The investigation of the influence of Norfloxacin and Ciprofloxacin on Bacillus pumilus by means of Raman spectroscopy

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Fluoroquinolones are the dominant gyrase inhibitors and play an important role amongst all prescribed antibacterial drugs. The quinolones attack the bacterial DNA-gyrase-complex. This gyrase-DNA-complex is responsible for the supercoiling of bacterial DNA and necessary during bacteria replication. The disturbance of this process by the quinolones is bactericidal. Even though, it is of great interest, the detailed mechanism of biological action on a molecular level is yet not fully understood [1]. But the action of the drug should cause changes in the chemical composition and ternary structure of the components inside the bacillus which should be observable by means of Raman spectroscopy.

The aim of this work is to monitor the effect of the fluoroquinolone drugs norfloxacin and ciprofloxacin on the growth of the Gram positive bacteria *Bacillus pumilus* by means of Raman spectroscopy.

For that purpose, *Bacillus pumilus* were incubated at 37°C in nutrient bouillon to which different concentration of the antibiotics ciprofloxacin and norfloxacin were added. The final concentration of the drugs in the culture medium was ranging from less than 0.1 up to 100-fold of the minimal inhibition concentration (MIC) of the drug. The growth of the cells was evaluated by means of UV/Vis spectroscopy (optical density) and compared with an untreated *Bacillus pumilus* culture. After an incubation time of 2.5 hours the cells were washed and investigated by means of Raman spectroscopy. For a better analysis of the very small changes in the Raman spectra due to the action of the drug in the cell, the first derivative of the Raman spectra were used for further analysis. Hierarchical cluster analysis (HCA) was performed to group the spectra due to changes caused by the drug.

In order to find the best conditions for monitoring the effect of the fluoroquinolone drugs on the growth of bacteria comparative studies were performed with *Bacillus pumilus* cultures on nutrient agar which was inoculated with different concentrations of norfloxacin.

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Reference:
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