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Report #: H2A-24032601

### Laboratory Report

#### Introduction

This report summarizes our analysis of the Nord hydrogen water bottle distributed by Nord Hydrogen, Gothenburg Sweden. The product is a battery-operated portable device that uses electrolysis and pressure to infuse molecular hydrogen gas (H<sub>2</sub>) into the drinking water.

Tests requested: Dissolved H<sub>2</sub> (mg/L) on 5-min & 10-min cycles; additional tests performed: ΔpH

#### Product Description

Name: Nord Hydrogen                      Model #: Nord Hydrogen Water Bottle

The Nord Hydrogen Bottle features a reservoir made from food-grade polycarbonate with a capacity of 210 mL. The design is geared towards optimizing the production of dissolved hydrogen by minimizing headspace, which, in turn, allows for dissolved hydrogen concentrations to exceed 1.57 mg/L. This exceeds the typical maximum concentration achievable at sea-level pressure, 1 atm, according to Henry's law. Located in the cap is a pressure relief valve to prevent the excessive buildup of pressure. The bottle is equipped with a rechargeable battery and includes a USB-C charging cable. The bottle features two pre-programmed cycle times for producing hydrogen-enriched water: a 5-minute cycle and a 10-minute cycle, selectable via the power button. The electrolytic cell consists of a proton-exchange membrane (PEM, specifically Nafion®) sandwiched between two platinum-coated titanium electrodes. This configuration ensures that the device can operate with any potable water source, including distilled water and those with varied mineral contents. An integral part of the bottle's design is the front panel display, which informs the user of the battery status and the remaining time in the selected cycle. Post-cycle, shaking the bottle is suggested to improve the dissolution of hydrogen, a step that maximizes the potential health benefits associated with hydrogen-rich water.

#### Materials & Methods

Water: generic, distilled, pH 6.29 ± 0.25; starting temperature 25.1°C ± 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: nitrogen (99.999%)  
GC Test Method: Static headspace analysis (HS-GC)  
Calibration (H<sub>2</sub>): 2-point (1.72 / 6.88 mg/L), performed on the day of testing using 1000 ppm calibration gas  
The battery was fully charged and the membrane wetted overnight before testing. All tests were conducted with the USB charging cable connected.

For each test, the bottle was filled with distilled water to minimize the volume of the headspace, 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 bottle was shaken for 30 seconds before removing the cap and gently pouring a 100 mL sample into a glass beaker. 1000 uL of the water was immediately drawn using a gas-tight syringe and then injected into the headspace vial. The test sample was then agitated on an equilibrator device for five minutes to permit the dissolved H<sub>2</sub> in the water sample to equilibrate with the headspace. After equilibration, a 1000 uL sample of the headspace was drawn using a gas-tight syringe and injected into the GC for analysis. After completion of testing for each cycle, results were recorded, and the mean and standard deviations of the dissolved H<sub>2</sub> concentrations were calculated. Based on the mean dissolved H<sub>2</sub> concentration and the volume of water in the bottle, the average amount of H<sub>2</sub> that would be ingested when drinking the entire contents was calculated and reported as "Available H<sub>2</sub>". Tests were also performed to measure how much the bottle changed the water's original pH and reported as "ΔpH". Attachment 1 shows a sample chromatogram (10-minute cycle).

