Topic № 1
FIBRES AND YARNS; CHEMICAL TECHNOLOGIES; NANOTECHNOLOGIES


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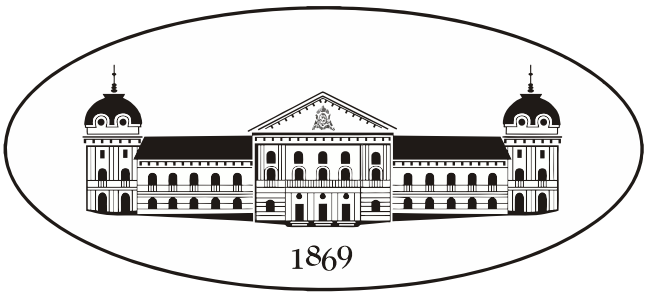
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STUDY ON FLAME RETARDANT FINISH FOR POLYESTER FABRIC

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Introduction

Poly(ethylene terephthalate) (PET) fiber has many desirable properties such as high tensile strength, dimensional stability, high light fastness and resistance to many chemicals. These advantages make it have a wide range of applications especially for interior textiles. Unfortunately, its LOI is only 20-21 <21 and it is classified as a very flammable textile fiber (those with LOI ~ 21.0–25.0 are moderately flammable and generally if LOI > 25.0, textiles start to pass various national and international standard tests for fl ame retardant textiles). Nowadays, to make fire retardant polyester fabric, one can use flame retardant polyester yarn or flame retardant treatment for polyester fabric. In this study, Cetaflam PDP 30 of AVOCET, An Organo-phosphonate ester flame retardant (a non halogen flame retardant for polyester fabric) was used as a flame retardant agent. One bath, pad-dry-cure technique was used to finish fabrics. The flammability, tensile strength and dimensional stability of the fabric after treatment is compared with these properties of the un-treated fabric to clarify the effectiveness of the treatment and their influence on the physico-mechanical properties of the fabric.

Experimental

Polyester woven fabric with mass of 170g/m^2 was supplied by Namdinh Textile Company

Cetaflam PDP 30 of AVOCET was supplied by Tan Hong Phat Company

Method: One bath, pad-dry-cure technique was used to finish fabrics. The study was conducted with 17 experiments differed in curing conditions and concentration of padding solution, while all other parameters were the same for all experiments.

These 17 experiments were designed according to the central composite designs for 3 factors

After treatment, the samples were stored at standard condition for 24h before the different tests.

Assessment of treated fabric's properties: the real uptake of recipe chemicals on fabric, the vertical flammability characteristics of the untreated, finished fabrics. Tensile strength of the untreated and finished fabric was determined. The shrinkage of the fabric due to the processing is also determined. Based on the experimental results, the optimal parameters of the flame-retardant treatment for poyester fabric were determined

Results

The results show that the optimal parameters of the flame-retardant treatment for poyester fabric are the highest concentration of CETAFLAM PDP 30, the lowest curing temperature and the longest curing time.

Conclusion

CETAFLAM PDP 30 is an effective flame-retardant agent for polyester fabric. The disadvantage of this chemical is that the curing step must be at high temperature for a long time. This will shrink the fabric and reduce its tensile strength. To alleviate these constraints, the heating process should be conducted at the lowest temperature possible and prolong the heating time to ensure the necessary chemical reactions can occur.

Keywords: PET fabric, Cetaflam PDP 30, flame-retardant, pad-dry-cure technique

UDC677

COMPOSITE TEXTILE-HYDROGEL MATERIAL FOR CONTOL RELEASE OF VITAMIN B12

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Introduction

Vitamin B12, also known as cobalamin, is a water-soluble compound and plays important role in the haematological and nervous systems. Both deficiency and excess of this vitamin can lead to negative dermatological action. Control release and delivery is an important mechanism for providing its effective dose over a period of time. Hydrogels offer an ideal solution for this task and also provide simultaneous moisturizing of the skin. In recent years, our research has been focused on the production of textile materials modified with hydrogel with sensor and antimicrobial properties [1,2]. The present study has been used a previously developed technique for modification of cotton fabric with hydrogel. The following parameters for the preparation of the hydrogel (the amount of crosslinking monomer and the amount of hydrogel on the cotton surface) have been changed to find the most suitable structure providing adequate loading and releasing of vitamin B12 under appropriate physiological conditions (temperature and pH).

