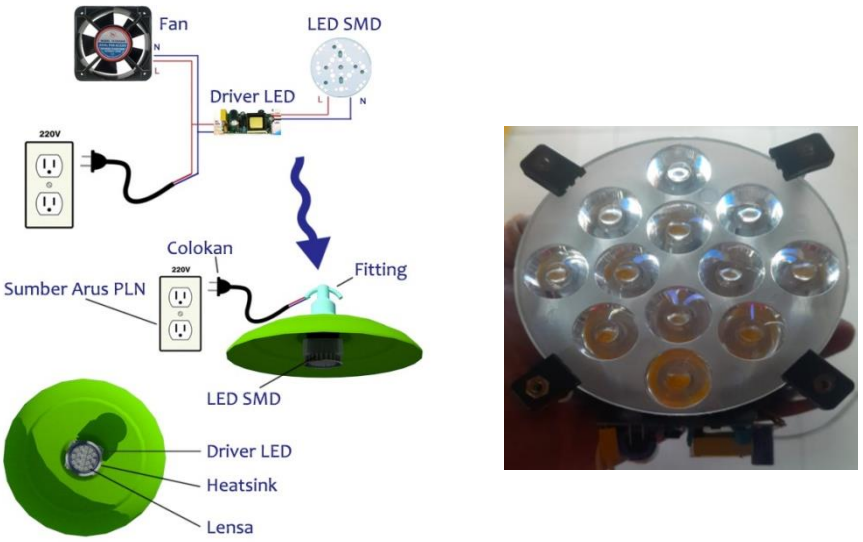


Figure 4. SMD LED lighting system circuit

1) LED Light Lumens Comparison

Based on the results of data analysis, it can be seen that there is a comparison of the number of lumens in 45 Watt Neon lamps and 30 Watt HPL LEDs. The highest lumens at a distance of 0.50 m are found in 30 Watt HPL LED lamps with a total lumen of 1746 lm, while the lowest at that distance is a 45-watt fluorescent lamp with a total lumen of 193 lm. This shows that this type of LED lamp has a lumens level of 9 times greater than Neon lamps.

Based on the picture, it can be concluded that the physical shape of each type of lamp can affect the intensity of the lighting produced. According to (Agam et al., 2015), The theory of the luminescence produced by fluorescent lamps states that the intensity of the lamp illumination is influenced by electrons and the type of luminescent gas. The electrons that come from the incoming electrical energy are heated by the electrodes, which cause the electrons to jump and collide with the mercury in the tube, these collisions, produces energy release in the form of electromagnetic waves, namely ultraviolet radiation.

HPL 30 LED lamps have a greater lighting intensity than Neon lamps because the reflector leaves are trapezoidal in shape and made of stainless steel. Each part of the reflector leaf is coated with silver-coloured tape, which serves to increase the strength of the reflected light (Umam et al., 2020).

In fishing activities, the use of HPL lights, especially on boat lifts, will be more effective than other types of lights, such as fluorescent lights. The light emitted by the lamp will be further in reach so that it affects the wide range of waters which are the fishing ground area. Schools of fish far from the chart will move quickly because it is easier to detect light when the angle of the reflector opening begins to be narrowed, and the light becomes dim.

The effect of using lights causes plankton, both in the form of phytoplankton and zooplankton, to gather around the light source (Umam et al., 2020), so that fish that are plankton feeders will move closer to the light source.

Testing the LED lamp circuit aims to see the comparison of lamp lighting through the calculation of the lumen value. The light emitted by the LED is slightly temporal and spatial coherence. That is, the LED light has a narrow frequency spectrum. LEDs provide many advantages because they use lower power, last longer and faster switching (Karunatilaka et al., 2015).

2) **Voltage and Current Measurement**

The results of the voltage and current measurements are shown in (Table 1) below:

Table 1. Voltage and Current Measurement Results

Type of Lamp	Voltage (V)	Current (mA)	Watt (W)
LED HPL	230	0.06	30
LED SMD	230	0.07	30
Neon	235	0.09	45

Source: 2021 Data Processing

In table 1, it can be seen that the 30 W HPL LED at a voltage of 230 V with a smaller current of 0.06 mA, a 30 W SMD LED with a 230 V voltage of 0.07 and a 45 W fluorescent lamp at a voltage of 235 V with a higher current 0,09 mA. These results indicate that the HPL LED lamp is the lamp that requires the least electric current or the most energy-efficient. According to

Mutmainnah et al. (2020)Stating that the characteristics of several types of lamps are seen from the dark current. Dark current states the physical quantity of an electronic device, namely the amount of electric current that is measured when it is not turned on. This quantity is measured when the LED lights up. The dark current value also represents energy loss, so it will be better if the value is small. Energy loss occurs due to the conversion of electrical energy into thermal energy.

4. Conclusion

Based on the results of the study, the following conclusions are stated.

1. The experiments that have been carried out have resulted in 2 (two) types of modified LED lamp circuits, namely: LED Lamp Assembled Type HPL (High Power Lamp) and LED Lamp Assembled Type SMD (Surface Mounted Device).
2. Lumens measurement results of LED lamps indicate that LED lamps have a lumens level of 9 times greater than Neon lamps. Lumens is the level of illumination possessed by LED lamps that can reach more distant water areas, especially fishing ground areas.
3. Measurement of Voltage and Current on LED and Neon Lamps that the amount of currency issued to turn on HPL LED lamps are 0.06, SMD LED is 0.07, and Neon is 0.09. So it can be seen that the HPL LED lamp is the light that requires the least electric current or the most energy-efficient in its use, especially as a fishing tool on the boat chart.

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