DETECTION AND QUANTIFICATION OF MAGNESIUM IN BIOLOGICAL SAMPLES

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Abstract

Among its many functions, magnesium is of critical importance in maintaining the mineral homeostasis in the lens of the human eye. Cataracts, the leading cause of blindness, is a disease which occurs due to a loss of transparency in the lens. This loss of transparency may have causes rooted in the onset of an imbalance in intracellular ionic concentrations, especially including magnesium.[1] Therefore, developing a reliable and accurate method for the quantification of magnesium in cataracts samples would allow for further insights into the process of cataract formation. The method that has been developed in this project utilized xylidyl blue I as the indicator, as well as *E. Coli* samples to mimic the biological matrix of cataracts samples in order to optimize the parameters for quantification. This method has so far been found to have a limit of detection of 0.785 ppm.

Introduction

- One of the possible mechanisms for magnesium to affect cataract formation in the eye requires a magnesium deficiency leading to the formation of nitric oxide in the lens, which creates free radicals that lead to the formation of cataracts.[1] This necessitates the development of a quantification method for magnesium concentration in cataracts samples.
- The complexing agent that was chosen for this project is xylidyl blue I, which forms a complex with magnesium that can be observed via a color-change interaction.
- In basic solution, this color change shifts from blue to violet with the addition of more magnesium.
- According to studies with this compound, the indicator functions optimally at a pH of around 9, and requires a basic buffer to achieve this pH value.[2] For this project, PBS buffer was utilized at pH 9.
- Xylidyl blue I was chosen for this experiment because it allows for Mg detection on the UV-Vis Spectrophotometer.

Experimental

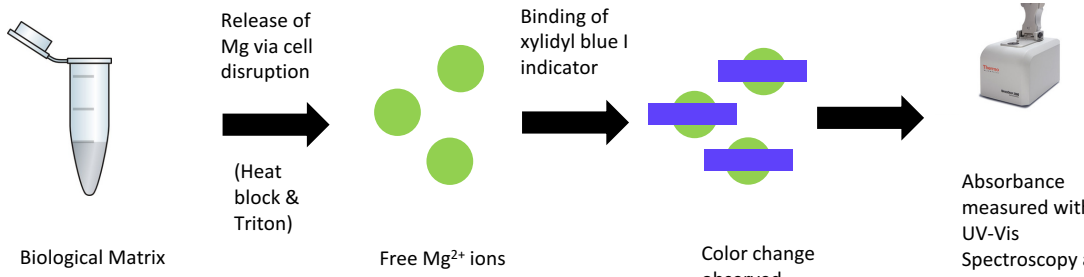

Figure 1. Quantification of Magnesium in Biological Samples using Xylidyl Blue I

Results

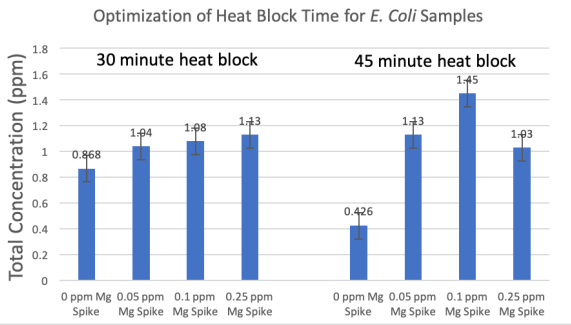

Figure 2. Heat Block Time Optimization

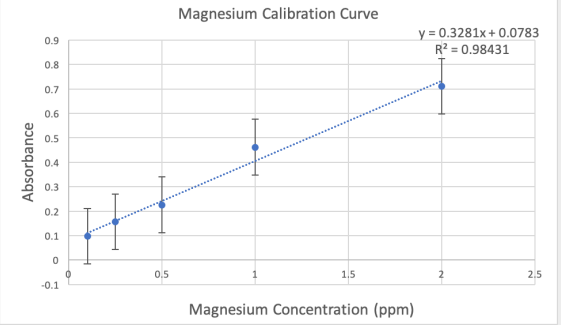

Figure 4. Magnesium Calibration Curve

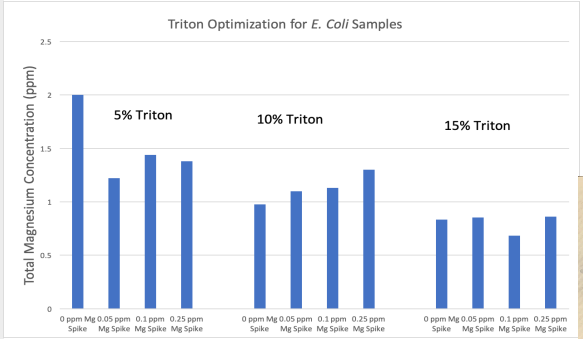

Figure 3. Triton Percentage Optimization

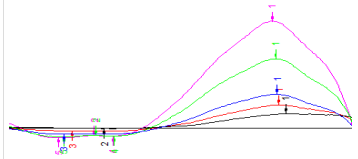

Figure 5. UV-Vis Absorbance for Mg Calibration Curve

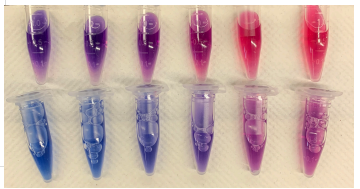

Figure 6. Mg Standards Showing Indicator Gradient: Top row has no triton, bottom row has 10% triton. Concentration increases from right to left.

Discussion

Table 1: Optimized Parameters

Xylidyl Blue Concentration	60 ppm
Triton Concentration	10%
pH	9
Heat Block Time	30 minutes

- Further testing will be performed to ensure reproducibility of these results with these parameters.
- The calibration curve indicated a linear trend from 0.1 ppm to 2.0 ppm Mg^{2+} concentration.
- The slope of the calibration curve allowed for a limit of detection of 0.785 ppm.

Future Aspects

- Adjustment or addition of new parameters will be made to improve the limit of detection.
- Eventually, this model of quantification of magnesium in *E. Coli* will be utilized to quantify magnesium in cataracts samples.

Acknowledgements

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References

1.) Agarwal, Renu, Igor N. Iezhitsa, Puneet Agarwal, and Alexander A. Spasov. "Mechanisms of Cataractogenesis in the Presence of Magnesium Deficiency." *Magnesium Research* 26, no. 1 (2013): 2–8.
2.) Mann, Charles K., and John H. Yoe. "Spectrophotometric Determination of Magnesium with 1-Azo-2-Hydroxy-3-(2,4-Dimethylcarboxanilido)-Naphtha- Lene-1-(2-Hydroxybenzene)." *Science Direct*, Analytica Chemica Acta, 22 Jan. 2002.

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