Experimental part

100% cotton fabric; acrylamide (Fluka AG); *N,N`*-methylene-bis-acrylamide, *N*-methyldiethanolamine, methylcobalamin B12 (Sigma Aldrich); modified eosin Y [1]; phosphate buffer (pH 7.4), prepared with sodium dihydrogen phosphate dihydrate and di-sodium hydrogen phosphate dodecahydrate (Valerus). The preparation of the cotton fabric-hydrogel composite materials was carried out in two steps, comprising dyeing a cotton fabric with modified Eosin Y and its modification with a hydrogel by photopolymerization of monomers. The composites have been prepared by dipping in vitamin solution for 36 h at room temperature and characterized by the obtained gel fraction and their swelling in water. The *in vitro* studies have been carried out in phosphate buffer pH 7.4 at 37 oC and with UV-visible spectroscopy the loading and releasing of vitamin B12 have been followed.

Results and discussion

The gel fraction increases with increasing the amount of acrylamide and crosslinker. The swelling is more pronounced in less crosslinked and thinner hydrogel layer. The samples that absorb the largest amount of water also absorb and released the largest amount of the vitamin, as it is well water-soluble.

Conclusions

New composite materials have been obtained which can be used as carriers of vitamin B12 and for its steady release under physiological conditions. This process can be regulated by altering the structure of the resulting hydrogel, such as hydrophilicity, degree of swelling, and pore size.

Keywords: cotton fabric; hydrogel; vitamin B12, drug release

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UDC678

INORGANIC-ORGANIC HYBRID COATINGS AS FLAME RETARDANT TEXTILE FINISHING

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The conventional treatments of halogen, nitrogen, and organic-phosphorus compounds act as flame retardants because they prevent the formation of flammable volatiles, isolate the flame from oxygen/air supply, release flame inhibitors, influence the pyrolysis reaction, and increase the formation of char. They are characterized with excellent fire resistance properties, but the drawbacks are their non-environmental and toxic nature. In recent years, the purposeful design of hybrid materials permits to tailor their functional characteristics. The combination of both inorganic and organic components can fulfil all technological needs for different applications.

The aim of this review is to summarize the advantages and disadvantages of the most promising organic and inorganic flame retardants used in textile processing.

The organic biomacromolecules (whey proteins, caseins, hydrophobins, and deoxyribonucleic acid) have been shown their potential as environmentally-friendly, biodegradable intumescent materials, which are able to grow and increase in volume against the heat. However, their disadvantage is the blockage of fabric porosity by higher viscosity, deterioration of physiological comfort and mechanical properties.

In general the metal hydroxides (magnesium hydroxide, [Mg(OH)2] Ca(OH)2, Al(OH)3) have been extensively used in halogen-free flame-retardant as cost effective and an environmentally friendly, with low toxicity additives. They are decomposing endothermically and converted from metal hydroxides to metal oxides and water molecules. Water molecules ensure that the oxygen concentration around the burning material is lowered and the flammable gases diluted, reducing the intensity of the fire. They are normally smoke suppressants and work predominantly in the condensed phase of combustion. The metal oxide forms a layer on the textile material and thus impedes burning.

Recently silicone-based compounds have been used in the design of flame-retardant textiles because of their promising properties and environmental friendliness. The ceramic layer is a thermal shielding barrier to oxygen, flame and heat. The siliceous char hinders the formation of volatile species that lead to further textile degradation. However the typical textile structure interfere the shielding effect.

These shortcomings can be overcome by developing methods for the simultaneous application of different flame retardants in order to achieve a synergistic effect.

