Protein-Bound Uremic Toxins Quantification by a Colorimetric Sensor Based on the Oxidation of Silver Nanoparticles

Elberth M. Schiefer ; Andressa F. Santos ; Marcia Muller ; Andrea E. M. Stinghen ; Lucas H. Negri ; José L. Fabris   **All Authors**

Abstract

Document Sections

I. Introduction

II. Methods

III. Results and Discussion

IV. Conclusion

» Appendix

Authors

Figures

References

Keywords

Metrics

Abstract:
This work shows a colorimetric sensor based on albumin bound to citrate-capped silver nanoparticles. The sensor capability of detecting protein-bound uremic toxins, such as indoxyl sulfate and p-cresylsulfate, is demonstrated. These uremic toxins enhance the oxidation of citrate-capped silver nanoparticles by hydrogen peroxide, affecting the localized surface plasmon resonance and allowing the proposed colorimetric sensing method. The method exhibits a linear response for indoxyl sulfate and p-cresylsulfate concentrations ranging from 15 to 100 mg/L with resolutions of 0.56 mg/L and 0.41 mg/L and expanded uncertainties for a confidence level of 95% of 17.23 mg/L and 12.55 mg/L, respectively. Limits of detection and quantification of 5.7 mg/L and 19 mg/L for indoxyl sulfate and of 3.2 mg/L and 10.7 mg/L for p-cresylsulfate were obtained for $p < 0.05$. These characteristics of the colorimetric method allow for a distinction between total normal and total uremic blood concentrations, which reported levels are (0.54 ± 4.00) mg/L and (37.07 ± 26.50) mg/L for indoxyl sulfate and (1.87 ± 2.31) mg/L and (23.00 ± 16.90) mg/L for p-cresylsulfate. Besides, this novel sensor significantly reduces costs of analysis and facilitates the quantification of those toxins. The interaction between albumin and citrate-capped silver nanoparticles was also investigated by Raman spectroscopy.