ABSTRACT

Portable Hardwater Molecules Buster is a compact and mobile water purification system designed to effectively treat hard water and make it safe for human consumption. Hard water, which contains high concentrations of calcium and magnesium ions, contributes to limescale buildup, reduced appliance efficiency, and increased maintenance costs. Conventional softening methods involving chemicals or salts are often expensive, environmentally harmful, and unsuitable for mobile or off-grid applications.

The system employs a Reverse Osmosis (RO)-based purification process incorporating a 24V booster pump, carbon filter, and membrane filter to remove hardness-causing ions along with other contaminants. Power is supplied via a 24V AC to DC adapter for standard mains operation, with an alternative 24V battery option available to support use in remote and off-grid environments.

To ensure drinking water safety, TDS and pH sensors are included, with real-time monitoring handled by an ESP8266 microcontroller. These components operate at 5V, with power efficiently stepped down from the 24V battery using an LM2596 buck converter. The ESP8266 facilitates wireless data transmission to a mobile application, enabling users to track water quality and system performance remotely.

Future integration of a 24V solar panel can enable renewable energy generation and battery charging, enhancing the system's sustainability in resource-constrained settings.

The Portable Hardwater Molecules Buster offers a smart, portable, and energy-efficient solution for decentralized water purification, ideally suited for rural areas, agricultural use, mobile units, and emergency deployments.