Keywords: flame retardants, hybrid materials, textiles, coatings

UDC677

NEW POLY(PROPYLEN IMINE) DENDRIMER MODIFIED WITH ACRIDINE AND ITS CU(II) COMPLEX. SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL ACTIVITY

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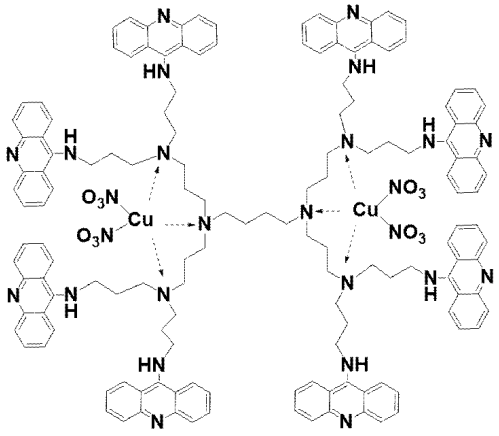
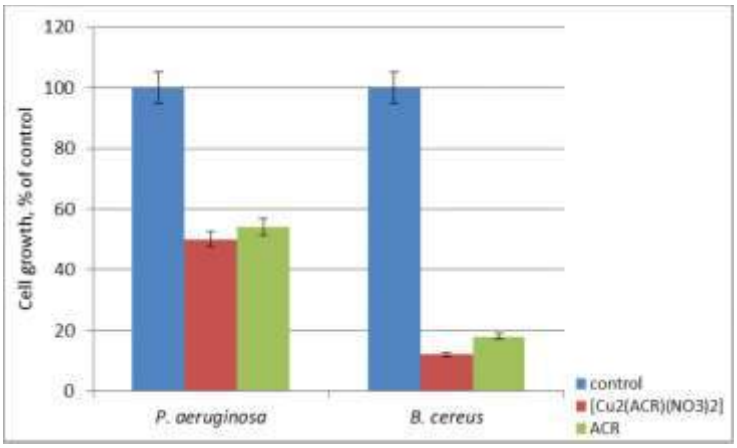
For the first time acridine has been used for the modification of a poly(propylene imine) dendrimer (ACR). The new fluoresent dendrimer has been used as a ligand to obtaine its Cu(II) complex $[Cu_2(ACR)(NO_3)_2]$. EPR, FTIR and fluorescence spectroscopy has been used to confirme the structure of metallodendrimer. It has been found that two copper ions are included into the dendrimer core by coordination with the inner tertiary nitrogen atoms. The basic photophysical characteristics of dendrimer have been examined in different organic solvents, and a negative fluorescence solvatochromism has been observed. The antimicrobial activity of dendrimers has been tested *in vitro* against some model Gram-positive and Gram-negative bacteria and yeasts. The results demonstrated enhancement in the antimicrobial activity of acridine dendrimer via complexation with Cu(II) ions against *B. cereus* and *C. lipolytica*. Deposition of dendrimers on the surface of cotton fabric has led to an increase in hydrophobicity of the textile. That prevents the formation of bacterial biofilm and makes these compounds useful for the production of antibacterial cotton fabrics.





***Scheme**:* Chemical structure of $[Cu_2(ACR)(NO_3)_2]$ and Reduction of the growth of model bacteria by untreated (control) and treated cotton fabrics

Keywords: Dendrimer; Metallodendrimer, Acridine; Antimicrobial activity; Antibacterial cotton fabric

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UDC679

ANTIMICROBIAL COATINGS OF TEXTILES IN THE FOOD INDUSTRY

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Microorganisms are found everywhere in the world and most of them cause infectious diseases in humans such as viruses, fungi, pathogenic bacteria and etc. The Good Hygiene Practices and Good Manufacturing Practices in food industry are based on process control, where antimicrobial protection gaining interest from many years. Antimicrobial textiles need to be used to protect the health of consumers, workers and the integrity of the entire business.

