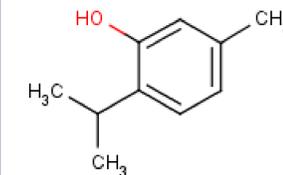




DETERMINATION OF THYMOL IN MOUTHWASH BY CAPILLARY ELECTROPHORESIS



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Objective

This study was conducted to separate and quantify the concentration of thymol (C₁₀H₁₄O) in selected mouthwash samples by capillary electrophoresis, and to compare the observed values to the manufacturers claim.

Introduction

- ❖ Thymol is a natural monoterpene phenol derivative of p-cymene that contains strong antiseptic properties and can be found in the oil of thyme and extracted from various plants.
- ❖ Many brands of mouthwash state that thymol fights tooth decay, infections and bad breath, and it was found that thymol was effective at preventing the initiation of dental caries.

Theory

- ❖ Capillary electrophoresis (CE) was chosen as it is an extremely sensitive instrument that is proficient at separating analytes.
- ❖ CE separates analytes via an applied voltage based on their electrophoretic mobility; this mobility depends on the molecules radius (size), charge and viscosity.
- ❖ The voltage device is connected to an electrode to induce an electric field to move the ions through the capillary from the anode to the cathode.
- ❖ The absorbance of the sample is analyzed through a small window near the cathodic end of the capillary that allows UV light to pass through it.
- ❖ The read-out produces an electropherogram, which plots peak area of the separated analytes against the migration time.
- ❖ Migration time is used to determine which peak is the analyte thymol. Thymol appears between 2 and 3 minutes on the electropherograms.
- ❖ A calibration curve of the relation between peak area and concentration of thymol can be produced and used to determine the concentration of the samples based on their peak area.

Experimental Samples



Samples:

- ❖ Listerine Green Tea
- ❖ Listerine Cool Mint
- ❖ Listerine Fresh Burst
- ❖ Listerine Total Care (Blue)
- ❖ Listerine Total Care (Purple)
- ❖ Listerine Zero
- ❖ Crest
- ❖ Equate
- ❖ Life

Sample Data



Figure 3. Electropherograms of mouthwash samples.

Thymol Calibration

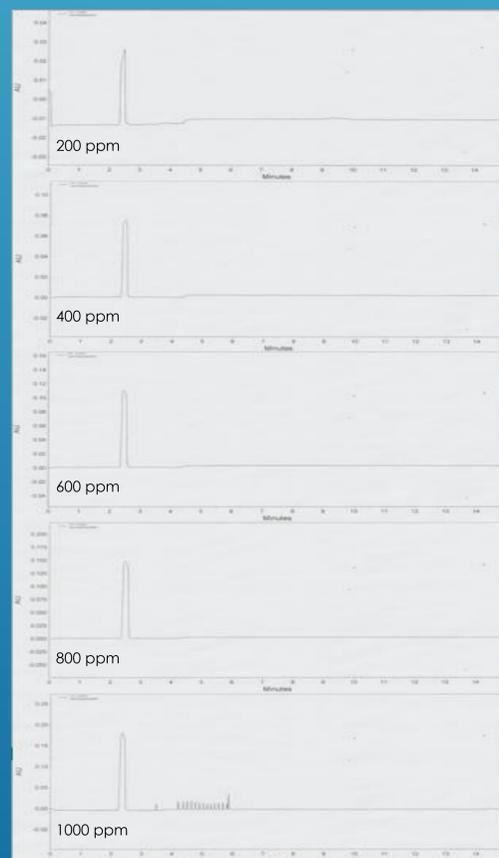


Figure 1. Electropherogram of thymol standards for generation of calibration curve.

Instrument Parameters	
UV Detector Absorbance	214 nm
Inner Diameter of Capillary	50 µm
Borate Buffer Concentration	50 mM
Buffer pH	9.0
Experimental Temperature	25 °C
Separation Voltage	20 kV

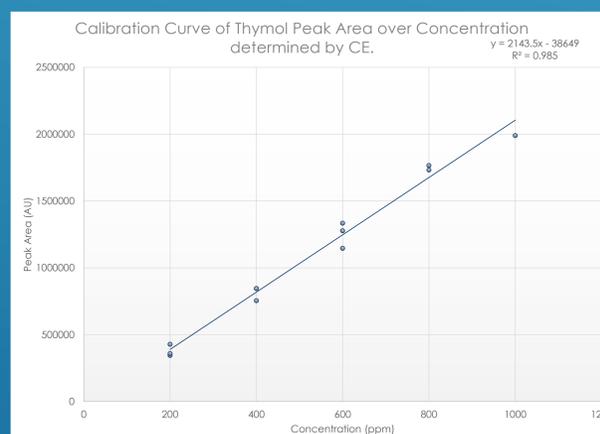


Figure 2. Calibration curve for the concentration of thymol.

Results and Conclusions

Sample	Average Thymol ppm
Listerine Green Tea	601
Listerine Cool Mint	844
Listerine Fresh Burst	723
Listerine Total Care (Blue)	711
Listerine Total Care (Purple)	896
Listerine Zero	616
Crest	751
Equate	855
Life	454

- ❖ Thymol is reported at 0.063 % (630 ppm) in most mouthwash; similar concentrations were observed.
- ❖ A calibration curve for the concentration of thymol from 200-1000ppm was produced with an R² = 0.985
- ❖ Capillary electrophoresis is shown to be effective at separating and analyzing thymol from mouthwash.

Future Work

- ❖ Additional sample runs should be completed to confirm the presence of thymol within mouthwash; especially in samples of Crest, Equate, and Life.
- ❖ Additional standard runs should be done to improve the calibration curve.
- ❖ The thymol results should be quantified and compared to literature values.

Acknowledgements

I would like to thank Dr. Kingsley Donkor for all of his help and support through this research as well as TRU UREAP, and TRU Department of Chemistry.