Design and Development of Water Ioinzer

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***Abstract*— The consumption of alkaline reduced water produced by domestic electrolysis devices was approved in Japan in 1965 by the Ministry of Health, Labour, and Welfare for the cure of gastro-intestinal disorders. Today, these devices are freely available in several countries and can be easily purchased without reserve. Recently, alkaline ionized water (AIW) generated by water electrolysis has received increasing attention because of its shown benefits in treatment and prevention of diseases. It was reported that intake of AIW has various beneficial effects such as removal of reactive oxygen species, improving constipation, suppressed accumulation of body fats, early expulsion of melamine, reduction of ultraviolet radiation-induced skin damage, modulation of immune response and ameliorating diabetes. The impact of AIW is believed to be related to its high concentration of liquid hydrogen and negative oxidation reduction potential. Due to its large hydrogen content, the primary function of AIW as an antioxidant has long been recognized. Inhaling hydrogen gas and consuming hydrogen water both showed signs of preventing oxidative illnesses. In this research, an electrolysis-based water ionizer that lowers total dissolved solids (TDS) and creates alkaline water was designed and tested. To keep the acidic and alkaline water from mixing, we used a two-stage electrolysis procedure with a bipolar membrane to divide the anode and cathode chambers. We assessed the ionized water's pH, TDS, and alkalinity and contrasted it with potable water. Our findings demonstrated that the ionized water had considerably lower TDS, higher pH, and alkalinity than tap water. Even though these devices are on the market, many people cannot purchase them due to their high price. In our endeavour, we'll focus on lowering the device's cost.**

Keywords— ***domestic electrolysis devices, alkaline ionized water, water electrolysis***

I. INTRODUCTION

Nowadays considering the fast-paced lifestyle, it is essential to have a healthy and a balanced diet. Alkaline water is one of the important aspects to reduce the acidity, and improve the overall digestion and metabolism in the human body. Maintaining good health largely depends on keeping the pH level in your body in balance. This is the rationale behind the widespread advice to consume alkaline water. Alkaline water neutralises the acid found in water, which is the primary distinction between it and regular water. The highly acidic tap water we obtain can cause a variety of health issues. While it's crucial to consume clean water to avoid getting sick, you should also check the pH level. To make water safe for ingestion, alkaline water filters balance the pH level.

In this study, we show a water ionizer system that first uses a reverse osmosis (RO) filter to reduce total dissolved solids (TDS) before producing acidic and alkaline water. Customers will receive high-quality drinking water from the system that is clear of contaminants and impurities. The motor-driven RO filtration system in the water ionizer system cleans the tap water of TDS and other impurities before it reaches the ionization chamber. Alkaline and acidic water are created in the ionization chamber through an electrolysis procedure, and they are then stored in different chambers. We included a pH sensor that gauges the pH of the ionized water to guarantee that the system produces water with the desired pH levels. Once the pH of the water has reached the intended range, a relay is used to automatically shut off the solenoid valve. This attribute reduces the need for a microcontroller and improves the usability of the device. The Blynk app integration in the water ionizer system enables users to track pH levels and other system metrics in real-time on their mobile devices. Users can easily modify the ionization process using this feature, if required.

Thus, we created the water ionizer device to offer users high-quality drinking water that is free of harmful impurities and contaminants. To create water with the desired pH levels, the system uses a pH sensor and relay along with a RO filter to filter out TDS and other impurities. The alkaline components support the health and wellness of the body's organs while supporting their health. Additionally, the acidic water works well as an external cleaner for personal cleanliness. Real-time system monitoring and management are made simple for users thanks to the integration of the Blynk app.

II. WORKFLOW

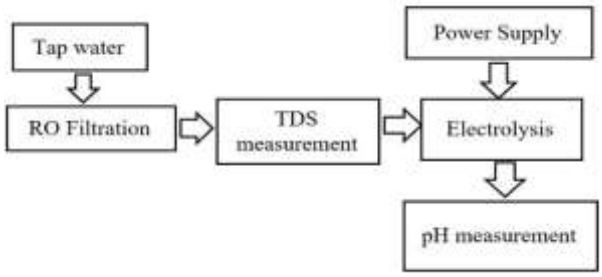

Fig 1.Overall flow of working

III. METHODOLOGY

A. *Methodology for filtration*

We integrated the RO filtration system with a motor to pump the tap water into the filtration system. The motor was connected to the inlet of the sediment filter, and outlet of the storage tank was connected to a tap for dispensing the purified water. We evaluated the filtration performance of the RO system by measuring the TDS levels of the tap water and the purified water using a TDS meter. The developed RO filtration system effectively reduces TDS levels in tap water and improve the overall quality. The filtration system is then further integrated with the other water technology like the electrolysis to provide high quality to consumers.

B. *Methodology for basic Electrolysis Process*

Water ionizers transform regular tap water into ionized alkaline water with acid-fighting alkalinity and antioxidant potential using electromagnetic. Alkaline minerals and CO2 dissolved in carbonates make up plain water. The carbonate in tap water is separated from the alkaline minerals by a water ionizer. Separate streams of water are used to discharge the acidic carbonate and the alkaline minerals. A water ionizer gives you access to the naturally occurring alkalinity of your water's alkaline minerals like calcium and magnesium, which fights acidity by separating the alkaline elements in tap water from the acidic elements. These alkaline minerals acquire antioxidant potential and acid-fighting alkalinity once they are liberated from the carbonate. Water flows between charged plates that are separated by an air gap within a water ionizer.

