Overland Park, KS
620-805-1216
tywon@h2hubb.com
www.h2hubb.com

H_2 HUBB Official Test Report

<u>Product:</u>
Company: Anonymous submission
Name: Hydrogen-Rich Water Cup (Silver Bottle)
Type: H_2 Water Device

- AWI Technology
- Portable hydrogen water generator
- Low-PSI bottle

Tester: Tywon Hubbard (TH)
Testing start date: 5/1/24
Completion date: 5/28/24

<u>PERFORMANCE:</u>
H_2 mg/L Concentration Test: Hydrogen-Rich Water Cup

- **METHODOLOGY:**
- Distilled Water: Verifies that the unit uses alkaline water ionizer technology
    - pH: 6.0 pH
    - TDS: 0 ppm
- Filtered Municipal Water
    - pH: 9.5 pH
    - TDS: 230 ppm
- Distilled Water w/$NaHCO_3$
    - pH: 8.5 pH
    - TDS: 400 ppm
- Water Temperature: 65~70°F/ 18~21°C
- Contamination Tests:
    - Cycle time: 6 minutes
    - Distilled Water w/ 100 TDS of NaCl
    - Filtered Municipal Water
        - Chlorine generation (Cl_2)
        - Ozone Generation (O_3)
- Bottle Vol Size: 0.420 L or 420 mL
- Cycle Time Frame:
    - 3 minutes
    - 6 minutes (2x 3-minute cycle)
- Test Location: 277 meters (909 ft elevation)
- Test Methodology: Titration: H_2Blue® Test Reagent
- All Dissolved H_2 Concentration Tests Converted to SATP (water temp and pressure)
- Claimed Dissolved H_2 mg/L: 1.2-1.6 mg/L (post 3~6 minutes)

H_2 mg/L (ppm) Concentration Test at SATP: Distilled Water w/$NaHCO_3$

- **3-mins avg mg/L (ppm):** ≅ 0.33 mg/L (ppm)
- **6-mins avg mg/L (ppm):** ≅ 0.50 mg/L (ppm)
- **Avg H_2 mg Produced in Designated Vol:**
    - **3-mins:** ≅ 0.14 mg
    - **6-mins:** ≅ 0.21 mg

H_2 mg/L (ppm) Concentration Test at SATP: Filtered Municipal Water

- **3-mins avg mg/L (ppm):** ≥ 0.10 mg/L (ppm)

- **6-mins avg mg/L (ppm):** ≅ 0.21 mg/L (ppm)
- **Avg H_2 mg Produced in Designated Vol:**
  - **3-mins:** ≅ 0.042 mg
  - **6-mins:** ≅ 0.088 mg
- **Claimed H_2 mg/L (ppm) confirmed:** No

H_2HUBB Hydrogen Concentration Assessment

- According to our testing, the Hydrogen-Rich Water Cup exhibits a dissolved molecular hydrogen concentration significantly below **H_2HUBB's standards for both H_2 concentration and Daily Milligram Dose of H_2** and also falls short of its online marketing claims. The majority of the online market claims for this hydrogen water bottle assert that it can produce 1.2-1.6 mg/L (ppm) of dissolved H_2 in water. However, we confirmed the device only dissolves 0.3-0.5 mg/L (ppm) depending on the cycle time. Also, the device utilizes alkaline water ionizer technology rather than PEM/SPE technology for producing hydrogen-rich water. This means the device produces oxyhydrogen (66.67% H_2 / 33.34% O_2) instead of pure H_2. Given that the device appears to be a low-pressure bottle not generating more than 15 psi, at best it can produce only 1.03 mg/L (ppm) of H_2. This is considerably less than the claimed concentration of 1.2-1.6 mg/L (ppm). The dissolution of oxyhydrogen into water (66% H_2 / 33% O_2) results in both gases dissolving up to their partial pressure/saturation point relative to the gas concentrations being supplied. According to Henry's Gas Law, saturation levels are based on 100% concentration of each gas. This means the hydrogen gas saturation point will be 1.03 mg/L (ppm) and for oxygen, the saturation point will be 13.72 mg/L (ppm), as oxyhydrogen (Brown's Gas) supplies 66% H_2 and 33% O_2.

