

Izvirni znanstveni članek *Original Scientific Paper*

Lidija Černe¹, Barbara Simončič¹, Odon Planinšek²

¹Univerza v Ljubljani, Naravoslovnotehniška fakulteta, Oddelek za tekstilstvo, Snežniška 5, 1000 Ljubljana, Slovenija/University of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Textiles, Snežniška 5, SI-1000 Ljubljana, Slovenia

²Univerza v Ljubljani, Fakulteta za farmacijo, Aškerčeva 7, 1000 Ljubljana/ University of Ljubljana, Faculty of Pharmacy, Aškerčeva 7, SI-1000 Ljubljana, Slovenia

Uporaba Zismanovega modela za določitev kritične površinske napetosti apretiranih vodo- in oljeodbojnih tekstilij

The use of Zisman model in determining the critical surface tension of the water and oil repellent finished textiles

Namen raziskave je bil preučiti uporabnost Zismanovega modela za določitev kritične površinske napetosti, γ_c , apretiranih vodo- in oljeodbojnih ploskovnih tekstilij. V raziskavo sta bili vključeni dve bombažni tkanini v vezavah keper in platno, ki sta bili apretirani z olje- in vodoodbojnim sredstvom na podlagi fluorooogljikovih polimerov ter kombinacijo olje- in vodoodbojnega ter vrhunskega apreturnega sredstva. Na tkaninah so bili izmerjeni statični in dinamični stični koti različnih *n*-alkanov, njihove vrednosti pa skupaj uporabljene za grafično določitev γ_c . Po pričakovanju so najnižje vrednosti γ_c pripadale tkaninam apretiranim s fluorooogljikovimi polimeri. Dodatek vrhunskega apreturnega sredstva v apreturi kot tudi povečanje odprte površine tkanine sta povzročila povečanje vrednosti γ_c . Tudi s pranjem apretirane tkanine se je vrednost γ_c povečala, kar pomeni, da se je njena odbojnost zmanjšala. Termična obdelava po pranju, ki je bistveno pripomogla k boljši urejenosti apreturnega filma, je vplivala na ponovno znižanje vrednosti γ_c in s tem na ponovno povečanje odbojnosti tkanine. Smiselno dobljenih rezultatov je potrdila možnost združitve vrednosti statičnih in dinamičnih stičnih kotov kljub različnim načinom njihove določitve in s tem uporabnost Zismanovega modela za grafično določitev vrednosti γ_c apretirane ploskovne tekstilije.

Ključne besede: ploskovna tekstilija, vodo- in oljeodbojna apertura, kritična površinska napetost, Zismanov model, stični kot, goniometrična metoda, metoda tankoplastnega pronicanja.

*The object of this research was to investigate the use of Zisman model in determining the critical surface tension, γ_c , of finished water and oil repellent textiles. The research included two cotton fabrics in plain and twill weave, which were finished with oil and water repellent finish based on fluorocarbon polymers, as well as with a combination of oil and water repellent and easy-care finishes. The static and dynamic contact angles of the *n*-alkanes were measured on the textiles and combined to graphically determine the value γ_c . As expected, the lowest values of γ_c were obtained for fabrics treated with the fluorocarbon polymers. The addition of the easy-care finish as*

well as the increase in open surface within the fabric, both increased the value γ_c . The value of γ_c also increased with washing of the chemically finished fabrics, what indicates the lowering of its repellency. Heat treatment after the washing, which dramatically contributed towards better distribution of the finishing network, once again contributed to reduction of the value γ_c . The consistency of the results obtained confirmed the possibility of joining the values of static and dynamic contact angles, despite the differences in their methods of acquisition, and hence also confirmed the validity of Zisman model to graphically determine the value γ_c of finished flat fabrics.

