A comparison between Raman and FTIR focal plane imaging for diagnosing malaria parasites in single cells

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Malaria still remains one of the most devastating diseases afflicting the modern world. Critical to reducing the burden of this disease is developing diagnostic techniques that have high sensitivity and specificity, which can be rapidly, routinely and safely carried by non-expert personnel. In pursuit of these aims we have been investigating the potential of vibrational spectroscopy as an independent modality to diagnose malaria at the erythrocytic stage of the parasite's life cycle. During this stage the parasite develops distinct organelles and accumulates lipids and a by-product know as haemozoin in its food vacuole. Haemozoin is spectroscopically very similar to β-haematin which is reported to be a hydrogen bonded array of haem dimers linked through reciprocal iron-carboxylate bonds to one of the propionate side chains of an adjacent Fe(III)PPIX moiety.[1,2] Haemozoin has a very distinct spectrum that can be easily distinguished from haemoglobin in a blood smear using Raman spectroscopy.[3] Moreover, each stage of the parasite has a distinct lipid signature that enables rapid identification using FTIR and a neural network.[4] Recently we applied FTIR microspectroscopy using a focal plane array coupled to synchrotron source and incorporating 74 x Cassegrain objective. In this presentation these two technologies will be compared in terms of sensitivity, specificity, sample preparation, sample analysis and spectral processing time.

References

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