

Raman Microspectroscopic Investigation on the Interaction of Endothelial Cells with Anthracycline Antibiotics

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The anthracycline antibiotics such as doxorubicin and daunorubicin are cytotoxic drugs, which owing to their broad antitumor activity are widely used in the treatment of many malignant diseases. One of the major side effects of these chemotherapeutics are arrhythmias, cardiomyopathies and increase risk of heart failure. Anthracycline-induced cardiac toxicity may be mediated by its injurious effects on the cardiac vascular endothelium.

The analytical methods mostly used for the determination of anthracyclines in plasma and serum are based on liquid chromatography with fluorescence or electrochemical detection. However, all of these methods require sample pretreatment, i.e. extraction with chloroform or acetone. Based on Raman spectrum, which gives a unique chemical signature of a specimen and using multivariate statistical and chemometric approaches it is possible to investigate biochemical changes induced by pharmacological treatment. Raman spectral imaging at the single cell level represents a potential avenue for probing various cellular processes and monitoring for example cell–drug interactions.

The purpose of this work was to monitor changes in biochemical composition and evaluate cytotoxic effects of doxorubicin (adriamycin) and daunorubicin (daunomycin) on the human endothelial cells.

In this study Confocal Raman Imaging was used to monitor a molecular composition occurring in single cells as a result of anthracycline exposure on living endothelium. Cells were directly grown on calcium fluoride slides (CaF₂, 25×2 mm, Pike Technologies, U.S.) and treated with appropriate dose of antibiotic for 24 hours.

Raman mapping was done with a Confocal Raman Imaging system Witec alpha 300 equipped with a 60× water immersion objective (Nikon Fluor, NA=1).

The obtained results may help to investigate and better characterised molecular mechanisms of cardiotoxicity induced by the anthracycline antibiotics.

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