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Effects of Friction on BPA Leaching in Infant Toothbrushes

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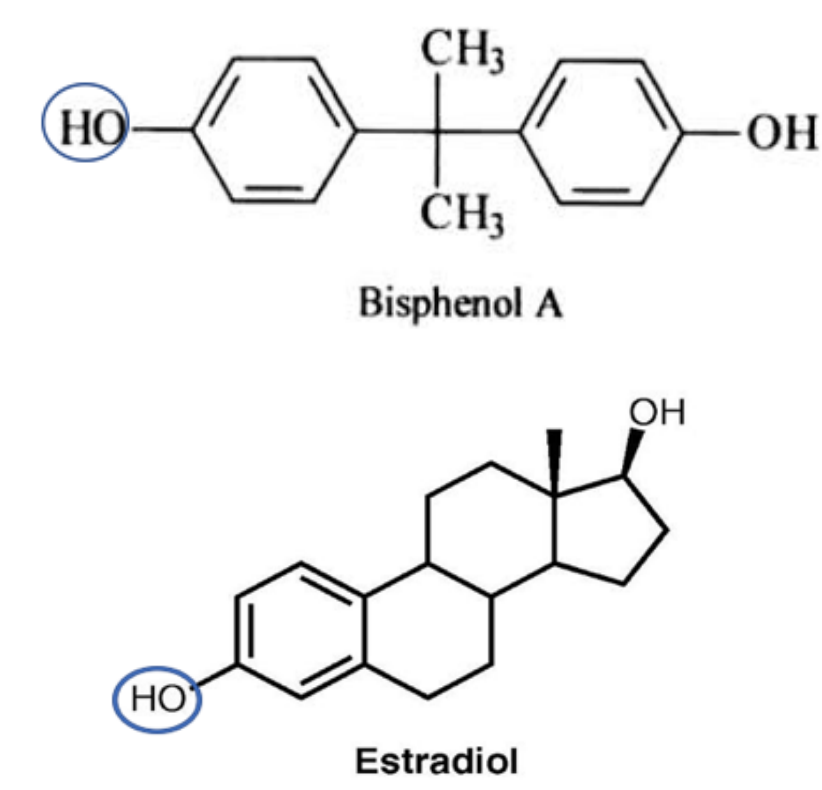
Effects of Friction on BPA Leaching in Infant Toothbrushes

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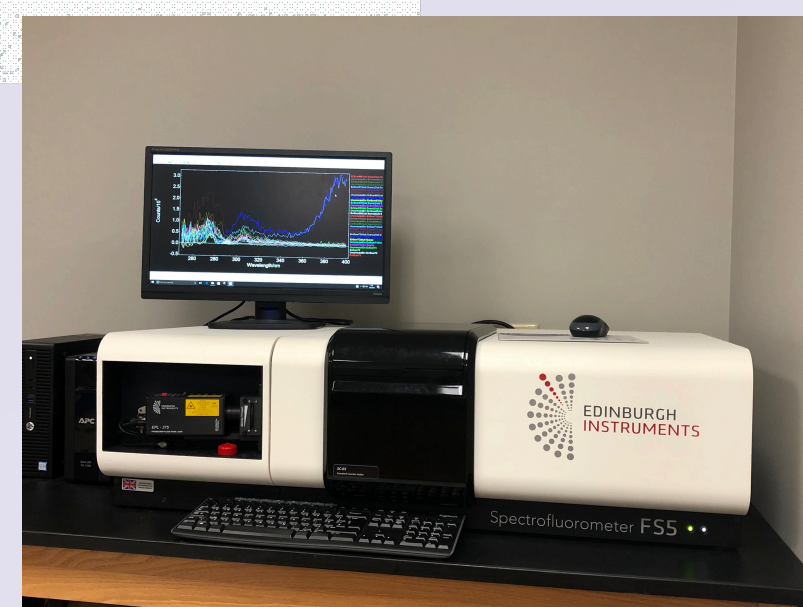
Background

- Bisphenol A (BPA) mimics estrogen causing it to act as an endocrine disrupter.
- This can lead to developmental issues, reproductive issues, and cancer, particularly for infants.
- BPA is used to make hard plastics, such as toothbrushes.
- There is no regulation on the amount of BPA that can be present in infant toothbrushes.



Materials

- Edinburgh Instruments FS5 Spectrofluorometer
- 1:1 Methanol:Water
- Volumetric Flasks
- Pasteur Pipets
- Brushing Apparatus with Orbital Shaker
- Various Infant Toothbrushes



Methods

- A brushing apparatus was developed.
- Toothbrushes were attached to the apparatus and inserted into a test tube.
- The test tube was originally filled with 90 mL of 1:1 Methanol/Water.
- At each time increment, a 5 mL sample was taken from each test tube.
- Fluorescence emission intensities were obtained in duplicate for each sample using the spectrofluorometer.
- The emission data were compared to samples that were obtained without using the brushing apparatus.



