

Concentration of Mestranol in Wastewater Using High-Performance Liquid Chromatography

Lauren Sperling, Dr. Jeanne Franz

Department of Chemistry, Winona State University, Winona, Minnesota 55987



Background

- Most dangerous endocrine disruptors (EEDS) are the natural and synthetic estrogens, such as mestranol¹
- Currently no removal in water treatment process.
- Studies worldwide have seen a common occurrence of feminized male fish at sites impacted by human and animal wastes²

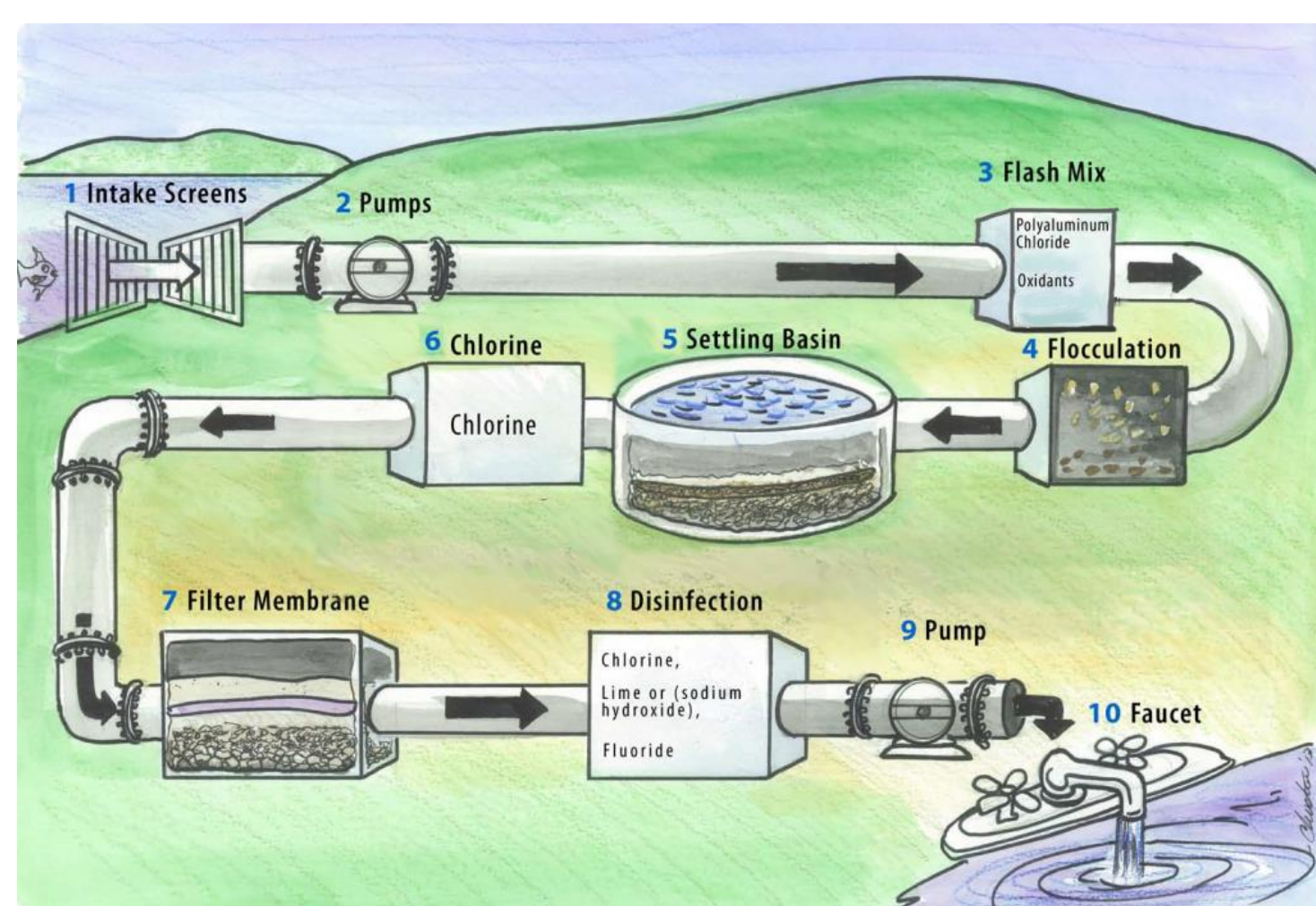


Fig. 1 Water Treatment Process

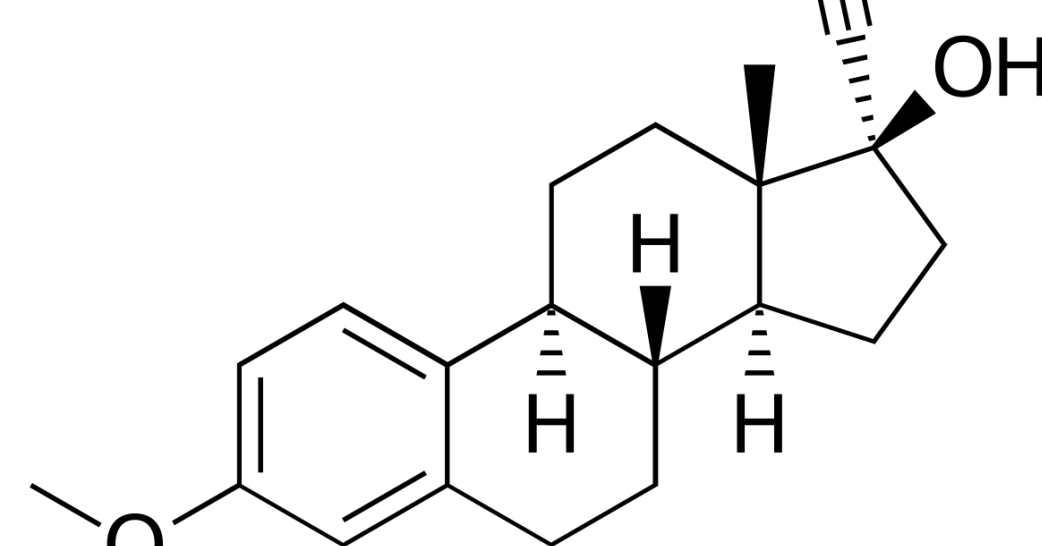


