



Hydrogen Water Testing & Certification

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Laboratory Report

Introduction

This report summarizes the testing of a hydrogen water bottle from EVOLV LLC. The product is a battery-operated portable bottle that produces hydrogen water using electrolysis. The bottle is a sealed system that allows the internal gas pressure to build resulting in a higher concentration of molecular hydrogen gas (H_2) than can be attained under conditions of normal atmospheric pressure. This testing was requested by EVOLV LLC and the bottle was received for testing on 6/12/2024 in a factory-new box and included a magnetic USB-C power cable and user manual.

Tests requested: Dissolved H_2 for the following cycle times: 5-min & 10-min cycles

Product Description

Name: Hydrogen Water Bottle Brand: EVOLV Model: EVOLV Hydrogen Bottle

The bottle is a battery-operated device that uses electrolysis to produce and infuse hydrogen gas (H_2) into the drinking water. The bottle material is polycarbonate with an approximate volume of 230 mL. Because the design allows for pressure to build during electrolysis, it is capable of dissolving hydrogen at concentrations higher than the maximum concentration at sea level, 1.57 mg/L (1570 ppb). To prevent an unsafe buildup of pressure, the cap includes an internal pressure relief valve. The unit has two pre-programmed cycle times, 5 minutes (by touching the power button once) and 10 minutes (by touching the power button a second time). The bottle has a rechargeable lithium-ion battery to permit portable use and includes a charging cable (magnetic USB). The front panel digital display shows the battery level and the amount of time remaining in the selected cycle. Because the design utilizes a proton-exchange membrane (PEM, Nafion[®]) sandwiched between two platinum electrodes, this unit will work with any type of drinking water, including distilled, regardless of the mineral content.

Materials & Methods

Water: generic, distilled, pH 6.23 ± 0.25 ; starting temperature $24.8^\circ\text{C} \pm 1.5$ EC: 2 us/cm

Laboratory elevation: 883 meters (0.90 atm); all measurements adjusted to sea level where applicable.

Gas Chromatograph: SRI 8610C; column: Hayesep-D 6M; column/oven temp: 60°C ; detector: tungsten-rhenium TCD; carrier gas: N_2

GC Test Method: Static headspace analysis (HS-GC)

Calibration (H_2): 2-point (1.42 / 7.17 mg/L), performed on day of testing using H_2 -saturated water & 1000 ppm calibration gas

The battery was fully charged and the membrane wetted overnight using warm water (60°C) before testing. All tests were conducted with the USB charging cable connected.

For each dissolved H_2 test, the bottle was filled with distilled water just below the cap threads, the cap was securely tightened, and the power button was pressed either once to start the 5-minute cycle, or twice to start the 10-minute cycle. After each cycle was completed, the cap was removed, and a 100 mL test sample was immediately poured into a glass beaker. A 2000 uL aliquot of the beaker water was then drawn using a gas-tight syringe and injected into the headspace vial. The test sample was then placed into a 2400 rpm centrifuge for 3 minutes to permit the dissolved H_2 in the water sample to equilibrate with the headspace. After equilibration, a 1000 uL aliquot of the headspace was drawn using a gas-tight syringe and injected into the GC for analysis. After completing three tests, the results were recorded, and the mean and standard deviation of the three dissolved H_2 concentrations were calculated. Based on the mean dissolved H_2 concentration and the volume of water in the bottle, the average amount of H_2 that would be ingested when drinking the entire contents was calculated and reported as " H_2 Ingested Dose". Attachment 1 includes a sample chromatogram (10-minute test).

