DYES (incl. Food colorants)

NPARR 3(3), 2012-0241, Production of a concentrated natural dye from Canadian Goldenrod (*Solidago canadensis*) extracts

The dyestuff content in plant sources is rather low, usually in the order of a few % of the mass of dry plant material. Introduction of plant dyes into technical scale textile dyeing operations thus requires handling, extraction and disposal of huge amounts of plant material. The precipitation of a solid, dyestuff-containing residue by addition of FeSO₄·7H₂O to the aqueous plant extract yields a highly concentrated plant dye. In this work Canadian Goldenrod (*Solidago canadensis*) was used as representative case to study production of a concentrated solid plant dye. An iron content of 5% w/w of the dry precipitate was analysed by photometry (1, 10-Phenanthrolinechloride). The content of total phenolics (TPH) calculated as gallic acid monohydrate equivalents according the Folin-Ciocalteau method, was determined with 45% w/w.

The dyestuff precipitate was tested in standard dyeing experiments. Shade and colour depth were found comparable to dyeings obtained with direct use of plant extracts. Use of a concentrated natural dye product offers new approaches with regard to standardisation of dyestuff quality, handling and applicable dyeing techniques. [Peter Leitner, Christa Fitz-Binder, Amalid Mahmud-Ali, Thomas Bechtol* (Research Institute of Textile Chemistry and Textile Physics of the University Innsbruck, Hoechsterstrasse 73, 6850 Dornbirn, Austria), Dyes and Pigments, 2012, 93(1-3), 1416-1421].

NPARR 3(3), 2012-0243, Dyeing of silk with natural plant extract from *Rhizoma picrorhiza*

A new concept that uses natural plant extract from Rhizoma Picrorhiza (RP) as a natural dye in silk dyeing was proposed. The RP extract can be adsorbed by silk to provide yellow to brown color, depending on the RP concentration. The stabilities of RP solution against pH, heat, and ultraviolet light were investigated. Factors such as pH, temperature, dyeing time, RP concentration were studied in order to understand the dyeing properties of RP extract for silk fabric. After dyeing, some of the samples are mordanted with different mordants. It was founded that RP extract was stable at acidic conditions and stable to heat and ultraviolet light, and the interactions between silk and RP extract molecules were non-electrostatic interactions; and that RP extract showed good building-up properties on silk. Furthermore, the colors of the dyed fabric mordanted with different mordants as well as their depth were greatly dependent on the chemical nature of mordants. In conclusion, RP was a potential natural dye which can be applied to silk dyeing [Sha Sha Sun, Jie Jie Wang and Ren Cheng Tang, Advanced Materials Research, 2012, 441, 155-159].
**Assessment of colorimetric, antibacterial and antifungal properties of woollen yarn dyed with the extract of the leaves of henna (Lawsonia inermis)**

The extract of leaves of henna was applied on woollen yarn to investigate the dyeing characteristics and antimicrobial efficacy against common human pathogens such as *Escherichia coli* MTCC 443, *Staphylococcus aureus* MTCC 902 and *Candida albicans* ATCC 90028. Bioactivity of henna dyed woollen yarn was compared with commercial antibacterial (Ampicillin) and antifungal (Fluconazole) agents. *Lawsonia inermis* dyed woollen yarn samples were found considerably active against tested microorganisms. Dyed wool yarns were tested for fastness toward light, washing and crocking (dry and wet). Fastness properties of dyed woollen yarn samples were found considerably good. Effect of eco-friendly metallic salt mordants on bioactivity and color characteristics of dyed woollen yarn samples were also investigated. The results proved that mordanted wool yarn showed increase in dye uptake resulting in high color strength and better fastness properties but considerable decrease in antimicrobial activity and slight decrease in the case of antifungal activity were observed with the application of mordants. [Mohd Yusuf, Aijaz Ahmad, Mohammad Shahid, Mohd Ibrahim Khan, Shafat Ahmad Khan, Nikhat Manzoor, Faqeer Mohammad* (Department of Chemistry, Jamia Millia Islamia (Central University), Jamia Nagar, New Delhi 110025, India), *Journal of Cleaner Production*, 2012, 27, 42-50].

**Dyeing silk with tea polyphenol**

Tea polyphenol (TP) was used to dye silk by the post-mordanting method using three different metal salts as the mordant; ferrous sulfate, copper sulfate and potassium aluminum sulfate. The results were analyzed in terms of color strength (K/S value) and fastness characteristics as well as the influence of variables such as dyeing time, temperature and pH on the color depth of the dyed sample. A weak acid medium and a low dyeing temperature were found to be optimal for adsorption of TP when dyeing silk with TP. Comparing the color

**Aluminium based dye lakes from plant extracts for textile coloration**

Production of concentrated natural dyes is a pre-requisite for a re-introduction of plant colorant based dyes into modern textile dyeing operations. Aluminium salts such as Al$_2$(SO$_4$)$_3$.14-15H$_2$O or KAl(SO$_4$)$_2$.12H$_2$O can be used to precipitate extracted plant dyes from aqueous extracts at pH 5.0-5.5. Onion peel, Canadian Goldenrod and pomegranate peel were studied as representative sources for dye extraction. As an average 5% w/w of the extracted dry plant material could be collected as precipitate. After dissolving these residues in diluted oxalic acid, the quality of the dye lake was characterised by photometric analysis of the total phenol content in the dry using the Folin-Ciocalteau method, determination of the aluminium content and measurement of the absorbance at 400nm. Representative values of TPH in the dry solid dyestuff range from 20 to 40% and representative values for the aluminium content were determined with 3-5% w/w. Colour strength of the dissolved lakes was determined in dyeing experiments using different substrates and mordants followed by measurement of CIELab coordinates and K/S value according Kubelka-Munk function. Compared to the direct use of plant extracts the colour strength of the lakes is lower, however chroma of the dyeings is higher, as the lake formation also represents a dye purification step. [Amalid Mahmud-Ali, Christa Fitz-Binder, Thomas Bechtold* (Research Institute of Textile Chemistry and Textile Physics of the University Innsbruck, Hoechsterstrasse 73, 6850 Dornbirn, Austria), *Dyes and Pigments*, 2012, 94(3), 533-540].
shade of dyed silk obtained with different metal salts as the mordant showed that ferrous sulfate gave the highest K/S value followed by copper and then aluminum. During the soaping colorfastness test, a relatively large color change was associated with increased color strength as well as non-staining of adjacent fibers [Hong Fei Qian, Ping Zhu, Gang Bai and Yan Chun Liu, *Journal Advanced Materials Research*, 2012, *441*, 83-87].