Seaweed gel utilization in wet battery

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Abstract. The weaknesses of wet batteries that require extra attention in maintenance such as having to routinely check and add water batteries, less stable voltage, water batteries can spill out and damage the body of a car or motorcycle, and water batteries can cause itching and irritation when touched by the skin. This study aims to determine the potential of seaweed powder as a gel that is added to a wet battery and functions like a dry battery. The method used is: data collection, concept design, manufacturing process, testing. The results of the study were obtained that the wet battery can function like a dry battery so that it does not need to refill the battery water anymore and the results of the battery voltage measurement using an ammeter show the number 12.6 volts.

1. Introduction

The battery on a motorcycle functions as an energy source to supply electricity for the starter system, ignition system, lighting system and other electrical systems. When starting position, the battery supplies electrical energy to rotate the starter motor and start the ignition system so that the engine comes alive. After the engine starts, the battery functions to receive and store electrical energy from the charging system. In addition, the charging system supplies electrical energy needs to each electrical system during engine life. Currently, power batteries that have been provided on the market consists of lead-acid batteries, nickel-cadmium batteries, and lithium ion batteries [1]. Lead acid batteries are in ever increasing demand in various sector such as automobile sector, electric vehicle industries, solar power systems and telecommunication industries [2]. Currently, the automotive battery is an essential component in more 1 billion road vehicles in use and it is the dominant application of lead-acid battery technology worldwide [3]. Wet batteries or lead-acid batteries are ventilated or require the addition of battery/distilled water in use. Wet batteries have the advantage of lower prices and if there is damage it can be repaired. However, wet batteries have several disadvantages, namely: high evaporation so that it is necessary to check the battery fluid regularly so as not to run out of electrolyte liquid, if the electrolyte liquid is exposed to the skin and eyes can cause burns and blindness, if the electrolyte liquid exposed to paint or metal on the vehicle can cause corrosion. In fact, battery performance depends upon the cell design, the materials of construction, a complex interplay between the multitudinous parameters involved in plate preparation, the chemical composition/structure of the active materials, and the conditions of battery operation [4]. In addition, battery performance depending on the application, is normally defined by power delivery, electrical capacity, cycling regime and life in service [5].

Dry battery is a battery that does not require the addition of battery water/distilled water in its use. Dry batteries have several advantages, which are maintenance free, safer to use, more compact and shock resistant, and do not cause corrosion. While the disadvantage of a dry battery is that it is only used
once or if it has damage it must be replaced with a new one, other than that the price of a dry battery is more expensive. Increasing busyness makes vehicle owners do not have enough time to perform maintenance of wet batteries both independently and to the garage. So it is recommended to use dry batteries, but because they are expensive, people still prefer wet batteries in their use.

Gel batteries are included in the type of dry batteries, different from dry batteries that still use electrolyte liquid in it but do not need the addition of distilled water/battery water in its use, gel batteries do not contain electrolyte liquid in it but gel-shaped electrolytes as a replacement so it is safer, there will be no leakage of electrolyte fluid and does not cause corrosion or damage to the battery body. In addition, the gel battery also does not require maintenance during use or maintenance free and has a longer service life than a dry battery. However, gel batteries on the market have the disadvantage of being more expensive than wet and dry batteries and have not been widely available on the market, making it difficult to obtain at the nearest workshops. Over the years, the application of gel electrolytes in energy storage devices has been extensively studied [6]. A great variety of environmentally friendly materials, such as gelatin, sodium alginate, chitin, chitosan and hydrocellulose, have been tested as gelling agents which is sodium alginate being the most widely applied [7]. Capacitors operating with gel-like membranes based on agar as the electrolyte medium was characterized by good cycling stability, similar to that of liquid counterparts. The self-discharge and gas generation rates were significantly limited [8].

Indonesia is an archipelagic country which certainly holds a large potential of natural marine biological resources to be developed. One of the great marine biological resources is seaweed. Seaweed/algae is one of the potential export commodities to be developed. Types of seaweed with high value are classified into two namely Rhodophyceae or jelly producer and carrageenan and Phaeophyceae which is alginate-producing seaweed. Jelly is useful as a stabilizing agent, stabilizer, emulsifier, thickener, purifier and gel maker. The carrageenan is used as a gel-forming or stabilizer, emulsifier and emulsifier-forming texture. While alginate is used as an emulsifier, stabilizer and suspending agent in the manufacture of tablets, capsules, plasters, filters, as a laxative and a mixture of dental sample printing materials. The purpose of this study is to determine the potential of seaweed as a gel that is applied to wet batteries and convert them into dry batteries. So that it can overcome the deficiencies found in wet batteries and of course at an affordable price or below a dry battery.