Fig 2. Structure of Mestranol

UV-Vis Spectroscopy

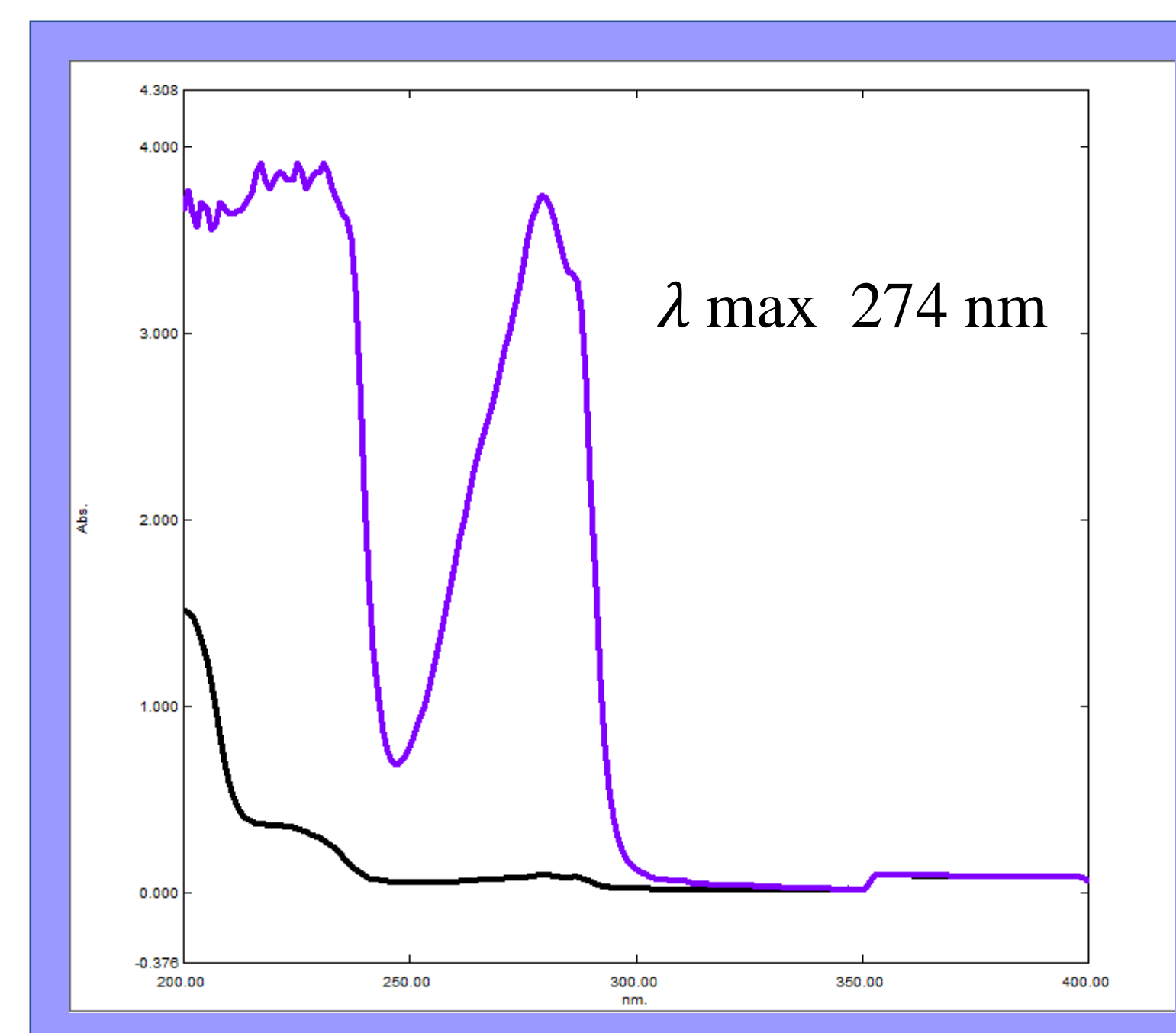


Fig 5. Absorbance of Acetonitrile (black) and Absorbance of Mestranol 0.4 g/L (purple)

- Absorbs UV light efficiently
- Acetonitrile appears to be a better solvent than methanol
- Acetonitrile does absorb somewhat at 274 nm, but it is a small interferent

Conclusion/Next Steps

- Determined a quick (less than 10 min) method to determine the concentration of mestranol in a wastewater sample.
- Developing an efficient and precise method will provide a safer and cleaner water and environment.
- In the future, exploration of the kinetic and oxidative effects of mestranol will be developed.
- A bleach ball will be tested in order to determine if it could work fast enough in order to degrade mestranol before entering into the water treatment process.



Fig. 10 Clorox toilet bowl tablet

Objectives

- To find the specific concentration of mestranol
- Use HPLC ultimately to determine if mestranol concentration will decrease³ if a product such as a toilet bleach ball is used.

Contamination

- Struggled to find the specific concentration of mestranol
- Used several different solvents
- Such as water, methanol, acetonitrile.