A wide spectrum of bacteria *Bacillus cereus, Listeria Monocytogenes, Salmonella enteric, Escherichia Coli*, *Staphylococcus aureus* and etc. were responsible for many food borne epidemics with high hospitalisation and mortality rates worldwide, especially affecting young, old, pregnant, immunosuppressed people. The transporting belts, work clothes, textile cleaning and packing materials must have suitable antimicrobial treatment. Coatings applied to textile materials have many advantages, such as inhibiting the spread of germs, controlling infections, controlling odors, wound healing, and more.

The purpose of this review is to summarize the most important requirements for antimicrobial treatment of textile materials applied in food industry. These finishes reduce the risk of spreading infectious diseases and minimize hygiene problems.

The specificity of production determines the requirements for antimicrobial coatings as bacteriostatic and with preventive action in a biofilm formation. In addition, they must be insoluble in water and not separated from the treated surface to avoid contamination of food by antimicrobial agents, affecting health of both consumers and workers.

They must be resistant under conditions of use as friction, different temperature treatments and cleaning agents. It is important to achieve adequate level of disinfection, hygiene in the washing and prevention the recontamination of textiles or wastewater systems with viable micro-organisms, which can be responsible for antimicrobial resistance.

The most important antimicrobial agents with strong antimicrobial activity and safety, durability and chargeability are the N-halamines. Polybiguanides are specifically used as a cleaning agent in the food industry as 20% aqueous solution. Natural by-products of plant secondary metabolites can also be used as antimicrobial agents for textile processing. Photocatalytic nanoparticles, quaternary ammonium compounds and etc. have demonstrated strong antibiofilm effects against important human pathogens as well.

Keywords: food industry, antimicrobial, biofilm, coatings, textile

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UDC677

A NEW ERA OR ALREADY CURRENT MANUFACTURING PROCESS. A SUPERCRITICAL Co_2 AND THE TEXTILE CHEMISTRY

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The textile chemistry involves the processes for pretreatment (sizing, desizing, scouring, bleaching) dyeing and finishing (antishrinking, antimicrobial, different surface modification, etc.) of textile materials. At present all applied methods in textile production need a pure water and produce a large amount of wastewater, containing sodium chlorite, soda ash, hydrogen peroxide, dyes, detergents, polymers and other chemicals. The multiple aqueous rinsing and washing is also required. Developments of water-free manufacturing processes are essential for the textile industry due to ecological and economical reasons.

Many studies have been proved supercritical carbon dioxide ($scCO_2$) as a green alternative of water. It is an inexpensive, in abundance, non-flammable, relatively non-toxic, environmentally friendly and chemically inert. It is a good solvent for hydrophobic substances.

It has a higher diffusion rate and viscosity as a gas, which leads to shorter processing time. Sc-CO_2 exhibits density and solvating power similar to liquid solvents and this reducing requires chemicals and auxiliaries, energy consumption and air emissions. At the end of the processes both the used chemicals and solvent can be easily and completely recycled.

The benefits of changing processing methods are undoubted. However, issues related to their mass industrial deployment are of interest. Replacing water with another fluid leads to a significant change in the traditional views and knowledge about the textile processing.

It is important to study the interaction of a number of parameters in order to make these long-known technologies commercially available. These are pressure; temperature; carbon dioxide flow, chemical structure and dye concentration; type of fibers, treatment time and etc. Many questions are still stay without answer about relationship structure-solubility of dyes or of the other textile processing chemicals in supercritical carbon dioxide.

The initial capital costs related with the equipment for compressing CO_2 in a dense state are higher, but the return on the investment is expected to be excellent for both the shareholders and the society. Are the textile industry and the scientific community in Bulgaria ready to face these new challenges and restore their previously forgotten fruitful cooperation?

The purpose of this article is to introduce technologies using super-critical carbon dioxide as an important element in sustainable textile production and consumption.