2. Theory study

2.1. Battery

The battery is a device that can produce DC voltage by converting chemical energy into electrical energy through electro-chemical reactions, redox (reduction-oxidation) [9]. Batteries are classified into two types namely batteries that require the addition of distilled water are called ventilated batteries or known as wet batteries and batteries that do not require the addition of distilled water or are known as dry batteries. The wet battery construction has a cell lid on top for the addition of distilled water and other work, and there is a drain hole to dispose of the gas produced on electric charging, whereas the dry type battery has no cell cover or drain hole. Battery electrolytes are sulfuric acid solutions with distilled water. High evaporation can occur in wet batteries and are prone to leakage of electrolyte fluids, therefore it is necessary to check the condition and surface of electrolytes in wet batteries regularly. In contrast to dry batteries that do not need to be checked on the condition and surface of the electrolyte.

2.2. Seaweed

Seaweed is a plant that has no true roots, stems and leaves, its entire body is called thallus. Seaweed Thallus is flat, sheet, filament and round like hair. Seaweeds contain 80–90 percentage water and their dry weight has 50% carbohydrate, 1%– 3% lipids, and 7%–8% minerals. The protein content is highly variable (10%–47%) with high proportions of essential amino acids [10]. Seaweed can be processed into seaweed powder or carrageenan which has characteristics that can be shaped gel, is thickened and stabilize the material as its main function. Seaweed powder mixed with electrolyte liquid can make electrolyte liquid thick or gel-shaped. Gel-shaped electrolytes when used on batteries can reduce the
Electrolyte evaporation that occurs due to the process of charging and emptying the battery. So that the electrolyte in the battery does not quickly decrease as occurs in wet batteries that do not use seaweed powder. Therefore, there is no need to periodically check the surface of the battery electrolyte. The work reports a proteic sol-gel green method that uses agar-agar from red seaweed (Rhodophyta) for synthesizing cobalt tungstate (CoWO$_4$) powders for battery-like electrodes. The performance of CoWO$_4$ as battery-like electrodes is ascribed due to a surface faradaic redox reaction redox reaction mechanism related to reversible valence state between CO$_{2+}$ and CO$_{3+}$ [11].

3. Research methods
The purpose of this study was to determine the potential of seaweed which is used as a gel on a wet battery and convert it into a dry battery. This research is using experimental method that was development product from wet battery which provided in the market [12]. This research was conducted in two years, from 2018 to 2020 to determine battery life. Stages of research carried out are: Data collection through observation and study of literature; conduct experiments using seaweed gel into wet batteries; analysis of experimental results and research conclusions. The trial was conducted in Pemalang with the number of wet batteries as much as 1 piece.

4. Research results and discussion
The process of making gel on a wet battery is as follows:

- Use work safety tools
- Prepare tools and materials, namely: minus screwdriver, measuring cup, funnel, spoon, wet battery, battery/liquid electrolyte, seaweed powder.
- Pour electrolyte liquid into the battery up to the upper level on the battery.
- Remove/pour electrolyte fluid back into the measuring cup provided.
- Pour seaweed powder into a measuring cup at half the volume of the electrolyte liquid.
- Mix until evenly mixed and thicken into gel.
- Pour electrolyte gel into the wet battery.
- Close the holes in the battery cell and make sure it is tight in closing it.
- Perform battery voltage measurements using an avometer; the battery is ready to use.

![Figure 1. Prepare tools and materials.](image)
The measurement results on the gel battery reaches 12.6 volts. The working principle of a gel battery is the same as a normal battery that can carry out the process of charging and emptying a battery. Seaweed gel only functions as a thickener of electrolyte liquid in order to reduce evaporation during charging and emptying of batteries as occurs in wet batteries. Therefore, gel batteries do not require the addition of distilled water and check the surface of the electrolyte liquid routinely in their use as in dry batteries. Based on the results of usage for two years and without the addition of electrolyte liquid or gel, this gel battery can last up to two years. When compared to the manufacturer's gel batteries, these gel batteries are economically far cheaper.

5. Conclusions
The measurement result of the voltage on the gel battery is 12.6 volts. Seaweed powder can be used as a gel to convert wet batteries into dry batteries. Gel batteries do not require maintenance and the addition of distilled water in their use is the same as in dry batteries. The age of using a gel battery can reach 2 years.

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