Ions—atoms and molecules that have an energetic charge—can pass through that membrane. Atoms and molecules with no net charge cannot pass through it. Water molecules cannot pass through the membrane because they have a neutral energy. As a result of their energetic charges, the alkaline mineral ions and carbonate ions in water are both permitted to pass through.

Fig 2: Electrolysis process

Alkaline minerals are thus separated from acidic carbonate in this manner. The positively charged ions that are created by the alkaline minerals in water are energetically positive. Like how acidic carbonate in water has a negative electrical charge, negatively charged ions are created by them. A water ionizer separates those ions using electromagnetically charged plates. The ions of alkaline mineral are positively charged, and they are drawn to the negative plates. The positively charged plates are drawn to the acidic carbonate. The negatively charged carbonate ions and the positively charged alkaline mineral ions can both flow through the ion-permeable membrane, which divides them into two compartments.

C. *Methodology for PH Measurement*

This system uses a pH sensor to find out the pH level of the water. The pH of the water is determined by this technique using a pH sensor. The finest pH sensor kit is used to measure many parameters, including water quality. It features a pH sensor, a BNC connector, an LED that serves as a power indicator, and a variable resistor that is used to calibrate the sensor interface circuit. The Signal Conversion Board (Transmitter) V2 and pH Probe are both included in the Ph Sensor Kit. They are both linked to one another.

The Ph meter is then interfaced with the Arduino Uno with the simple connections. Using NodeMCU we connect objects and let data transfer using the Wi-Fi protocol. Then the code is to be uploaded to the NodeMCUESP8266 wi-fi module for the further process using the Arduino IDE. Once the code is uploaded, we can take the required tests for the ph. Measurements. The monitoring results will be forwarded to Cloud Blynk so that it can be viewed via a smartphone via the Blynk Android application.

IV. WORKING PRINCIPLE

Firstly, we filter the water. The water is taken by the motor via pipe and then is passed to the filter that reduces the TDS of water. One relay is connected to the motor that will automatically stop taking the tap water once the container is filled. Then the process of electrolysis takes place as the water has been cleaned of contaminants. Calcium carbonate and magnesium sulphate, two mineral compounds that dissolve in tap water, fly over the pristine stainless steel. The electron charge that binds the mineral compounds together is split in half by a process known as. The negatively charged plate, also known as the cathode, is attracted towards by positively charged ions including calcium, magnesium, and potassium.

Sulphate and carbonate ions, among other negatively charged ions, are driven towards the anode, a positively charged plate. The separated ions then travelled across an ion permeable membrane, which allows the ions to pass through but prevents them from returning. The alkaline ions and acidic ions on either side [of the membrane] only last on their own for a brief period before interacting chemically with water molecules. The alkaline ions and the water molecules form mineral hydrates. On the other side the acidic ions combine with water molecules to create aqueous acids. We then use a solenoid valve where relay is connected. Once we get the desired value of pH on the pH meter then the solenoid valve will stop automatically and transistors are also used for this process. The valve keeps the acidic and alkaline water separate and also prevent mixing of ions.

Once the electrolysis process is done, the process of the pH measurement takes place. The pH sensor kit can be used with a GSM or NodeMCUesp8266 wi-fi module for remote notifications and is utilized in water quality monitoring devices, fish aquariums, and water tanks. We join the wire to the Arduino's 5v and the blue wire to the Analog pin A0 of the Arduino. The Arduino's Pins 2 and 3 are connected to the TX and RX pins of the NodeMCUESP8266 wi-fi module. as seen in the illustration above. The Arduino IDE is then used to programmed the NodeMCUESP8266 wi-fi module to carry out the task of uploading the data to the cloud.

The pH sensor is often made of glass and has a rod-like construction with a bulb at the bottom that houses the sensor. A glass bulb that is specifically made to be selective to hydrogen-ion concentration is present in the glass electrode used to measure ph. Hydrogen ions in the test solution swap places with other positively charged ions on the glass bulb upon immersion in the solution under test, creating an electrochemical potential across the bulb. The electrical potential difference between the two electrodes created during the test is detected by the electronic amplifier, which transforms it to pH units. As we need to access the data which is sent over the cloud by NodeMCUESP8266 wi-fi module, therefore we use the Blynk Application. First, we open the application and enter pH meter as the Project name. Next, we on the NodeMCUESP8266 wi-fi module. Once the connection type is set to wi-fi and the create button is pressed, an authentication token will be delivered to the email address associated with your account. You can then use this token in programming by simply copying it and decide pasting it there. Then we search for the suitable widget to display the results.

V. Result and Conclusion

The original TDS of water was observed as 352ppm then after the filtration the reduced TDS is 84ppm and the value of pH is 7.36. The value of pH can be set as per the need of the consumer. In conclusion, the water ionizer discussed in this research paper utilizes a reverse osmosis (RO) filter to reduce total dissolved solids (TDS) before undergoing electrolysis to produce both acidic and alkaline water. The pH values of the resulting water are displayed on a Blynk app in real-time, providing users with accurate and convenient information about the water they are consuming. The process is entirely automatic, controlled by a relay, and requires minimal user input. Overall, this water ionizer is a practical and efficient solution for individuals seeking a reliable and convenient method to obtain both acidic and alkaline water with customizable pH levels.

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