Keywords: supercritical carbon dioxide, textile chemistry, sustainable production

Acknowledgements:
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UDC678

NOVEL NON-WOVEN MATERIALS FROM BIO-SOURCED POLYMERS PREPARED BY ELECTROSPINNING

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Introduction

Recently, the progress in the field of nanotechnology has enhanced the interest of researchers and industry in composite materials, especially those based on biodegradable polymers. Fibrous nanomaterials possess specific properties related to their size and their exceptionally large specific surface area and porous structure. The cutting edge technology electrospinning is currently considered to be the most effective and promising method for fabrication of such fibrous materials.

Experimental part

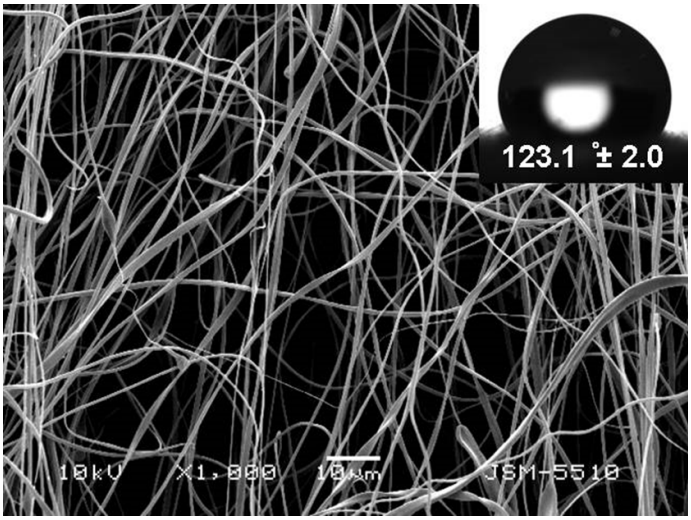
Cellulose acetate (CA, Aldrich) with Mn = 30 000 g/mol and DS 39.8%, was used. Poly(L-lactide) (PLLA, Mw = 152 000 g/mol, Fluka), poly(ethylene glycol) (PEG, Mr 900-2 200 g/mol, Fluka), poly(ethylene oxyde) (PEO, Mv = 800 000 g/mol) and high-molar mass chitosan (HMW, Mw = 600 000 g/mol, Sigma, degree of deacetylation 80%) were used. Acetone and chloroform were of analytical grade of purity and was purchased from Sigma-Aldrich.

Results

In this respect, among the polymers from renewable sources, polyesters and polysaccharides deserve special attention. Conditions for preparation of biodegradable and bioactive fibrous materials based on cellulose acetate (CA), polylactic acid (PLA) and chitosan were found. The surface morphologies, optical and mechanical properties of the fibrous materials were characterized by using scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), ultraviolet - visible spectroscopy (UV-Vis), water contact angle measurements and mechanical tests.

Discussion

Our findings reveal that the viscosity of the spinning solutions and the morphology of the obtained fibrous mats were greatly influenced by the used polymer, solvent and the solution concentration. Suitable conditions for the preparation of defect-free fibers from CA, PLA and chitosan-containing solutions were found. Potential application of the obtained materials was proposed.



Conclusion

The key parameters influencing the morphology of fibrous mats of CA, PLA and chitosan were determined.

Keywords: cellulose acetate, PLA, chitosan, electrospinning

Acknowledgments: Financial support from the Bulgarian National Science Fund (Grant KP-06-OPR03/2) is gratefully acknowledged.

UDC678

ELECTROSPUN NON-WOVEN TEXTILE CONTAINING THE BIOFLAVONOID QUERCETIN

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Introduction

In recent years, the health concerns associated with the side effects of synthetic compounds used in cosmetics, medicine, and food industry and the emergence of antibiotic resistance of pathogens have driven electrospinning research towards the development of nonwoven textiles encapsulating plant extracts. Quercetin, a bioflavonoid, present in some fruits and vegetables, possesses antioxidant, anticancer, anti-inflammatory, antidiabetic and neuroprotective properties.

