Whey-protein coating formulations on chocolate surface

The food scientists at Department of Food Science and Technology, University of California, United States compared four different whey-protein-isolate (WPI)/plasticizer formulations to determine which provided the most gloss and which was most stable with time when applied on chocolates. The 4 plasticizers studied were glycerol, polyethylene glycol 400 (PEG 400), propylene glycol (PG) and sucrose, all in a 1:1 ratio with WPI. Gloss stability was determined by measuring gloss fade over time using the Tricor Gloss Analysis System. WPI/sucrose coatings provided the highest and most stable gloss. With optimization, water-based WPI/sucrose coatings could be an alternative source of glaze to alcohol-based shellac coatings in the confectionary industry [Lee et al, J Food Sci, 2002, 67(3), 1121-1125].

Removal of malachite green dye

The scientists at Department of Environmental Science and Engineering, Garg Jambheshwar University, Hisar, India investigated removal of malachite green dye from aqueous solution by adsorption using agro-industry waste. During experiment adsorbents prepared from Prosopis cineraria Druce (Hindi — Khejri) sawdust—an agro-industry waste were used to remove the malachite green from an aqueous solution in a batch reactor. The adsorbents included formaldehyde-treated sawdust (PCSD) and sulphuric acid-treated sawdust (PCSDC). The effects of adsorbent surface change, initial pH, initial dye concentration, adsorbent mass and contact time on dye removal have been determined. Similar experiments were carried out with commercially available coconut based carbon (GAC) to evaluate the performance of PCSD and PCSDC. The adsorption efficiency of different adsorbents was in the order GAC>PCSDC>PCSD. Kinetic parameters of adsorption such as the Lagergren pseudo-first-order constant and the intra particle diffusion were determined. An initial pH of the solution in the range 6-10 was favourable for the malachite green removal for both the adsorbents. These experimental studies have indicated that PCSD and PCSDC could be employed as low-cost alternatives in wastewater treatment for the removal of dyes [Garg et al, Dyes & Pigments, 2004, 62(1), 1-10].

Optimization of wool dyeing procedure for some natural dyes

The conditions for dyeing of wool with the dye obtained from Madder roots (Rubia cordifolia Linn.) have been optimized. The conditions include concentration of dye, the extraction and dyeing time, concentration of mordants and the method of mordanting for wool fibers. The dyed samples were subjected to tests for fastness to light and washing. The optimum concentration of the dye was found to be 5 g per 100 ml of water, while the optimum extraction and dyeing time were found to be 120 minutes and 90 minutes, respectively. The simultaneous method of mordanting was observed to give the best results in terms of luster, depth of shade, evenness of the dye and the overall appearance.

The optimization of wool dyeing procedure, using dye from Rhododendron arboreum Sm. has also been done by scientists. The results of the studies revealed that 8 g of shade dried flowers are optimum to give maximum optical density of dye solution with 30 minutes being the optimum time for both dye extraction and dyeing [Agarwal & Gupta, Colourage, 2003, 50(10), 43-46; Sati et al, ibid, 2003, 50(12), 43-44].
Lac dye adsorption on cotton fibres by poly(ethyleneimine)

Cotton is the most common textile fibre in the world because it possesses many useful characteristics such as comfort,softness to the hand, has good absorbency, colour retention, good strength and is machine-washable. Raw cotton consists of about 96% cellulose and 4% waxes, pectin and other proteinaceous and plant materials.

Natural dyes are known for their beautiful and multi-hued shades. Therefore, they require a mordant to fix to the fabric, and prevent the colour from either fading after exposure to light or washing out. Mordants promote the binding of dyes to fabric by forming a chemical bridge from dye to fibre, improving the staining ability of a dye along with increasing its fastness properties. Mordants form insoluble compounds of the dye within the fibre. Currently, most dyeing processes use metallic mordants. The presence of certain functional groups in suitable positions in the dye molecule causes its coordination to the metal ion. Unfortunately, many of the metallic mordants are toxic, and have serious detrimental effect on the environment. Clearly, a new type of mordant is required.

Lac dye is a natural dye extracted from a secretion of the insect Coccus lacca (Laccifer lacca Kerr) and is widely used for colouring food and dyeing textile such as silk, cotton and wool. However, this natural dye has a limited usefulness in cotton dyeing, as it does not readily adsorb to (dye) cotton. Sorapong Janhom and others at Department of Chemistry, Faculty of Science, Chiang Mai University, Thailand and Department of Chemistry, Cardiff University, UK worked on the enhancement of lac dye adsorption on cotton fibres by poly(ethyleneimine).