Key words: flat textile, oil and water repellent finish, critical surface tension, Zisman model, contact angle, goniometry, thin-layer wicking

Izvirni znanstveni članek *Original Scientific Paper*

Sonja Šostar-Turk¹, Reinhold Schneider², Irena Petrinčič¹

Rebeka Fijan¹

¹Univerza v Mariboru, Fakulteta za strojništvo, Inštitut za inženirske materiale in oblikovanje, Smetanova ulica 17, 2000 Maribor, Slovenija/University of Maribor, Faculty of Mechanical Engineering, Institute of Engineering Materials and Design, Smetanova ulica 17, 2000 Maribor, Slovenia

²Institute for Textile Chemistry and Chemical Fibers (ITCF), Koerschtalstr. 26, 73770 Denkendorf, Nemčija/Institute for Textile Chemistry and Chemical Fibers (ITCF), Koerschtalstr. 26, 73770 Denkendorf, Germany

Ekološke alternative v konvencionalnem postopku barvanja z reaktivnimi barvili

Ecological alternatives in the conventional process of dyeing with reactive dyes

V raziskavi smo v tekstilni tovarni izbrali dve recepturi za barvanje bombažne tkanine z reaktivnimi barvili ter proučili količino in kakovost tekstilnih pomožnih sredstev. Receptura smo modificirali, da bi nevarne kemikalije nadomestili z ekološko prijaznejšimi produkti. KPK vrednosti so pokazale nižjo obremenitev izpiralnih odpadnih voda po barvanju bombaža z modificirano recepturo, kakor tudi višjo biorazgradljivost v primerjavi z izpiralnimi odpadnimi vodami po barvanju bombaža z nemodificirano recepturo, pri čemer je obstojnost barv ostala nespremenjena. Razen tega smo izvedli izboljšanje konvencionalnega izpiranja bombaža, barvanega z reaktivnimi barvili, po modificirani recepturi z uporabo inventivne tehnologije, imenovane „vroče pranje“. Pri kontroli izpiralnega procesa se je pokazal prevladujoč vpliv temperature na lastnosti izpiranja barvila. Uporaba procesa „vročega pranja“ po reaktivnem barvanju pomeni prihranek vode in časa ter izboljšanje barvnih obstojnosti.

Ključne besede: barvanje, reaktivno barvilo, bombaž, „vroče pranje“, ekologija

Two dyeing recipes from a textile factory were studied, focusing on the quantity and quality of the added textile auxiliaries. The recipes were modified to replace hazardous chemicals with environ-

mentally-friendly products. The COD values indicated that wastewaters resulting from the wash-off process of cotton dyed with modified recipes have a lower waste water load and simultaneously a higher degradable capacity, with the same fastness properties as textiles dyed with the original recipes. Additionally, improvement in conventional washing was attained using an innovative rinsing technology, called 'hot-washing', after cotton dyeing using a modified recipe. The temperature was a predominant influence on the removal properties of dyestuff and textile auxiliaries. Application of the 'hot-washing' process after reactive dyeing resulted in water and time savings, and an improvement in the fastness properties.

Keywords: dyeing, reactive dye, cotton, 'hot-washing', ecology

Strokovni članek *Professional Paper*

Tomaž Završnik

Dražgoška 3, 4000 Kranj, Slovenija/Dražgoška 3, SI-4000 Kranj, Slovenia

Čiščenje tekstilij v tekočem CO₂

Textile cleaning in liquid CO₂

Članek obravnava sedanje razmere pri čiščenju tekstilij v tekočem, komprimiranem ogljikovem dioksidu. Najprej poda opis danes še uporabnih, običajnih vrst postopkov mokrega (pranja) in suhega (kemičnega) čiščenja tekstilij in pregled uporabe čistilnih topil v svetu. Potem podrobno predstavi tehnologijo čiščenja tekstilij v tekočem CO₂, opiše topilo CO₂ in njegove lastnosti, pridobivanje le-tega in njegove naravne vire, dosednji razvoj tega postopka in samo tehnologijo čiščenja v CO₂ z njenimi prednostmi in slabostmi. Potem pojasni vlogo vode in ojačevalca (tenzida) v sistemu in ekološki vidik postopka, obstojnosti tekstilij pri tem načinu čiščenja in končno problem izdelave primerne strojne opreme. V sklepu poda primerjavo čistilnih topil po različnih med seboj primerljivih elementih, kot npr. njihovo uporabnost, ustreznost, strojno opremo in ekološki vidik, sledi pregled nekaterih alternativnih čistilnih sredstev, ki so zdaj na trgu. Članek konča s kritičnim pogledom na današnji razvoj doslej še vedno nedodelane nove tehnologije.