Results

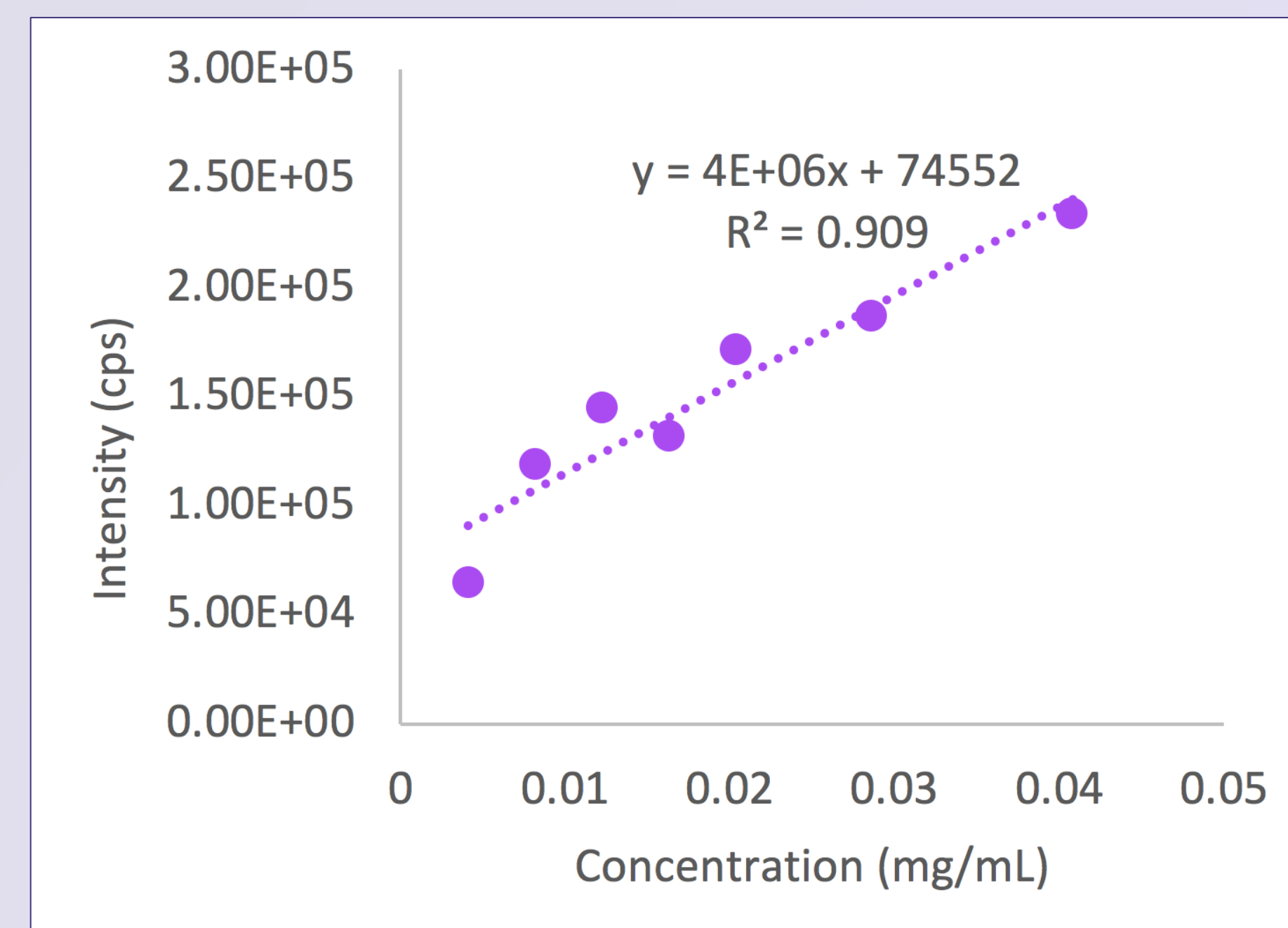


Figure 1.

Calibration curve of emission intensities compared to concentration of the BPA stock solution in each sample (initial concentration 0.102 mg/mL BPA in 1:1 M/W).

Figure 2.
Excitation and emission spectra for calibration curve of BPA stock solution.

