



## Bisphenol-A Leaching from Water Bottles

prepared for

**SIGG USA**  
Stamford, CT

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|------------|--|
| Client:    | SIGG USA<br>1177 High Ridge Road<br>Stamford, CT 06905 |
| Requestor: | Steve Wasik  |
| Study:     | Re: Bisphenol-A Leaching from Water Bottles            |
| LIMS #:    | 20070075   |

#### SUMMARY











Five types of water bottles were submitted to determine bisphenol-A (BPA) leaching into reverse osmosis (RO) water. The bottles were filled with water and heated in a temperature regulated oven in order to simulate usage & aging. This treated water was extracted and analyzed for BPA by gas chromatography and mass spectrometry (GCMS). A significant amount of BPA leached out of Lexan polycarbonate (PC #7) bottles, generic aluminum, and low density polyethylene bike bottles at 90°C after 3 days of incubation. In contrast, no BPA was detected above the LOQ in SIGG bottles under the same severe environmental conditions.

#### EXPERIMENTAL

40 Bottles were received and entered into a Laboratory Information Management System (LIMS) (Figure 2). Each bottle was filled with RO water and the volume of water and the surface area exposed to the water were measured and recorded. The bottles were placed in a regulated environmental chamber (Espec) at a fixed temperature. At specified periods of time, the plastic or aluminum bottles were removed from the oven and the water transferred to individual glass jars and stored in a refrigerator until analysis.

To extract the BPA, the pH of the treated water was adjusted to about 3 before extraction using a small solid phase extraction (SPE) column (Oasis HLB WAT106202). The loaded SPE cartridges were eluted with a methanol:ethylether mixture and dried over solid sodium sulfate. The solvent from the filtered sample was removed over a hot water bath and the residue dissolved in 1 ml chloroform for GCMS analysis.

Figure 1: Typical Bottle Types and Sample Designations

|   |   |  |
|---|---|--|
| <p>New SIGG<br/>20070075-01</p>                       |    |    |
| <p>Used SIGG<br/>20070075-02</p>                      |    |    |
| <p>Generic Aluminum<br/>20070075-03</p>               |   |   |
| <p>Lexan<br/>(Polycarbonate #7)<br/>20070075-04</p>   |  |  |
| <p>Bike Bottle<br/>(Polyethylene)<br/>20070075-05</p> |  |  |



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### Calibration:

A series of standards were prepared by quantitatively dissolving solid Bisphenol-A (Aldrich, 99+%) in chloroform and analyzing by GCMS. The standards were used to quantify BPA in the water samples.

## RESULTS & DISCUSSION

### 7-Day, 90°C Lexan Polycarbonate #7 Bottle Exposure Conditions Study

In order to determine suitable exposure conditions 4 Lexan (polycarbonate #7) bottles were incubated with RO water over several days. At set time periods the bottles were removed from the oven and transferred to glass jars. The RO water from these bottles was extracted to determine the level of leachable BPA as a function of exposure time.

Each Lexan bottle was filled with about 750mL of RO water and maintained at 90°C for 1, 2, 3, and 7 days. The liquid was then extracted for BPA and analyzed. Figure 2 summarizes the BPA leached as a function of time. Results were reported as parts per billion (ppb) and also normalized by the area exposed to the water (nanograms BPA leached per square centimeter of exposed surface area or  $\text{ng}/\text{cm}^2$ ). At 90°C, a significant increase in BPA leaching was observed in two and three days compared to one. As a result, 3 days was chosen as a time period that would produce a measurable BPA concentration.

### 3-Day, 90°C Leach Test vs Bottle Type

Bottles of each type (SIGG, Used SIGG, Lexan, generic Al, and Bike Bottle) were filled with 750-1000mL RO water and heated at 90°C for 3 days. The leachate was extracted for BPA and analyzed. Results are shown in Figure 3.

After 3 days, a significant amount of BPA,  $>70\text{ppb}$  ( $110\text{ng}/\text{cm}^2$ ), was leached from the Lexan water bottles compared to the other bottles. The generic Aluminum bottles showed the next highest levels of BPA with  $19\text{ppb}$  ( $32\text{ng}/\text{cm}^2$ ) detected followed by the polyethylene bottles with nearly  $10\text{ppb}$  ( $16\text{ng}/\text{cm}^2$ ).

In comparison, SIGG bottles fared extremely well. Based on this analytical method, the limit of quantitation (LOQ) for BPA was approximately  $2\text{ppb}$ . The LOQ is the level of BPA that can be determined reliably in these samples. Even under these extreme temperature conditions, no BPA was detectable in the SIGG bottles above this LOQ.



Figure 2. Lexan Exposure Time Study

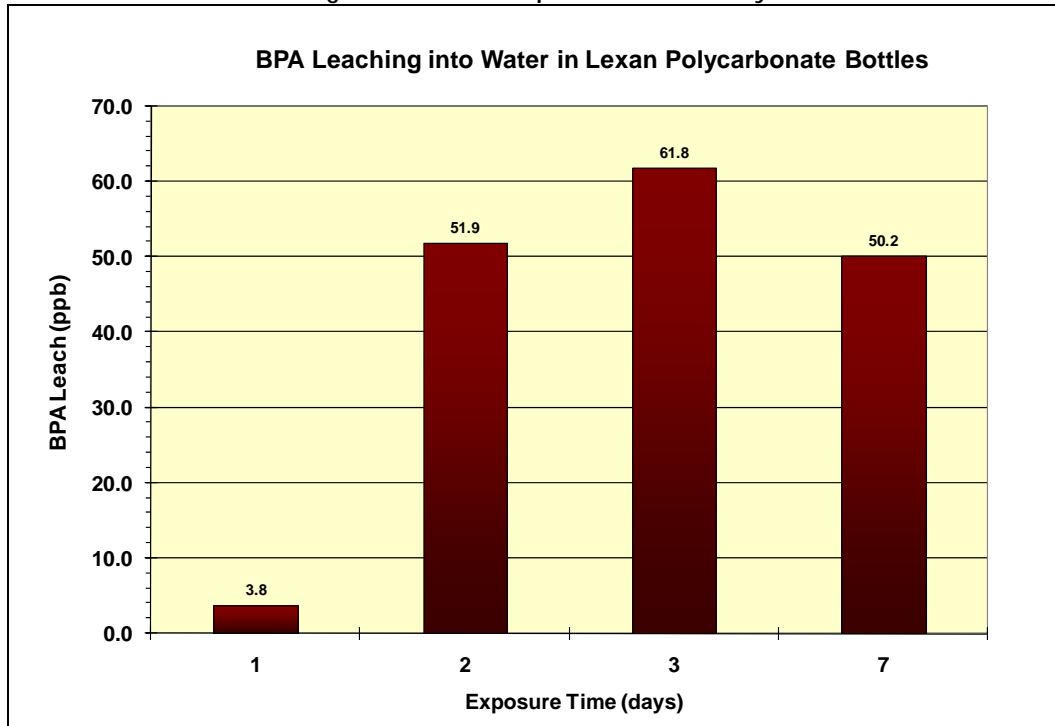


Figure 3. BPA Leaching Study