In the present study, fibrous materials containing quercetin (QUE) were prepared by electrospinning of cellulose acetate/polyethylene glycol/QUE solutions.

Experimental part

Cellulose acetate (CA, Aldrich) with Mw = 30,000 g/mol and acetyl groups content of 39.8 wt.%, polyethylene glycol (PEG, Fluka) with (Mr = 1,900-2,200 g/mol) and quercetin (QUE, ?95%, Sigma-Aldrich) were used. Acetone (Sigma-Aldrich) of analytical grade of purity was used as received. Custom-made electrospinning equipment was used.

Results

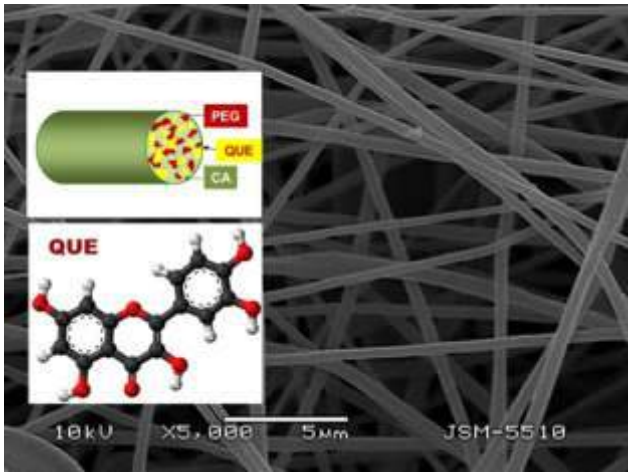
Suitable electrospinning conditions for obtaining the novel fibrous CA/PEG/QUE materials were found. The morphology of the electrospun materials was evaluated by SEM. The experimental results showed that fibers with mean fiber diameter of 390 ± 150 nm were obtained at total polymer concentration of 10 wt%, CA/PEG ratio of 80/20, and 10 wt% QUE in respect to polymers. The presence of QUE in the polymer matrix was confirmed by FT-IR analysis. XRD and DSC analyses were performed as well. The antioxidant activity of the quercetin-containing fibrous materials was studied by the DPPH radical scavenging method.

Discussion

The results from the DSC and XRD analyses show the absence of Tm for QUE as well as the absence of diffraction peaks for QUE in the CA/PEG/QUE fibers thus indicating that QUE is in amorphous state. Antioxidant activity tests have revealed that the quercetin-containing fibrous mats exhibit high antioxidant activity.

Conclusion

In this study it has been shown that the bioflavonoid quercetin may successfully be incorporated in cellulose acetate-based fibers. The obtained nonwoven materials are promising for biomedical applications.



Keywords: Cellulose acetate, nonwoven textile, quercetin, electrospinning, antioxidant properties

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UDC677

NOVEL ANTIBACTERIAL AND ANTIOXIDANT ELECTROSPUN NONWOVEN TEXTILE FROM BIOCOMPATIBLE POLYMERS AND COMPOUNDS OF PLANT ORIGIN

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Introduction Phenolic compounds and plant extracts are highly attractive for application in medicine and pharmacy due to the set of their beneficial biological properties (antioxidant, anticancer, anti-inflammatory and antimicrobial activities) [1]. When included in nanofibrous materials, such compounds may impart them beneficial properties. Therefore finding routes to prepare fibrous materials loaded with phenolic compound caffeic acid (CA) or plant extracts (Extr) is of great interest.

Experimental part CA-containing fibrous mats were prepared as described earlier [2,3]. Fibrous materials containing Extr were obtained by applying electrospinning in conjunction with dip-coating. The morphology of the prepared fibrous materials was examined by scanning electron microscopy (SEM) with Jeol JSM-5510 (Jeol Ltd., Japan). The antibacterial activity of the fibrous materials against S. aureus 749 and E. coli 3588 was studied in vitro by determining the number of surviving cells in liquid medium. The antioxidant activity of the mats was assessed using the DPPH assay.

