PENGARUH JUMLAH TEOS (TETRAETOKSISILAN) DAN JENIS BAHAN KAIN BATIK TERHADAP HIDROFOBISITAS KAIN TERLAPIS SILIKA/HDTMS (HEKSADESILTRIMETOKSISILAN)

INTISARI

Stepanus Fredi Manurung

09/283557/PA/12606

Kajian pengaruh jumlah TEOS dan jenis bahan kain batik (katun, blacu dan mori) terhadap hidrofobisitas kain terlapis silika/HDTMS telah dilakukan. Sintesis nanosol silika dilakukan dengan metode *sol-gel* menggunakan TEOS sebagai prekursor silika. TEOS dengan variasi 0,025; 0,050; dan 0,075 mol dilarutkan dalam campuran etanol-akuades dengan penambahan katalis NH_4OH pengadukan selama 2 jam. Pelapisan nanosol silika pada setiap jenis kain dilakukan dengan metode lapis celup *(dip-coating)* dengan laju tarik 3 cm/menit. Kain terlapisi nanosol silika dikeringkan pada suhu 80 °C selama 30 menit. Kemudian, kain terlapisi nanosol silika dicelupkan ke dalam larutan HDTMS 4% (v/v). Kain terlapisi silika/HDTMS selanjutnya dikeringkan dengan oven pada suhu 110 °C selama 10 menit. Pengukuran sudut kontak air dilakukan secara rekam *image* dengan kamera DSLR Canon berlensa Thamron 100mm. Setiap kain sebelum dan setelah pelapisan dikarakterisasi menggunakan *X-Ray Diffraction* (XRD), *Fourier Transform Infra Red Spectroscopy* (FTIR), dan *Scanning Electron Microscopy* (SEM). Karakterisasi nanosol silika dilakukan menggunakan *Transmission Electron Microscopy* (TEM). Parameter kain hidrofobik dilakukan pada sudut luncur 10°.

Pola XRD kain menunjukkan karakter puncak selulosa sebagai bahan dasar kain (bidang difraksi (101) di 15^o, $(10\bar{1})$ di 17^o, puncak minimum amorf di 19^o dan bidang (002) di 22^o). Berdasarkan citra TEM, distribusi ukuran nanosol silika berada pada rentang ukuran 15-115 nm dengan diameter partikel rata-rata sebesar 84,80 ± 0,085 nm. Hasil spektra FTIR setelah pelapisan nanosol silika menunjukkan peningkatan intensitas puncak pada bilangan gelombang 1103 cm^{-1} (vibrasi ulur Si-O dari Si-O-Si) sebagai indikasi pelapisan silika. Setelah pelapisan HDTMS, muncul puncak baru pada bilangan gelombang 2854 cm^{-1} dan 2916 cm^{-1} (vibrasi ulur dan tekuk C-H). Peningkatan jumlah TEOS meningkatkan sudut kontak air pada permukaan kain. Sudut kontak terbesar diperoleh pada jumlah TEOS 0,075 mol dengan sudut kontak permukaan pada kain katun, blacu dan mori berturut-turut adalah 135,8°, 136,2°, dan 133,9°. Kecepatan alir air pada kemiringan 10° terhadap tetesan air pada kain katun, blacu dan mori ialah 3,3; 6,0 dan 5,0 m/detik.

Kata kunci: selulosa, TEOS, nanosol, hidrofobik, heksadesiltrimetoksisilan

THE EFFECT OF TETRAETHOXYSILANE (TEOS) AMOUNT AND THE TYPE OF BATIK FABRIC ON THE HYDROPHOBICITY OF FABRIC-COATED SILICA/HDTMS

ABSTRACT

Stepanus Fredi Manurung

09/283557/PA/12606

The study of the effect of TEOS amount and the type of Batik fabrics (cotton, *blacu*, *mori*) on the hydrophobicity of the fabric-coated silica/HDTMS has been done. Silica nanosol has been synthesized through sol-gel method using TEOS as the silica precursor. TEOS with various amount of 0.025; 0.050; and 0.075 moles was dissolved in a mixture solvent of ethanol-aquadest under stirring for 2 h during drop-wisely addition of NH_4OH catalyst. The coating of silica onto the surface's fabrics was performed by dip-coating method with withdrawn rate of 3 cm min^{-1} and drying at 80 °C for 30 min. The coated fabrics were then dipped in the HDTMS 4% (v/v) and dried at 110 °C for 10 min. The contact angle of the fabric's surface was measured through image-recording using Canon camera with lens of Tamron 100 mm. The un- and coated fabrics were then characterized using X-Ray Diffraction (XRD), Fourier Transform Infra-Red Spectroscopy (FTIR), and Scanning Electron Microscopy (SEM). The silica nanosol was examined by Transmission Electron Microscopy (TEM). The water flow rate as the hydrophobicity parameter was measured at surface's sliding angle of 10°.

The XRD patterns of the fabrics showed characteristic peaks of cellulose at 15, 17, 19 and 22^o (diffraction space of 101, $10\bar{1}$, minimum of amorphous peak and diffraction space of 002, respectively). Based on TEM image, the size of silica nanosol was ranging from 15-115 nm with average at 84.80 ± 0.085 nm. The FTIR spectra of the coated fabrics showed increasing peak at 1103 cm^{-1} (stretching vibration of Si-O from Si-O-Si) indicating silica coating. The second layer of HDTMS was confirmed by the appearance of new peaks at 2854 cm^{-1} and 2916 cm^{-1} (stretching and bending of C-H, respectively). Increasing the amount of TEOS has increased the water contact angle on the surface's fabrics with the highest at 0.075 moles (the contact angle of cotton, *blacu* and *mori* at 135.8, 136.2 and 133.9°, respectively). The water flow rates on the surface of cotton, *blacu* and *mori* at sliding angle of 10° were 3.3; 6.0; and 5.0 m s^{-1}, respectively.

Keywords: cellulose, TEOS, nanosol, hydrophobic, hexadecytrimethoxysilane