Lignins are amongst the most abundant biopolymers on Earth, and are key components of the cell walls of many vascular plants. However, our fundamental knowledge of the photochemistry of the molecular building blocks that make up lignins (i.e. the monolignols, p-coumaryl, coniferyl and sinapyl alcohols) is currently limited. In this project, we will conduct novel experiments to explore the basic photochemical properties of key monolignols. Experiments will be performed on isolated gas-phase molecules, free from the influences of the other components in the complex native plant environment. In particular, we propose to investigate the key question of how the UV properties of monolignols are affected if the molecule is protonated or deprotonated. This critical issue has been almost entirely ignored to date, despite the fact that lignols exist in aqueous environments. The recently developed laser-interfaced electrospray mass spectrometer (CED group) is an ideal tool for producing the monolignol molecules in their protonated/deprotonated forms in the gas phase. The mass selectivity allows potentially for laser bandwidth limited UV spectra to be recorded not only of the protonated/deprotonated molecule but also any photoproducts. Data obtained for the charged lignols will then be directly compared to the analogous neutral molecule spectrum obtained using two-colour photoionization spectroscopy (MCRC group). Further experiments will be conducted on aggregates of the lignols (both neutral and ionic), involving pairs of lignols and also lignol-water molecule complexes to perform the first molecular-level investigations of how the UV properties evolve upon aggregation and also microsolvation. The availability of experimental systems for obtaining the gas-phase UV laser spectra of both neutral and charged lignol species within a single department is unique to York, and therefore offers a prime opportunity to perform internationally-leading measurements in this emerging field.

The project will provide very broad training opportunities in a range of highly-transferrable skills including mass spectrometry, (soft ionization techniques, CID, and mass spectral analysis), and laser spectroscopy (use of class 4 laser systems). Training will also be offered in computational chemistry techniques (ab initio and DFT) to support the interpretation of experimental results. The Dessent/Cockett research groups foster a lively scientific environment for students, with regular group meetings, directed literature reading, close links to the other internal and external research groups, rapid publication of post-graduate results and attendance at external UK and international scientific meetings.

Funding source: Student to secure own funding
Eligibility: UK/EU/Overseas

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For more information contact chemgrad@york.ac.uk or see our web page: http://www.york.ac.uk/chemistry/postgraduate/
The Department of Chemistry holds an Athena SWAN Gold Award and is committed to supporting equality and diversity for all staff and students