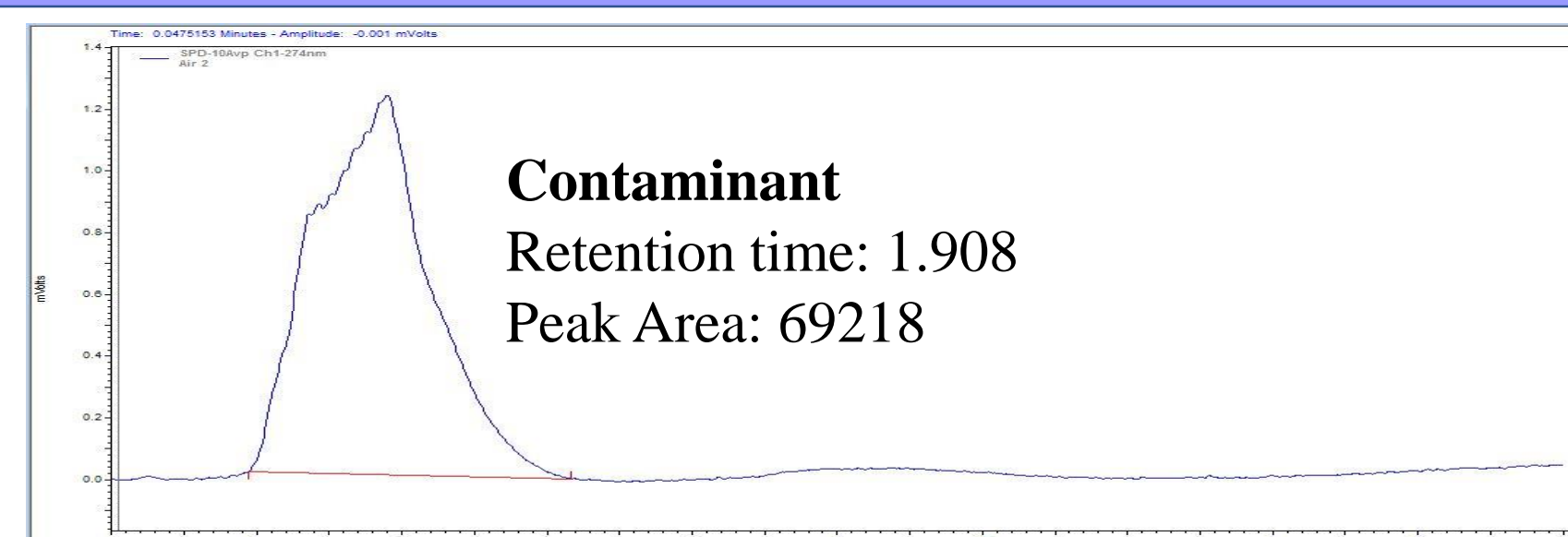


Fig.3 HPLC run of air at 274 nm

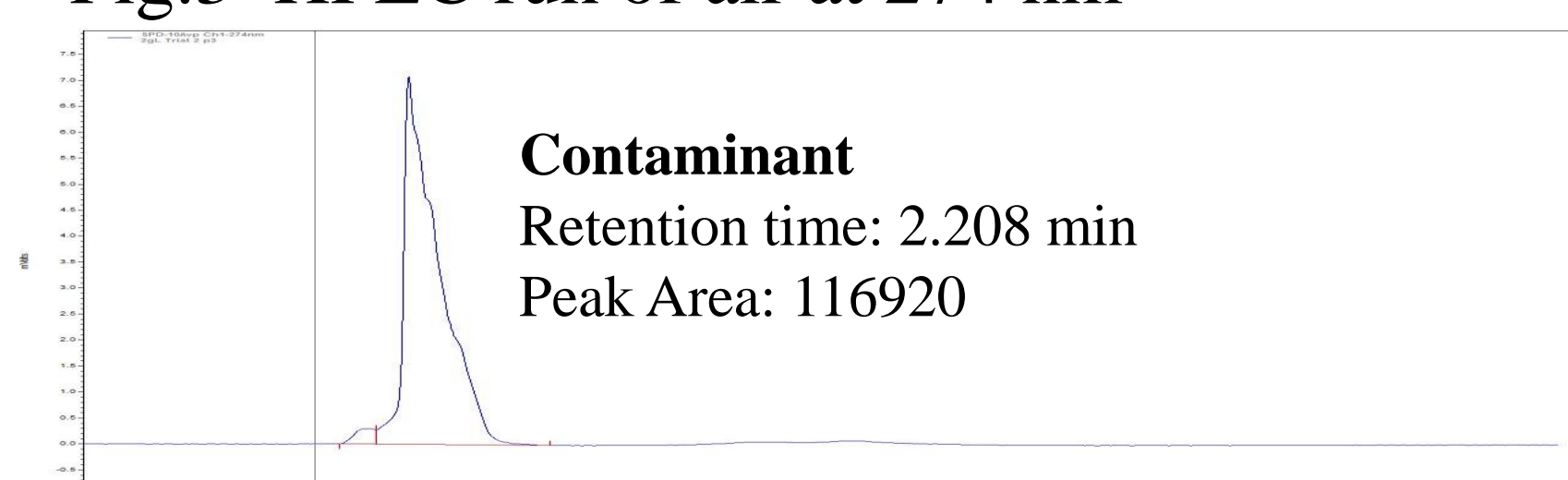


Fig.4 HPLC run of mestranol at 274 nm with concentration 2 g/L

HPLC Method Development

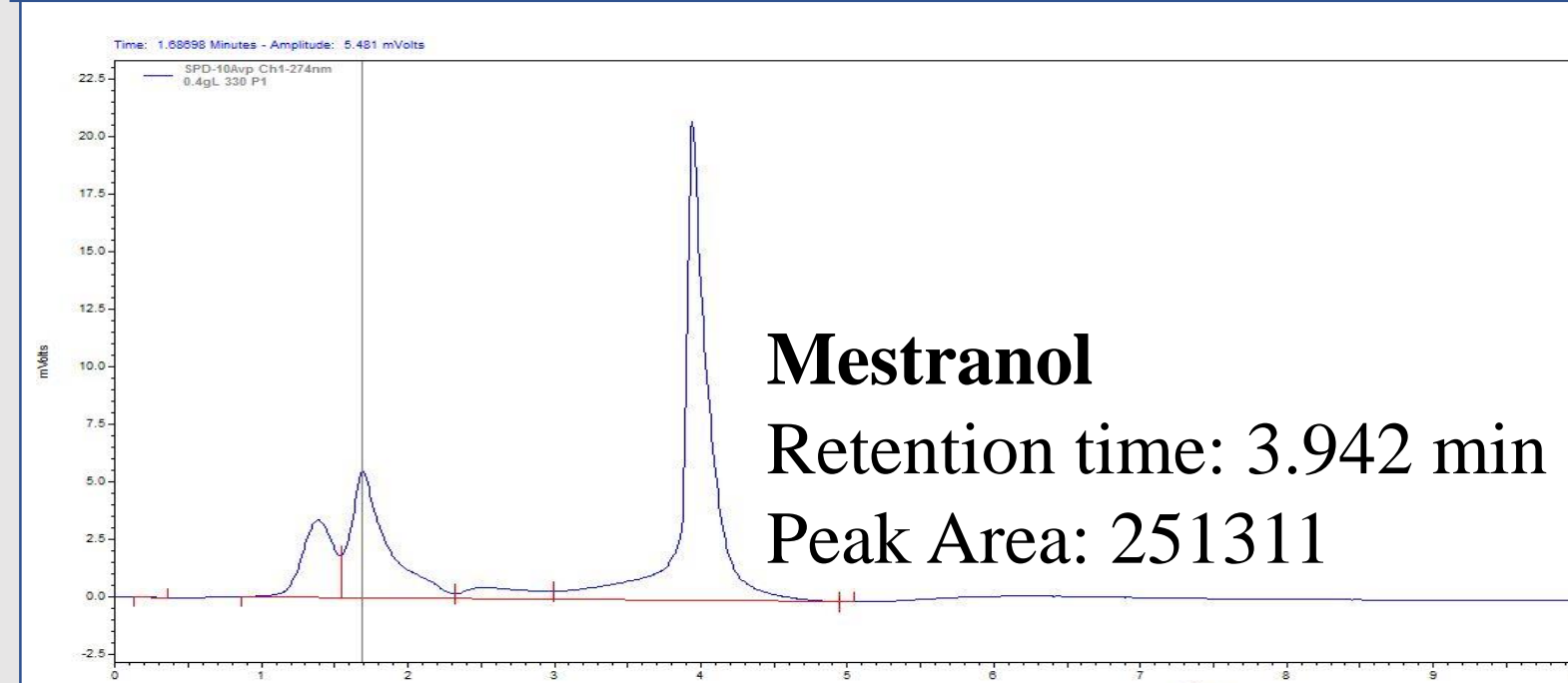


Fig 6. HPLC run of mestranol at 274 nm with concentration 0.4 g/L