  [H_2 saturation point at 100% H_2] 1.57 mg/L (ppm) x 66.6 = 1.03 mg/L (ppm) [oxyhydrogen saturation point for H_2]

  Unfortunately, our test results indicate that the bottle dissolves 50-66% less hydrogen gas than the oxyhydrogen saturation point for hydrogen gas and 70-80% less than its online marketed H_2 concentration claims. Based on our policy and standards, we cannot recommend this product to the market. Additionally, alkaline water ionizer technology in hydrogen water bottles can produce undesirable byproducts or contaminants from water electrolysis, which may dissolve into the drinking water. For these reasons, H_2HUBB does not approve of this hydrogen water bottle, as it fails to meet our standards for safety and therapeutic potential.

Contamination Test: 6 minutes

- Chlorine (Cl_2):
  - Distilled Water w/ 100 TDS of NaCl: 3-5 ppm
  - Filtered Municipal Supply: 1-2 ppm
- Ozone (O_3):
  - Distilled Water w/ 100 TDS of NaCl: 0.3 ppm

H_2HUBB Contamination Assessment

- The device, when used with our local municipal supply (tap water containing chloride), produced chlorine (Cl_2, HOCl, OCl-, etc.) in the drinking water. We confirmed this by adding 100 ppm of salt (NaCl) to distilled water and operating the bottle through a cycle. In both cases, chlorine was generated. We measured the total chlorine concentration to be 3 ppm with NaCl added, which is similar to chlorine concentrations found in tap water. Additionally, we investigated whether the device would produce ozone (O_3) in the drinking water. The hydrogen water bottle consistently generated ozone during its cycle time. These substances are considered contaminants and are not suitable for consumption. According to H_2HUBB performance standards for hydrogen water bottles, the device must not contaminate the drinking water with Cl_2 or O_3 to be approved. Unfortunately, this bottle produces both directly due to its water electrolysis technology, which is similar to that of alkaline water ionizers. Lastly, the device might be better suited for producing a disinfectant solution of HOCl/OCl- with the proper amount of table salt (NaCl) added to the water, rather than as a hydrogen water device. We did not evaluate the effectiveness of the device in creating an HOCl disinfectant solution with adequate levels of NaCl added to the water.

INTERNAL BREAKDOWN AND PERFORMANCE:

Manufacturer's Rated Electrical Values: (as stated on the power supply)

- **Type of device/electrolytic cell**
  - Pure H_2: PEM/SPE membrane
- **Applied volts:**
  - 3.7 volts
- **Total Amps:**
  - 1000 mAh (1.0 amps)
- **Total watts:**
  - 3.70 Wh (watts)
- **Electrolysis volts:**
  - 11.50 volts
- **Electrolysis amps:**
  - 0.28 amps
- **Total watts:**
  - 2.64 watts
- **H_2 Production vs. Dissolved Hydrogen:**
  - **Theoretical Max H_2 production:**
    - 2.13 mL/min or 0.18 mg/min

- **Theoretical Max Dissolved H_2 Level**
  - **3-mins**: ≅ 1.25 mg/L (ppm)
  - **6-mins**: ≅ 2.51 mg/L (ppm)
- **Measured Dissolved H_2 reading:**
  - **3-mins**: ≅ 0.33 mg/L (ppm)
  - **6-mins**: ≅ 0.50 mg/L (ppm)
- **Percentage of Max H_2 Dissolved (as measured):**
  - **3-mins**: ≅ 23.93% dissolved
  - **6-mins**: ≅ 19.94% dissolved
- **Percentage of Max H_2 Undissolved (loss)**:
  - **3-mins**: ≅ 76.07% undissolved
  - **6-mins**: ≅ 80.06% undissolved

PRODUCT ASSESSMENT:

Functionality:

- **Power on/off button**
  - Located on the H_2 generator.
  - Press the power button once to initiate electrolysis for hydrogen gas production and initiate a 3-minute session, then shuts off.
  - Press the power button again after the initial 3-minute cycle, without opening the lid, to extend the cycle time to 6 minutes.
- **Round hole charging port**
  - Located on the backside of the device.