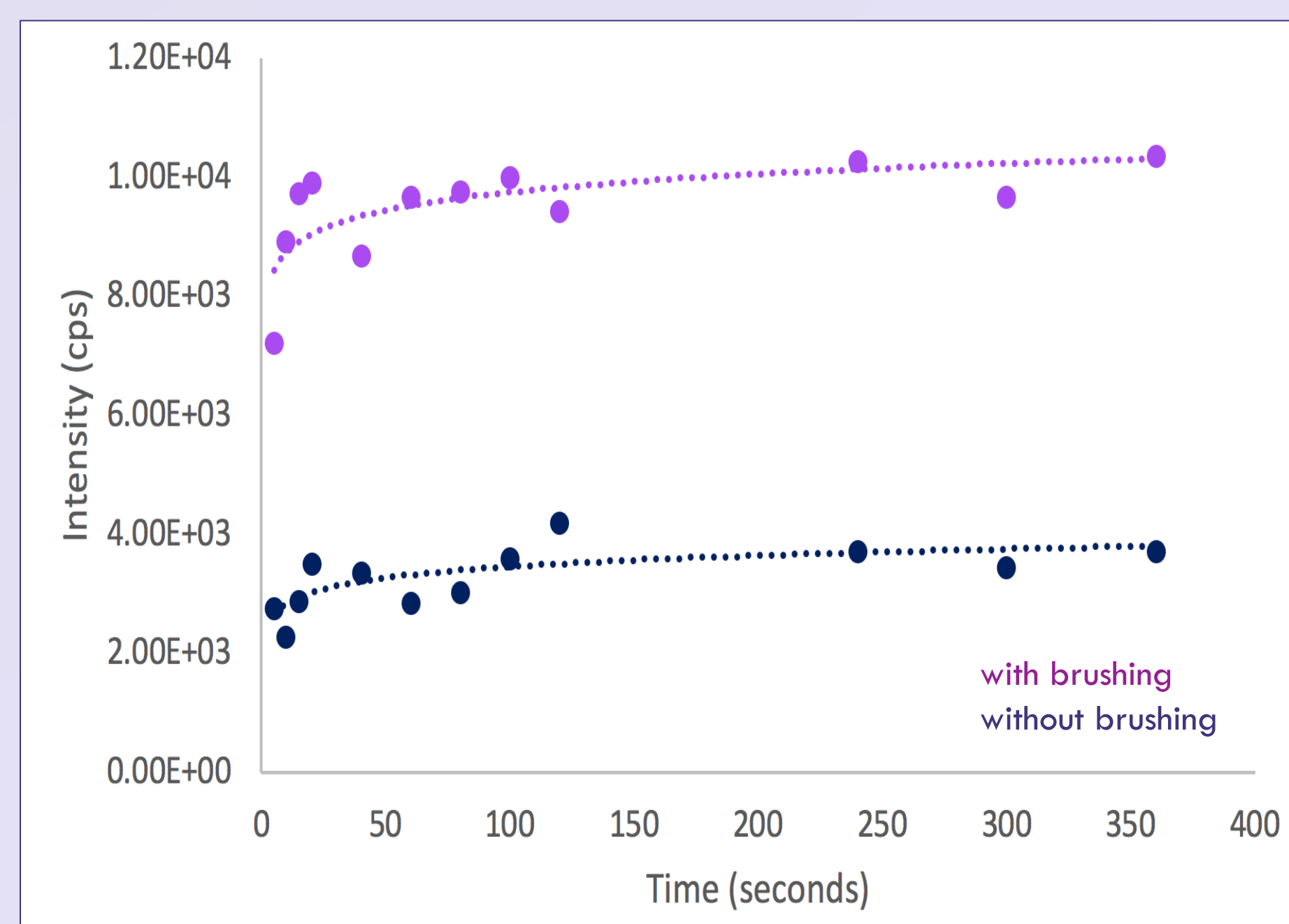
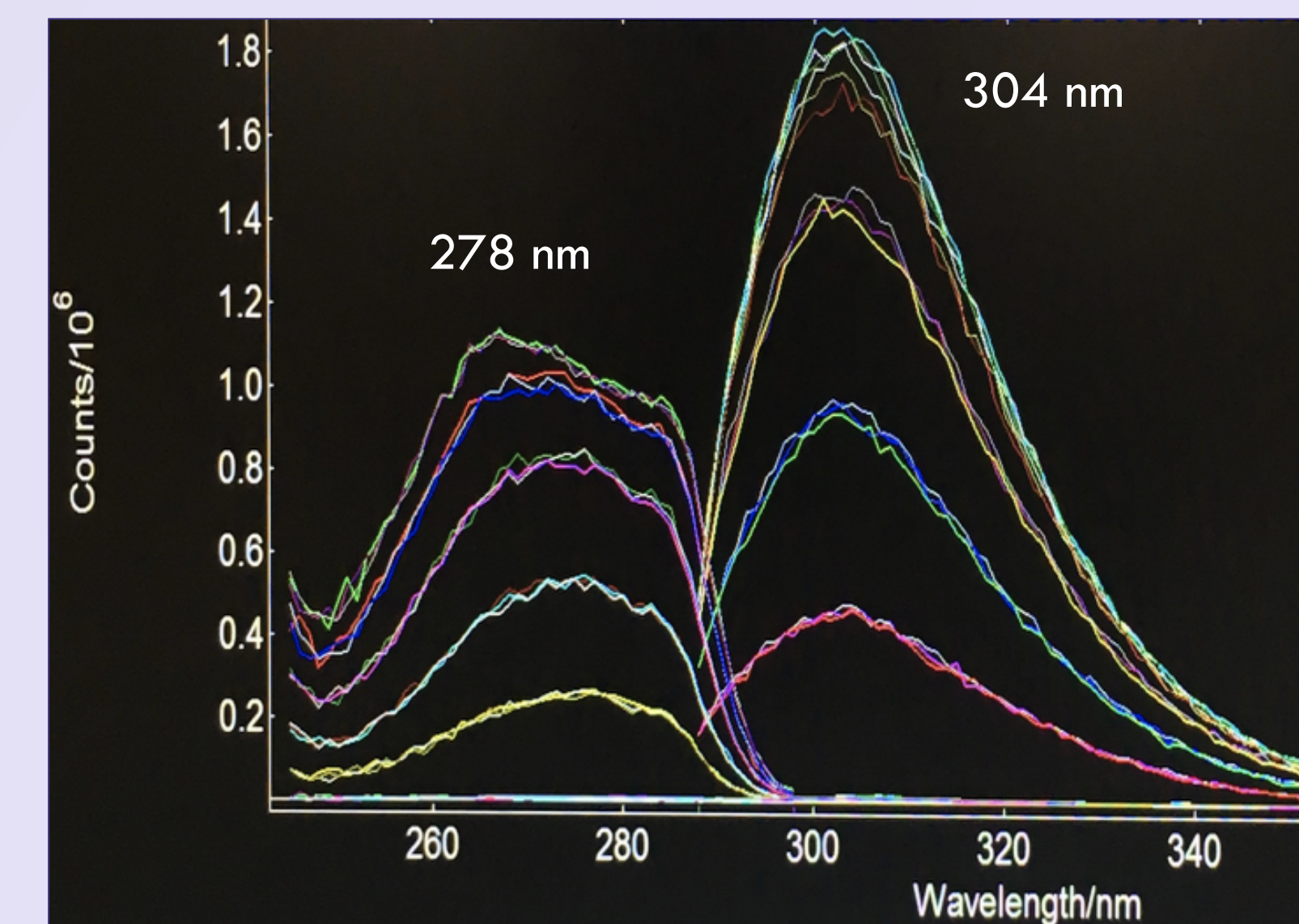


