

**Prof. Chris Rayner**

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<http://www.chem.leeds.ac.uk/People/Rayner.html>**Natural Products Chemistry / Sustainable Chemicals for the Future**

The large majority of chemically derived products we use in our daily lives originate from petrochemical resources. Given that the worldwide production of oil may arguably already have peaked, or is likely to in the near future, there is intense interest in the use of renewable, sustainable resources of products which can replace current petrochemical derived equivalents. There is also a perception (not always valid) that in consumer products, naturally derived compounds are better than their synthetic equivalents. By developing a full understanding of both synthetic and natural systems, we are devising new biochemically derived alternatives for a variety of applications, which we believe have real advantages over current approaches. Our research group has an underlying theme of sustainability and the environment throughout all its projects. In the case of sustainable chemicals, we have a variety of project areas underway summarised below.

**Use of Natural Products in Consumer Applications.**

We have been working for a number of years on the development and application of natural dyes in areas such as coloration of hair and textiles. Before the advent of synthetic dyes, those of natural origin were used extensively, and were very valuable. There is now a real resurgence of interest in natural dyes, mainly driven by the consumer looking for more ecologically sound products, and the real problems with some synthetic dyes and their precursors (e.g. *para*-phenylenediamine and resorcinol are both used extensively in permanent hair coloration but are strong sensitizers and have other toxicity issues associated with their use). With Dr Richard Blackburn (Centre for Technical Textiles), we have recently developed and patented<sup>1</sup> a new dye system which originates from a waste product from the food and beverage industry, and have established a spin out company ([www.keracol.co.uk](http://www.keracol.co.uk)) to commercialise this research. Importantly, as the raw materials for our new process are waste products, they do not compete with land for food use, which is a key issue in the renewables area. In related research, we are also developing useful products from seaweed for consumer applications.<sup>2</sup> Again, as seaweed does not compete with land for food use, it is particularly attractive as a source of renewable materials.

The expertise we have gained in the use of natural dyes has led to some less obvious projects, including one where we are developing an understanding of what happens to natural dyes over a prolonged period of time, particularly in the context of historical textiles.<sup>3</sup> Working with many of the major museums in the UK and abroad, we are using our expertise to identify the original dyes used in many historical textiles, which can be used to date and give geographical information on the origin of the dyes, and also help reconstruct images of the original textiles.

We are also developing a range of natural dyes as new platform chemicals, where we can enhance their potential for specific applications, by carrying out simple green chemical transformations, to improve aspects such as light fastness and substrate affinity.<sup>4</sup> New innovative methods for extraction and purification of these natural dyes which can potentially be developed on a commercial scale are also currently under investigation.

*The availability of funding for projects varies; if you wish to discuss the chemistry in more detail, and potential opportunities in any of these areas, please contact Professor Rayner directly.*

**References**

1. With Drs Richard Blackburn and Paul Rose, "Natural hair dyes", P122506GB, 2009. Currently working with Sannia Farooque, Muhammad Wathon and Drs Meryem Benohoud and Alenka Tidder in this area.
2. With Drs Richard Blackburn, and Henry Spurr.
3. With Dr Richard Blackburn and Lauren Ford.
4. With Dr Richard Blackburn and Muhammed Wathon.