Nanotechnology in the Production of Luxury Gold-Wool Textiles

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At Victoria University of Wellington and Noble Bond Ltd, Professor Jim Johnston and Doctor Kerstin Lucas, together with their research group, have created the world’s first gold-wool textiles; Aulana® [2]. Commercialised by Noble Bond Ltd for high-value rug and apparel markets, they utilise gold nanoparticles that form a range of intense and attractive colours. The colours are generated by the localised surface plasmon resonance of nanogold and depend on the size and shape of the particles.

Aim
This project involved further study to control the formation of the gold nanoparticles as well as their interaction with wool fibres, in order to better manipulate and control the yarn colour.

Method

1. Synthesis of gold (Au) nanoparticles

Common reducing agents include tannic acid and sodium borohydride. In excess tannic acid also acts as a stabilising agent.

2. Utilisation of the amino acids in wool fibres to ‘attach’ gold nanoparticles

The fibre-nanogold bond is achieved via pH adjustment.

The work completed for this project involved the careful manipulation of selected variables, including the type of reducing and stabilising agents used (in step 1), and the temperature, pH and solvent (in steps 1 and 2).

For proprietary reasons, specific method details cannot be provided.

Results

A range of coloured gold nanoparticle solutions were produced (centre photograph) and characterised by ultraviolet/visible spectroscopy.

Small spherical particles form pink and red solutions that absorb green light (~530 nm) and give a peak in the spectra at this wavelength. Grey and purple solutions of very large particles or agglomerates of particles absorb many wavelengths of light and give wide peaks.

These nanogold solutions dyed yarn in colours similar to those already being developed by the research group. However they absorbed onto wool at a slower rate offering greater control over the dyeing process. The method devised for grey wool synthesis is also simpler than that currently utilised.

Conclusion

The unique nanogold solutions produced during this research offer significant advantages over those currently employed. This work has been shared with other members of the research group who will further develop the methodology on an industrial scale.

References

[1] www.aulana.co.uk
[3] electron microscope images courtesy of Dr Andrea Kolb and Thomas Nilsson

Glossary

Localised surface plasmon resonance: the interaction of light with a particle’s electrons. The electrons are made to oscillate in a wave resulting in nanoparticle colour.

Spectroscopy: the study of the interaction between electromagnetic energy and matter, often used by chemists to gain information about their samples.