Overall Opinion:

The Hydrogen-Rich Water Cup is a low-pressure, low-concentration, portable hydrogen water bottle. H_2HUBB would classify this device as a low-pressure alkaline water ionizer H_2 water bottle. The device does not include a PEM/SPE membrane. Instead, it uses a cathode-anode hydrogen cell design, where both the cathode and anode are exposed directly to the drinking water without any membrane (PEM/SPE or ionic). This means the drinking water or source water used in the bottle must have a sufficient amount of minerals (TDS) to provide enough conductivity for water electrolysis to occur. Due to the high electrical resistance of the bottle's hydrogen cell, it is best to use drinking water with at least 200 TDS for electrolysis to occur. However, this does not guarantee that the conductivity will be sufficient to produce therapeutic levels of H_2 in the water, as demonstrated in this report. The bottle's session or cycle time frame is 3 minutes. However, we collected test results over a 6-minute period by operating the bottle twice without opening the lid. We evaluated the system's dissolved hydrogen performance for each cycle time. The unit contains a 3.7 +1000 mAh battery, as stated by the battery specs.

To assess the hydrogen dissolution capability of the bottle, we utilized distilled water as the base, enriched with sodium bicarbonate ($NaHCO_3$) to achieve a total dissolved solids (TDS) concentration of 400. We chose $NaHCO_3$ over NaCl (table salt) to prevent the formation of chlorine gas (Cl_2). NaCl introduces chloride ions (Cl-) into the water, crucial for chlorine generation during electrolysis. While a TDS concentration of 400 is relatively high for drinking water mineral content, our aim was to optimize the bottle's hydrogen gas production and dissolution efficiency.

Using this prepared water source, the unit produced 0.33 mg/L (ppm) of dissolved H_2 in a 420 mL water volume during a 3-minute session, and 0.50 mg/L (ppm) during a 6-minute session. This translates to approximately 0.14 mg of H_2 dissolved in the specified volume. However, this amount falls significantly below the acceptable range for a portable H_2 water generator, even considering the typically low H_2 levels produced by such devices (<0.5 mg of H_2 per bottle). Furthermore, we examined the dissolved hydrogen concentration using filtered municipal water (9.5 pH, 230 TDS) to simulate real-world conditions for consumers. Unfortunately, the bottle's hydrogen dissolution concentration was even lower than with the 400 TDS water. With filtered tap water, the unit generated a detectable level of 0.10 mg/L (ppm) of dissolved H_2 in 420 mL during a 3-minute session, and approximately 0.21 mg/L (ppm) during a 6-minute session. This equates to a mere 0.042-0.088 mg per bottle during the cycle times.

Such low H_2 doses per bottle translate to only 0.1-0.2 mg of H_2 ingested per liter of water from the bottle (equivalent to roughly 2.3 bottles). These levels are more than 4 times lower than IHSA standards and over 7 times lower than H_2HUBB standards for hydrogen water products. To achieve a daily intake of 0.8 mg of H_2, which is H_2HUBB's standard dose, one would need to consume an impractical amount of hydrogen water. In fact, it would necessitate ingesting 9-19 bottles per day, totaling 1-2.10 gallons (3780-7980 mL) of hydrogen water. This level of consumption is clearly not feasible.

Dissolved hydrogen concentration (mg/L(ppm)) is a critical performance metric as research suggests that 1~3 mg of H_2/day appears to be therapeutic for humans. Furthermore, the **IHSA** standard for this type of product is a minimum of 0.5 mg/serving or 0.5 mg/L. H_2HUBB's performance standard for hydrogen water devices is slightly higher than IHSA as we require the device to be able to provide a concentration of 0.8 mg/L (ppm) and 0.8 mg/day dose consistently. The Hydrogen-Rich Water Cup did not meet **H_2HUBB H_2 concentration and Daily Dose of H_2 standards**. Based on the current research data, we believe the device's mg/L (ppm) performance does not provide adequate levels of hydrogen gas to induce therapeutic effects in humans. We are dissatisfied with the concentration of dissolved hydrogen produced by the device.