Ključne besede: komprimirani, nadkritični, tekoči CO₂, perklorreten (PER), organska ogljikovodikova topila, ekologija CO₂, ojačevalci čiščenja, alternativna čistilna topila

The paper deals with the situation in the technology field of textile cleaning in liquid compressed carbon dioxide. The description of standard procedures, which are still in use today, such as wet cleaning (washing) and dry (chemical) cleaning of textiles, and the overview of cleaning solvents used worldwide, is followed by a detailed presentation of the technology of textile cleaning in liquid CO₂ with all its advantages and disadvantages. The role of water and of an intensifier in the system, the ecology aspect of the procedure, fastness of textiles to this type of cleaning, and the problem of manufacturing appropriate hardware are explained. In the conclusion, the comparison between cleaning solvents by various, comparable elements,

such as their applicability, suitability, hardware and ecology aspect is given, and certain alternative cleaning agents available in the market overviewed. The paper ends with a critical view over the existing state of the development of this new technology.

Key words: compressed, supercritical, liquid CO₂, perchlorethylene (PER), organic hydrocarbon solvents, ecology of CO₂ cleaning intensifiers, alternative cleaning solvents

Strokovni članek *Professional Paper*

Tomaž Završnik

Dražgoška 3, 4000 Kranj, Slovenija/Dražgoška 3, SI-4000 Kranj, Slovenia

Uredba REACH od ideje do njene dokončne veljavnosti

REACH regulation – from idea to adoption

Predstavljena sta potek uveljavljanja in postopek sprejemanja nove evropske uredbe o kemikalijah, imenovane REACH, sistem nadzora nad kemikalijami in kemičnimi izdelki. Najprej je opisan potek obravnavanja in sprejemanja uredbe po kronološkem zaporedju in predstavljeni glavni elementi sistema REACH. Temu sledi opis predvidenih posledic in vplivov nove uredbe na proizvajalce in uporabnike kemičnih snovi; osredotoči se predvsem na to, kako bo ta uredba vplivala na stroške, proizvodnjo, varovanje intelektualne lastnine in konkurenčnost. Podrobno predstavi tudi predlog za spremembo osnutka te uredbe, ki so jo pozneje sprejeli in upoštevali v novi uredbi. Na koncu povzame vsebino te uredbe in razčleni predvsem tiste anekse le-te, ki urejajo varovanje zdravja in okolja uporabnikov in zaposlenih, kar je sploh glavni cilj nove uredbe.

Ključne besede: evropska uredba o kemikalijah, sistem REACH, registracija, evalvacija, avtorizacija kemikalij, bela knjiga o kemikalijah, tveganja, celotna veriga uporabnikov, kemikalije, ki povzročajo tveganja.

The author presents the new European regulation on chemicals called REACH – the system of control over chemicals and chemical products. The description of discussion and adoption of the regulation in chronological order and the presentation of main elements of the REACH system is followed by the description of its expected consequences and influences on producers and users of chemical substances by focusing to its influence on costs, production and protection of intellectual property. The proposal for modification of the draft, which was later adopted and considered in the new regulation, is described in detail. At the end, the contents of the regulation are summarized. Its annexes regulating the protection of users' and employees' health and their environment, which is after all the main objective of the new regulation, are analysed.

Key words: European regulation on chemicals, REACH system, registration, evaluation, authorisation, Chemicals White Book, risks, down-stream users, harmful chemicals