Figure 3.

Fluorescence emission intensities over time comparing Toothbrush H with brushing and without brushing.

Toothbrush	1 hr with brushing (cps)	1 hr not brushing (cps)	6 hr with brushing (cps)	6 hr not brushing (cps)
A	4.64E+03	2.46E+03	7.19E+03	4.33E+03
E	6.88E+03	3.98E+03	6.12E+03	3.36E+03
F	1.30E+04	3.66E+03	7.74E+03	6.00E+03
H	9.69E+03	2.88E+03	1.04E+04	3.75E+03
I	1.30E+04	3.30E+03	1.48E+04	5.76E+03
J	6.74E+03	2.95E+03	8.11E+03	6.24E+03
L	6.22E+03	3.15E+03	9.80E+03	4.88E+03
M	6.87E+03	4.25E+03	7.48E+03	4.02E+03
N	6.14E+03	2.46E+03	1.08E+04	4.24E+03

Table 1.
Comparison of the emission intensities of brushing and not brushing at 1 hour and 6 hours

Conclusions

- From the research that has been conducted thus far, it appears that friction increases the amount of BPA leached from the toothbrushes.
- Some infant toothbrushes that are not labeled as being BPA-free appear to contain BPA. More work is needed to confirm these results.

Future Work

- Work is being done to run more samples in an effort to replicate these results.
- Reduce the sample times to smaller time intervals that would better imitate brushing.
- Change the solution to one of the ingredients present in toothpaste to see if toothpaste affects the leaching of BPA.

References

- Lazúrová, Z, and I Lazúrová. "The Environmental Estrogen Bisphenol A and Its Effects on the Human Organism." *Vnitřní Lekarství*, U.S. National Library of Medicine, June 2013, www.ncbi.nlm.nih.gov/pubmed/23808741.
- "Are Bisphenol A (BPA) Plastic Products Safe for Infants and Children?" *National Center for Health Research*, 10 Aug. 2017, www.center4research.org/bisphenol-bpa-plastic-products-safe-infants-children/.

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