#### Results

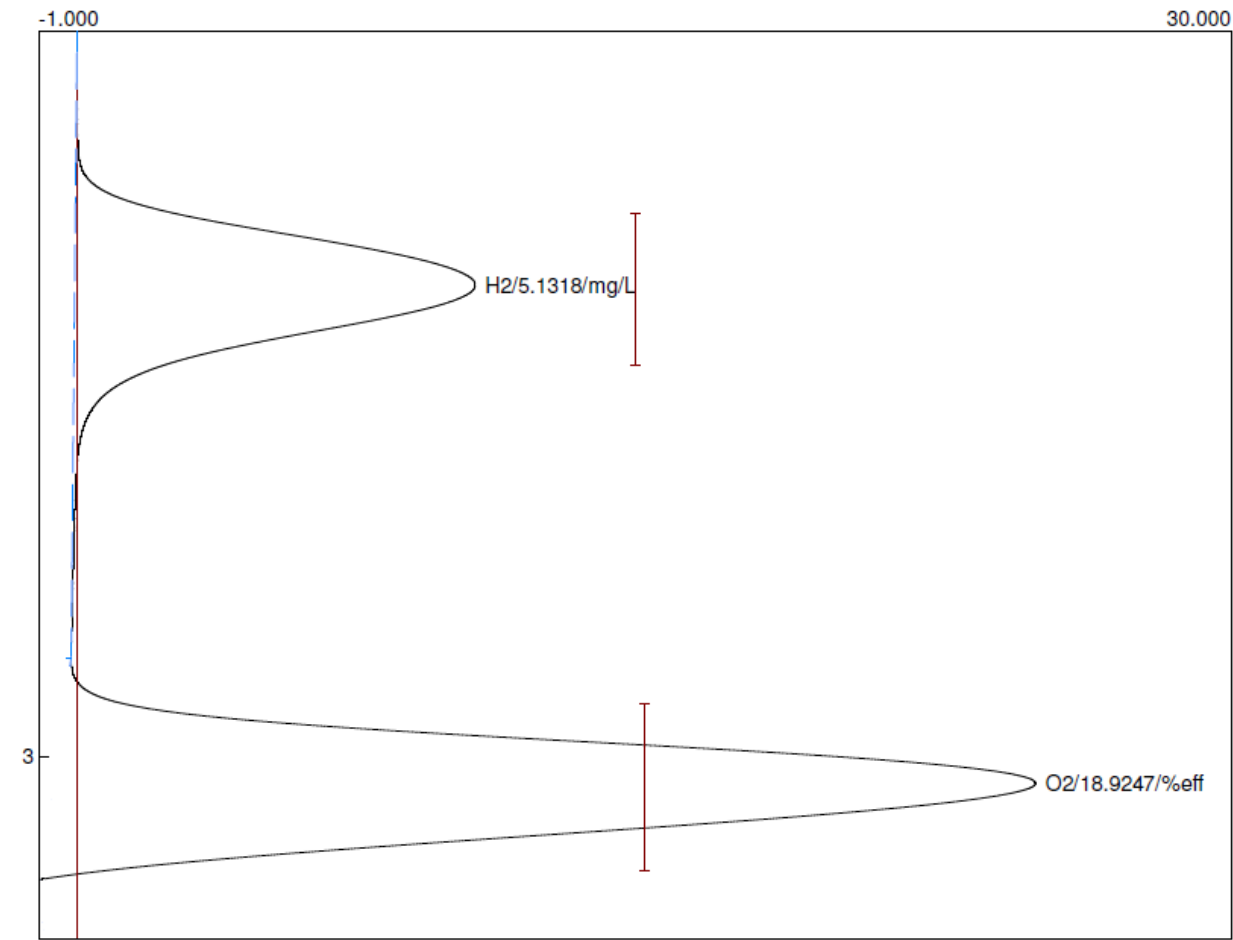
Dissolved H <sub>2</sub> (5-minute):	3.44 mg/L (3440 ppb)	SD: 0.16 mg/L	Available H <sub>2</sub> : 0.72 mg	ΔpH: + 0.15
Dissolved H <sub>2</sub> (10-minute):	5.14 mg/L (5140 ppb)	SD: 0.69 mg/L	Available H <sub>2</sub> : 1.08 mg	ΔpH: + 0.19



Approved By: *RSS*                      Title: Director of Testing

Report Date: 3/26/2024

Lab name: H2 Analytics  
 Client: Nord Hydrogen  
 Client ID: H2A-1028  
 Collected: 3-21-24  
 Holding time: 180 sec  
 Method: Static HS Analysis (GCHS)  
 Lab ID: HNV  
 Description: TCD CH1 60C  
 Column: Hayesep-D 6 meters 60C  
 Carrier: N2 @ 20psi (20 mL/min)  
 Components: AqH2O2.cpt  
 Integration: Peak sens=90.0 Base sens=40.0 Min area= 15.00 Standard= 1.000 Sample= 1.000 Tangents=off  
 Control filename: DEFAULT.CON  
 Data file: NordH2Bottle03.chr ()  
 Sample: Bottle  
 Operator: rs  
 Comments: DH2 Test Run  
 QC batch: Nord H2



Component	Retention	Area	External	Units
H2	2.350	98.7140	5.1318	mg/L
O2	3.036	220.3034	18.9247	%eff

Sample Chromatogram (10-min Cycle)