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Identification of Critical Care Medications: Optical Approaches

Ensuring the correct composition of administered medications is crucial for patient safety, particularly in oncology and intensive care settings. Despite existing control systems, direct verification of a drug's chemical identity is often missing. Raman spectroscopy, with its high specificity and minimal sample preparation requirements, offers a powerful tool for addressing this gap, as illustrated in Figure 1.

We present an evaluation of diagnostic approaches based on Raman spectroscopy, UV/Vis spectroscopy, and refractometry for the identification and verification of infusion medications at the point of care. In collaboration with the University Medical Center Mainz, cytostatics and critical care infusions were spectroscopically analyzed. Chemometric processing and machine learning models, ranging from linear regressors to neural networks, were employed to enhance classification accuracy.

Monitoring infusions in intensive care units is most effective when combined with UV/Vis spectroscopy and refractometry, given the low concentrations of the administered catecholamines [1]. In the case of cytostatic drugs, Raman spectroscopy proved especially effective when combined with advanced chemometric algorithms and a spectral database of over 500 entries, achieving identification rates of up to 99 % [2, 3]. These results underscore the strong potential of Raman-based analytics for real-time medication verification, offering significant safety improvements in clinical workflows and enabling new applications in pharmacy quality control.

References

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Figures

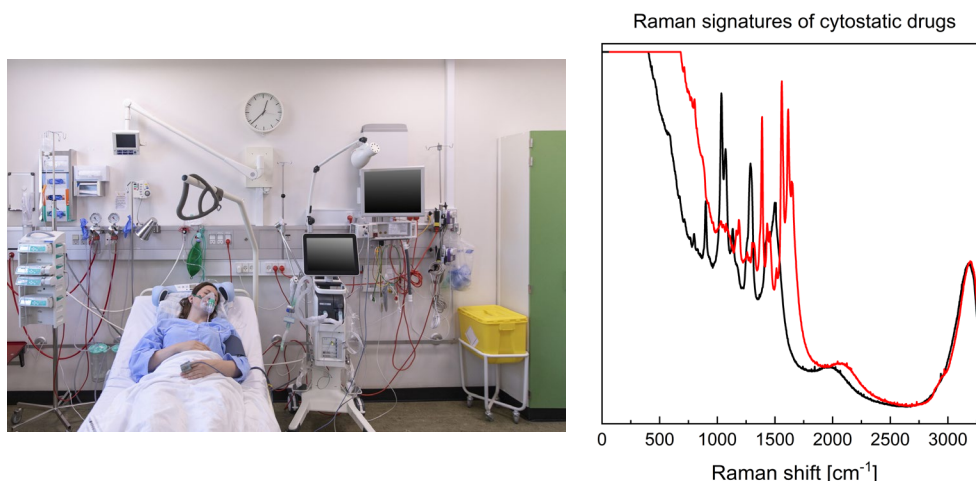


Figure 1: Raman spectroscopic evaluation of commonly used cytostatic drugs in a hospital environment. Red: Irinotecan (3.0 g/l; in NaCl 0.9 %), black: Doxorubicin (2.0 g/l; in Glucose 5 %).