Results

Mean dissolved H_2 , 5-min: 2.87 mg/L (2870 ppb); SD: 0.07; H_2 Ingested Dose: 0.66 mg

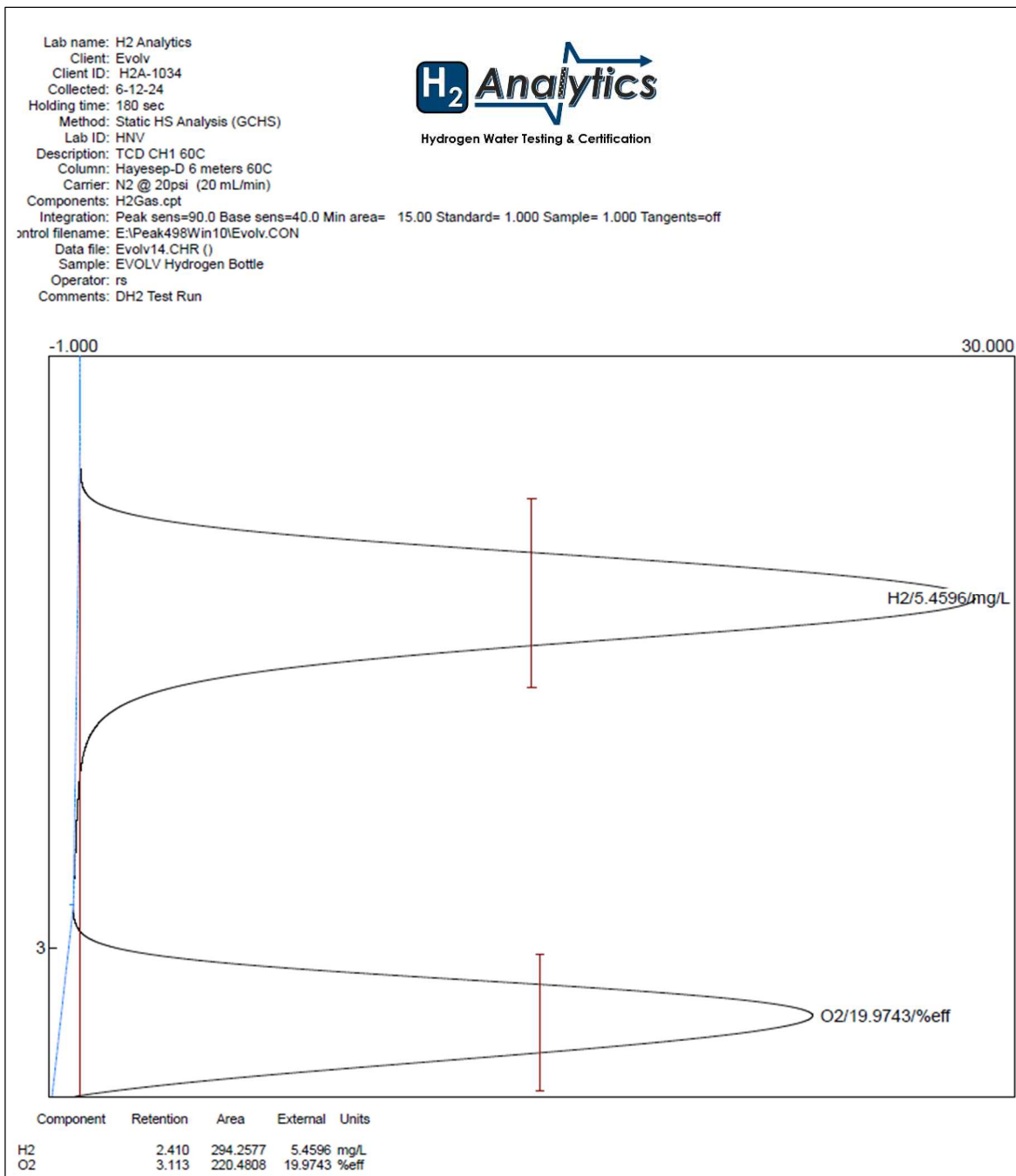
Mean dissolved H_2 , 10-min: 5.42 mg/L (5420 ppb); SD: 0.59; H_2 Ingested Dose: 1.25 mg



Approved By: Randy Sharpe

Title: Director of Testing

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EVOLV Hydrogen Bottle Sample Chromatogram (10-min)