One major concern with the hydrogen water bottle is the electrolysis technology it uses, which can generate undesirable or harmful by-products. According to H_2HUBB standards for hydrogen water bottles, these systems must not produce chlorine or ozone in the drinking water to receive our approval. Unfortunately, this product produced noticeable levels of both substances. We confirmed chlorine generation using filtered municipal water (FMW) and a prepared test water of distilled water with 100 TDS (total dissolved solids) of NaCl. The device generated 1-2 ppm of Cl_2 with FMW and 3-5 ppm of Cl_2 with our prepared test water during a 6-minute cycle. This was accompanied by a distinct chlorine smell, similar to pool water. The chlorine smell was stronger with our prepared test water compared to filtered tap water. Given these findings, many clients could unknowingly be consuming chlorinated hydrogen water. They may not be aware of the need to test for chlorine, and the chlorine smell is milder with filtered drinking water, which may have a low chloride (Cl-) content.

We measured the ozone concentration at 0.3 ppm after a 6-minute cycle time using our prepared test water. Our results indicate that the device can produce ozone in drinking water, leading to ozonated and chlorinated hydrogen water, which is problematic. Although the concentrations of these substances were low in our tests and may not pose harm to the individual consuming the water, both chemicals are not marketed to be produced by the product and are undesirable in drinking water. To safely drink hydrogen-rich water from this device, consumers must use water that contains no chloride ions (Cl-). This requirement significantly limits the sources of drinking water that can be used with this bottle, as Cl- is present in nearly all source waters. The best option for consumers would be to prepare their own drinking water from distilled water and add electrolytes that do not contain chloride. However, this process is cumbersome and impractical given the H_2 concentrations generated by the bottle.

Lastly, we evaluated whether the bottle increases the pH of the drinking water. The device increased the pH by 0.5-1 pH unit with each 3-minute cycle. This outcome was expected, as alkaline water electrolysis technology is known for raising the pH of drinking water. Importantly, the device did not increase the pH beyond 10, which is the safe limit for human consumption. However, we suspect that under certain source water conditions and initial pH levels, the device could potentially exceed this threshold.

Overall, the Hydrogen-rich Water Cup is a subpar hydrogen water bottle that did not meet our standards, and we would not advise consumers to drink hydrogen water from this bottle as outlined in this report. There is far better technology and hydrogen water bottles available for consumers than this bottle. The bottle exhibits technology that was seen on the market 6-8 years ago, based on our previous test data of these types of hydrogen water bottles. Ultimately, this hydrogen bottle needs significant improvements before H_2HUBB could even consider recommending this device.

The validity of the marked claims regarding the bottle's hydrogen gas performance is clearly in question, and the device's performance disagrees with virtually all the product's marketing materials online. The device clearly has safety concerns, and we are not pleased with its performance.

The Hydrogen-rich Water Cup performed below our minimum performance standards and, in the opinion of H2HUBB, the system is unsafe or unsuitable for in-home H2 Water Therapy.

H_2 Hubb LLC disclaimer: All tests conducted and test results produced by H_2 Hubb LLC have been done according to industry-accepted practices and standards. Nevertheless, these results may not necessarily reflect test results performed by manufacturers, suppliers, or third-party labs. Our test results are independent of all other parties, and testing by other parties may produce different results. We understand that many variables are involved in testing, some of which are extremely difficult to control. These reports are not meant or intended for any other purpose but to uphold H_2 Hubb LLC's business practices and to validate the reasons for our recommendations.

Approved by: Tywon Hubbard

Tywon Hubbard,

CEO, H_2 HUBB LLC.

Tywon@H2HUBB.com