TO DRINK OR NOT TO DRINK?

Laura Aguilar[1], Laura Garcia[1], Joshua Salas[1], Alma Loya[2], Dr. Wee-Yee Lee[2]
[1]Irvin High School, [2]Department of Chemistry UTEP

Introduction

Bisphenol A (BPA) is an important component used to produce mass quantities of polycarbonate plastics. BPA is classified as a "slight to moderate" estrogenic endocrine-disrupting chemical (EEDC). EEDCs infiltrate into our endocrine system by imitating estrogen, i.e. the sex hormone, resulting in the acceleration of puberty, sexual maturation in genders, genital abnormalities, miscarriages and infertility.

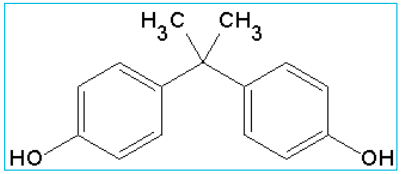


Fig. 1: Molecular Structure of BPA

We are exposed to BPA through the day to day consumption of products stored in plastic containers. BPA is infamously associated with the production of the plastic material used for bottled water. The purpose of our project was to determine the amount of BPA in different brands of bottled water under different temperatures and storage time.

Objectives

1. Does brand/package matter?
2. Does temperature matter?
3. Does the type of container matter? Plastic or glass?
4. Does storage time matter?

References

❖ Charles A. Staples, et al. "A review of the environmental fate, effects, and exposures of bisphenol A", Chemosphere, 36, 2149–2173.

Methodology

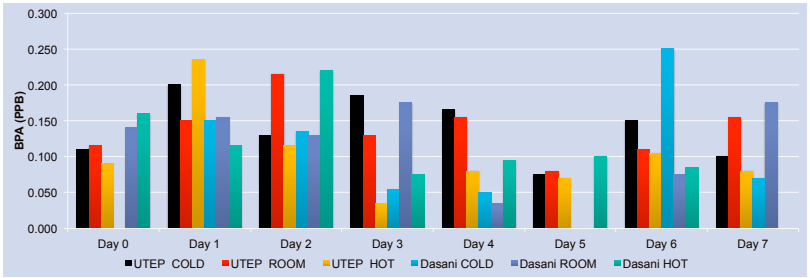
We have selected three of the nation's top brands of bottled water, along with local drinking water found in El Paso, and set them in three different temperatures: 48° C, 25 ° C, and 16 °C. Storage time tested ranged from 0 (i.e. upon purchase) to 8 days. BPA in water was analyzed using the Stir Bar Sorptive Extraction (SBSE) coupled with Gas Chromatography/ Mass Spectrometry (GC/MS).

Procedure

1.Add approximately 0.200g of Sodium carbonate (Na_2CO) into a 20ml vial.
2. Place 20ml of water sample into the 20ml vial.
3. Into the vial, pipette 0.1ml (100µl) of 1ppm Mirex (Internal Standard).
4. Pipette 200µl of Acetic acid anhydride.
5. Using tweezers carefully take a stir bar from its storing vial and place it into the solution.
6. Stir solution for 2hr.
7. Once the stirring is completed, use tweezers to remove the stir bar from solution and rinse it with DI (deionized) water.
8. Dry the stir bar using lint-free paper, such as kimwipes.
9. Place the stir bar into a Thermal Desorption Tube (TDT) and place the TDT on the tray for further chemical analysis on the GC/MS.

Results

The graph below shows the BPA concentrations (ng/mL) in various water samples by storage time and temperature.

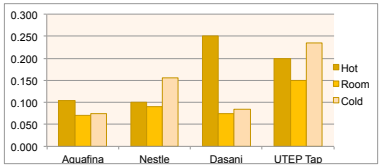


The results showed :

1. The levels of BPA are very similar in different brands of bottled water and type of water.
2. The release of BPA was not affected by temperature and storage time.
3. The average BPA concentration in bottled water is the lower than tap water and fountain water samples at UTEP. (See the table below)

	Bottled Water	Tap Water	Fountain Water	Monster	Average
BPA Conc. (ng/mL)	0.067	0.105	0.097	0.055	0.081

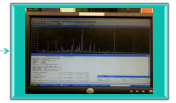
BPA concentration in different types of water samples under three different temperatures after 7 days of storage. The results showed that bottled water has lower BPA than tap water and that temperature does not affect the release of BPA.



Conducting the experiment.

Stir bars in action

GC/MS instrument



An example of the instrument output

Conclusion

Temperature and storage time did not affect the release of BPA into the bottled water and the levels of BPA fluctuated throughout the experiment duration.

Our results showed that the average BPA concentration in bottled water was 0.067 ng/mL. and it's the lowest among other types of water.

Future Work

We would like to study the effects of low level BPA on health through constant and long-term exposure.

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