Colorfastness of Bicolor Sorghum Leaf Sheath on Hemp Fabric

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Background. Sorghum is a cereal grain grown for food and as feed for livestock in several countries, but sorghum bicolor (L.) Moench or red sorghum is grown as a dye plant in Africa (Kayode, et al., 2005). The leaf sheath of bicolor sorghum, characterized by its dark red color and shorter grain, was historically used to dye leather and woven cloth in Africa and was used as an industrial dye in Europe (Cardon, 2007). Today, bicolor sorghum is used as a food, hair and textile dye. Previous research on colorfastness of bicolor sorghum on wool and silk showed good colorfastness (Hou et al., 2017; Lu et al., 2005). Due to limited research of bicolor sorghum leaf sheath dye on vegetable fiber and interest in hemp as a sustainable fiber, this study evaluated the colorfastness and staining of hemp fabric dyed with bicolor sorghum leaf sheath dye to hand laundering.

Methods. Hemp fabric samples were pre-treated (i.e., mordanted) with three solutions: 10% gallnut and 5% aluminum acetate, 8% pomegranate and 5% aluminum acetate, and 5% aluminum acetate. Dye was extracted from the bicolor sorghum leaf sheath in a heated aqueous solution. Hemp samples were dyed in heated dye solutions, rinsed, and air dried. Dyed specimens were hand laundered following Monograph 6 Home Laundering, Hand Washing (AATCC, 2009). Colorfastness was evaluated for CIELab color difference using a Spectrocolorimeter and staining to adjacent fabrics was evaluated according to AATCC gray scale under the illuminant light TL84.

Results and Discussion. While the hemp fabric dyed a similar red-brown with each mordant treatment there was much color loss (i.e., gray scale rating of 1) upon hand laundering (see Table 1). This result indicated that hemp fabric had poor colorfastness to bicolor sorghum leaf sheath dye. Results of staining assessment showed slight staining on plant fibers, and noticeable staining on nylon and polyamide and silk fabrics which indicated poor absorption to vegetable fibers. Results of this study differs from the good colorfastness on wool and silk (Hou et al., 2017; Lu et al., 2005). This may be because animal fibers carry positive charges which strengthen their dyeing potential. This result corroborated with Kabir (2017) who also reported poor colorfastness of hemp fabric, but with reactive dye.

Conclusions. Hemp fabric dyed with bicolor leaf sheath was not colorfast to hand laundering, even with tannin pretreatments. Evaluation of other cellulose fibers and colorfastness to light are recommended. This study contributes to the understanding of sorghum as a dye for cellulose fibers.

Table 1
*L*a*b* Coordinates, Color Difference, and Gray Scale Rating (gs) between Control and Hand-Laundered Sorghum Dyed Hemp Fabric*

Treatment	Control			Laundered			ΔE	gs
	L	*a*	*b*	*L*	*a*	*b*		
Aluminum Acetate	48.1	26.7	21	62.3	15.7	15	19.0	1
Gallnut + Aluminum Acetate	49.4	24.8	20	62.3	13.6	15.5	17.7	1
Pomegranate + Aluminum Acetate	45.1	24.7	22.1	57.7	13.6	18.9	17.2	1

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