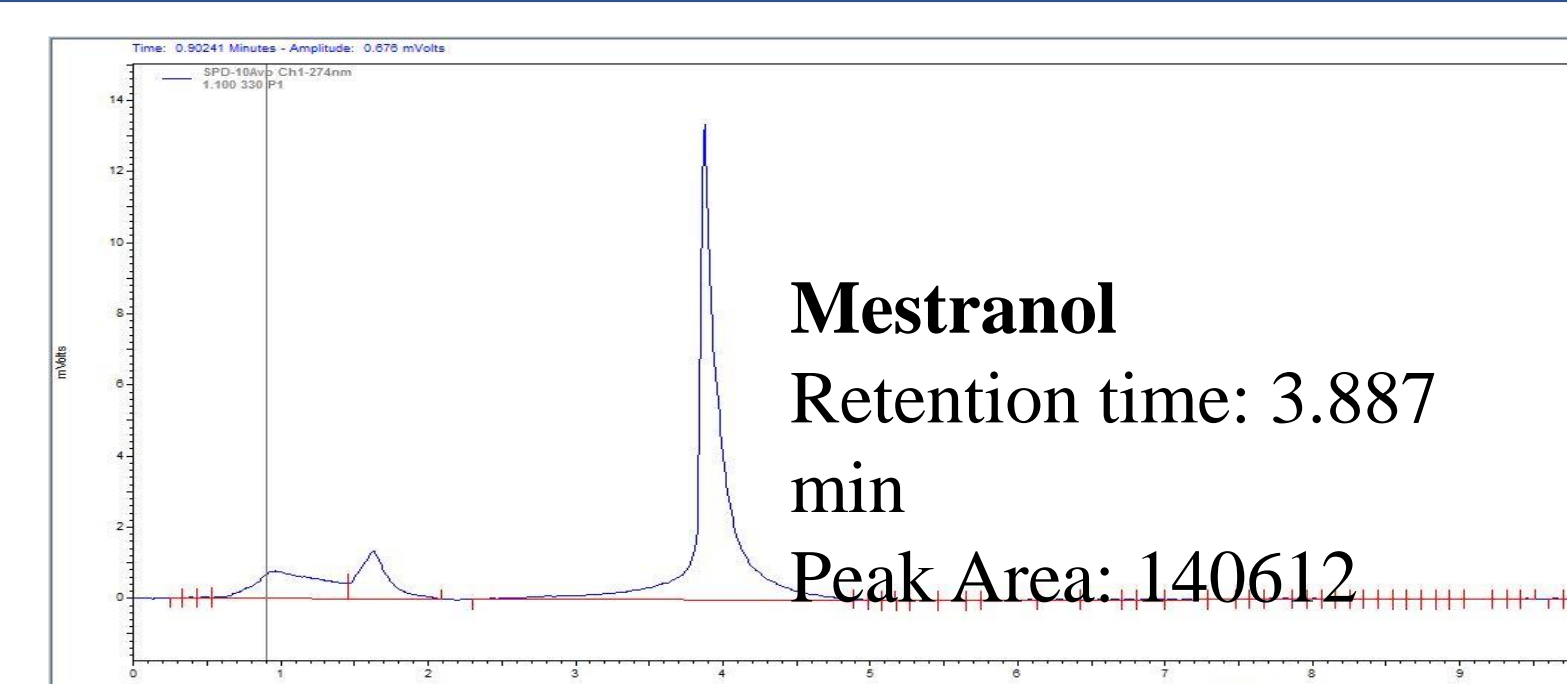


Fig 7. HPLC run of mestranol at 274 nm with Concentration 0.004 g/L

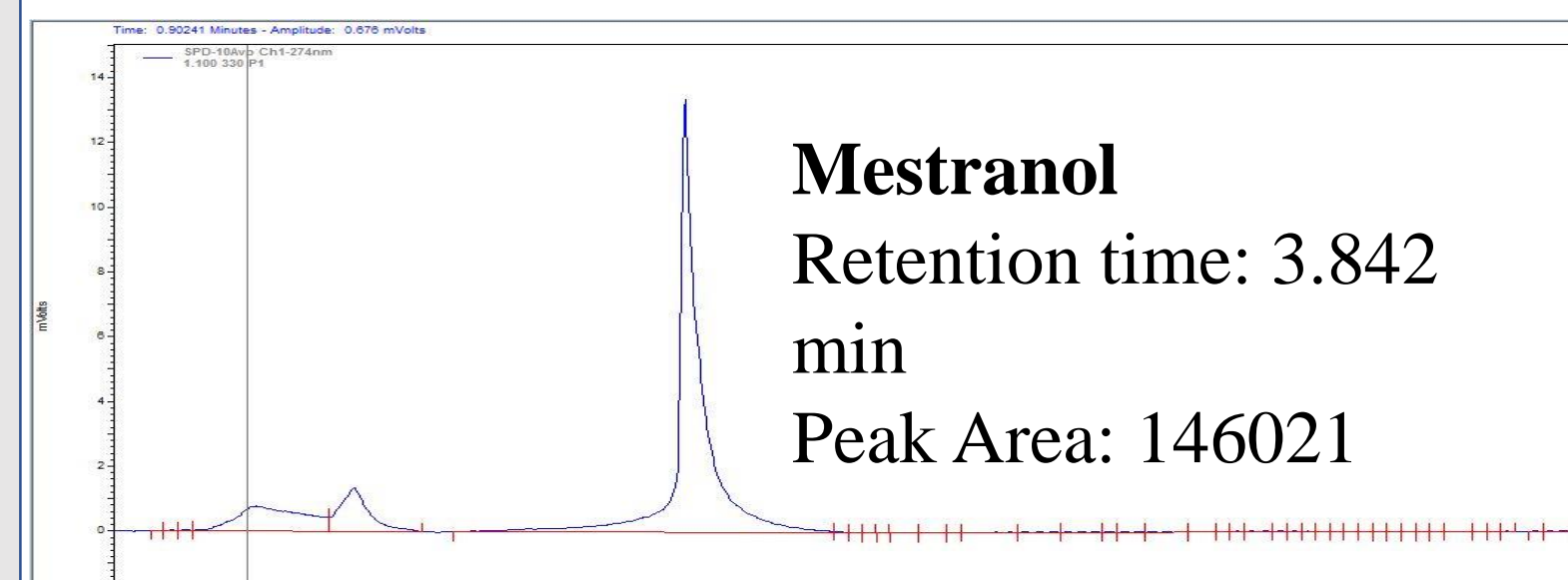


Fig 8. Channel HPLC run of mestranol at 274 nm with concentration 0.04 g/L

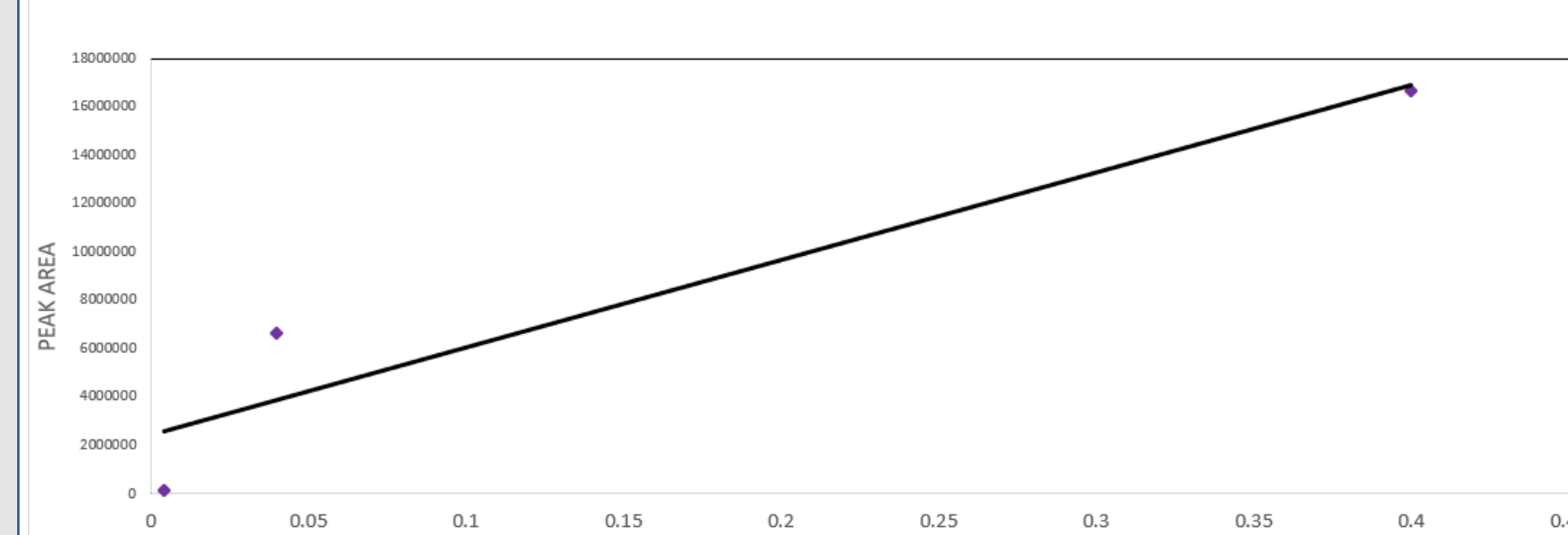


Fig 9. HPLC calibration curve for mestranol concentrations at 274 nm $y = 4 * 10^7 x + 2 * 10^6$ $R^2 = 0.9019$

- Developed an HPLC method based on analysis of mestranol in wastewater samples
- 274 nm measured wavelength
- Developed a method of 38% acetonitrile and 62% HPLC-grade water for 10 minutes
- C18 column was used

References

1. Keenan, H E, et al. "Environmental fate and partition coefficient of oestrogenic compounds in sewage treatment process" *Environmental Research*, vol. 106, no. 3, 2008, pp. 313–318., doi:10/10/2016.
2. Ankley, Gerald T, et al. "Re-Evaluating the Significance of Estrone as an Environmental Estrogen." *Environmental Science and Technology*, vol. 51, no. 8, 2017, pp. 4705–4713.
3. Henriques, Marta, et al. "Simultaneous Determination of Ten Endocrine Hormone Disruptors in Water Using SPE/LC-(ESI)MS-MS." *Journal of Water Resource and Protection*, vol. 2, no. 9, 2010, pp. 818–829.

Acknowledgements

- WSU Undergraduate Student Research and Creative Projects
- WSU Department of Chemistry