Poly(ethyleneimine) (PEI)—a highly branched aliphatic polyamine PEI promotes adhesion between similar and dissimilar materials, enhances surface characteristics such as wettability, bondability, is toxicologically benign, and of opposite charge to the lac dye, makes PEI a suitable candidate for a mordant.

During experiment the bleached cotton yarn (100 g) were first washed in a bath containing 10 g of a long chain fatty acid sodium salt soap (C<sub>18</sub>H<sub>37</sub>COONa), 16 g of sodium carbonate, and 1000 g of water at 80-90°C for 1 hour. Following repeated rinsing under distilled water, the cotton fibres were air-dried. Stick lac was finely ground and heated in distilled water at the ratio 1:5 of stick lac to distilled water for 1 hour at 80°C to obtain the red solution of lac dye.

The effect of PEI on cotton dyeing with lac dye was studied. It was found that PEI enhances dye adsorption of cotton fibres and also decreases the dye desorption from fibres. The adsorption isotherm of lac dye on cotton fibres after treatment with PEI solution can be seen to be of Langmuir-type at low temperature. The effect of NaCl on adsorption and desorption of lac dye on cotton fibres are also studied. It is shown that NaCl increases the adsorption ability of lac dye on cotton fibres. However, the dye still shows a high desorption from cotton fibres. In addition, the ratio of lac dye reacted with PEI are determined. It was found that the ratio of mole of lac dye to mole of ethyleneimine is quite constant around 1 at pH lower than 7. But increases to ~3.5 when the PEI is bound to the cotton [Janhom et al, Dyes & Pigments, 2004, 63 (3), 231-237].

Application of lac dye on Tasar silk

Each year India produces 25,000 tonnes of sticklac, which yields about 1% of lac dye. Application of the lac dye on Tasar silk has been evaluated with various metal mordants. Various shades from pink to black were obtained with good washing fastness [Ghosh et al, Colourage, 2002, 49 (7), 37-40].
Dyeing of cotton with some single and mixture of natural dyes

The method of dyeing cotton with the roots of Goldendrop (*Onosma echioiides* C. B. Clarke) has been standardized by determining the optimum dyeing conditions, namely dye material concentration, dye material extraction and dyeing time, mordant concentration and mordanting method.

Application of single and mixture of selected natural dyes on cotton fabric has also been evaluated scientifically. During experiment cotton fabric was dyed with four different dyes, viz. turmeric, myrobalan, madder, red sandal wood using pre-, post- and simultaneous-mordanting techniques. Aluminium sulphate was used as a mordant. Some samples were also dyed with a combination of turmeric with madder or red sandal wood and a combination of myrobalan with madder or red sandal wood in different proportions. Selected mordanted and dyed samples were after-treated with a cationic dye fixing agent. Turmeric being a direct dye type, gave maximum colour strength when applied by the simultaneous-mordanting method, either singly or in combination with other dyes. Turmeric also showed poor wash fastness, which was improved to some extent by after-treatment with a cationic dye fixing agent and on combination of turmeric with other dyes of better fastness. Combined dye application of turmeric with the other dyes by the simultaneous-mordanting method resulted in a better shade development, as the observed colour strength values were always higher than the calculated or the expected values. However, myrobalan on combination with other dyes gave higher colour strength when applied by the post-mordanting method. In the case of the simultaneous-mordanting method, myrobalan did not show a synergistic effect in terms of the observed and calculated K/S values [Bains et al, J Text Assoc, 2003, 64(4), 183-186; Samantha et al, Colourage, 2003, 50(10), 29-42].

Weld a viable natural yellow dye

*Reseda luteola* Linn., commonly known as Weld or Dyer's Rocket, grown in gardens in India is lesser known for its yellow dye and medicinal properties. Scientists at Italy studied its agronomic potential as new crop for natural dyes in textiles production. It was observed that the luteolin amount was affected by climatic conditions as experienced in two different growing seasons and by the plant phenological stages at harvest. Genetic variability existed for the luteolin content in leaves plus reproductive structures (inflorescences and fruits) that varied from 13.6 to 28.7 mg/g dry wt in the six accessions tested.

During experiment the dry powder from leaves and reproductive structures was used in the dyeing of cotton, wool and silk yarns. Good and bright yellow colours were observed using a ratio 30:100 (w/w) of Weld on the textile materials. Separated Weld organs showed different dyeing capacities being the leaves, inflorescences and fruits the most effective ones. Weld showed a progressive decrease in resistance to fading going from cotton to the other kind of yarns. Finally, all dyed specimens exhibited good resistance to light and wash fastness making the use of Weld a viable alternative to synthetic yellow dyes [Angelini et al, Ind Crops Prod, 2003, 17(3), 199-207].