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Resistance mechanism of Ni^{2+} ion individually and in combination with the Cr^{6+} ion in *Staphylococcus aureus* species to characterize the molecular changes studied using Infrared Spectroscopy coupled with chemometrics

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Abstract

The objective of this study was to clarify the Nickel resistance *Staphylococcus aureus* population individually and in combination with Chromium using Fourier Transform Infrared Spectroscopy. The increase in the intensity of the lipid bands due to metal resistance to *S. aureus* was observed when compared to control group. The increase in the intensity of ~1722cm^{-1} shows the increase in carbohydrates. The IR band at 964 cm^{-1} in nickel treatment has profound effects on DNA when compared to Cr. Principle component analysis shows Nickel and its mixtures 2Ni:Cr treated sample are the most prominent in influencing the toxicity in the sample studied. Loading plots enable 1800-450 cm^{-1} regions contribute to the dissemination of *S. aureus* due to metal treatment. The obtained results provide valuable information regarding the influence of one metal over the other. The study showed that Nickel has greater binding affinity to molecular changes occurring in the spectra when compared to Chromium. Further the addition of Nickel in the presence of chromium shows synergistic effect. Our approach showed that the infrared spectroscopy coupled with chemometric analysis can be used for rapid and reliable analysis in the discrimination of complex metal mixtures in the *S. aureus* populations.

Key Words: FTIR, *S. aureus*, Nickel, Chromium, Metal mixtures, PCA.

Introduction