Surface and cross-sectional comparative study of natural indigo dyed cotton fabrics using Na$_2$S$_2$O$_4$ and monosaccharides as reducing agents in different alkaline solutions

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Abstract: Sodium dithionite (Na$_2$S$_2$O$_4$) is a conventional reducing agent for indigo dyeing with cotton in an alkaline solution, to reduce an indigo pigment to a water soluble leuco form. In this study, three monosaccharides (glucose, fructose and galactose) were studied as eco-friendly reducing agents to compare with Na$_2$S$_2$O$_4$. Two alkaline media: NaOH and Ca(OH)$_2$ were applied in the reducing system. The optimum conditions for reduction natural indigo were at 50°C and 30 min. The results showed that surface and cross-section of the dye cotton fabrics using Na$_2$S$_2$O$_4$ and monosaccharides as reducing agents in NaOH solution could give darker blue shade than in Ca(OH)$_2$ solution. In addition, color strengths (K/S) of fabrics in NaOH medium from glucose were higher than the ones from other reducing sugars and Na$_2$S$_2$O$_4$. On the other hand, Na$_2$S$_2$O$_4$ gave higher color strength fabrics than that from monosaccharides in Ca(OH)$_2$ solution. From the build-up study, shade depths of cotton fabrics increased as indigo concentrations in the dyebath were raised. Therefore, monosaccharides could effectively use as green reducing agents in NaOH solution for natural indigo dyeing on cotton fabrics.

Keywords: Natural indigo; Surface; Cross-section; Reducing agents; Monosaccharides