Results and Discussion Novel poly(3-hydroxybutyrate) (PHB)-based fibrous materials containing natural phenolic compound CA coated with polyelectrolyte complex (PEC) of quaternized chitosan/k-carrageenan (alginate) of diverse architectures were obtained. These materials were prepared by applying electrospinning or electrospinning combined with dip-coating and PEC formation. Fibrous materials containing Extr were also successfully fabricated. Analyses by X-ray diffraction and differential scanning calorimetry showed that CA incorporated in the fibers was in the amorphous state, whereas CA included in the coating on the fiber surface was in the crystalline state. CA-containing fibrous materials (both non-coated and coated with PEC) exhibited considerable antibacterial effect against S. aureus and E. coli bacteria. These materials had capability of suppressing the adhesion of pathogenic S. aureus bacteria. The performed DPPH radical scavenging assay showed that in contrast to the neat mats, CA- and Extr-containing mats exerted good antioxidant activity similar to that of free CA or Extr.

Conclusion The results indicate that the obtained novel fibrous materials containing CA or Extr can be promising candidates for wound dressing applications.

Keywords: electrospinning, dip-coating, polyelectrolyte complex, caffeic acid, plant extracts, antibacterial nanofibers, antioxidant nanofibers

Acknowledgments: Financial support from Bulgarian National Science Fund (Grant DFNI T02/1 12.12.2014) and from Ministry of Education and Science (Grant D01-217/30.11.2018, National Scientific Program BioActiveMed) is gratefully acknowledged.

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UDC678

INORGANIC-ORGANIC HYBRID COATINGS AS FLAME RETARDANT TEXTILE FINISHING

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The conventional treatments of halogen, nitrogen, and organic-phosphorus compounds act as flame retardants because they prevent the formation of flammable volatiles, isolate the flame from oxygen/air supply, release flame inhibitors, influence the pyrolysis reaction, and increase the formation of char. They are characterized with excellent fire resistance properties, but the drawbacks are their non-environmental and toxic nature. In recent years, the purposeful design of hybrid materials permits to tailor their functional characteristics. The combination of both inorganic and organic components can fulfil all technological needs for different applications.

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These shortcomings can be overcome by developing methods for the simultaneous application of different flame retardants in order to achieve a synergistic effect.

Keywords: flame retardants, hybrid materials, textiles, coatings

UDC678

SANITARY-HYGIENIC REQUIREMENTS FOR LINING AND INSOCKS

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Introduction The lining is the material inside the shoe that comes in contact with the entire foot: the sides, top and heels. The main purpose of the lining is to cover the inside seams of the shoe and lengthen the shoe's lifespan. Linings made out of certain materials cushion and comfort the foot or draw out moisture. Sanitary hygienic properties of lining and insocks are of great importance for comfort and protection of the foot in the running period of shoes.

Lining are subjected to a smaller and weaker mechanical effects than upper leathers of the shoes both during the manufacture of the shoes and in the time of their running. This determines the smaller requirements for their physical and mechanical properties. This study applies current ISO standards to determine the performance of different types of lining and recommend the most appropriate ones.

Experimental part

Materials, procedures and analytical methods

• Sample 1 - Chrome tanned cattle hide (fodra) with finish
• Sample 2- Chrome-vegetable tanned pig skin (fodra) without finish
• Sample 3 - Chrome-syntan tanned pig skin (fodra) with finish

In this study we compare three different samples of leathers used as lining and insocks. Colour fastness to rubbing, perspiration resistance, water permeability and absorption are tested by ISO methods.

Results and discussion

Comparing the three linings with the four types of rubbing, the following is observed:

- Chrome tanned cattle hide (fodra) with finish is resistant to almost all types of rubbing, except rubbing under the influence of alcohol, where results are around and below the limit.

- Chrome-syntan tanned pig skin (fodra) with finish shows better test results than sample 1-chrome tanned cattle hide (fodra) with finish. For sample 2 only some types of rubbing results are about and below the requirements of the standard.

- Chrome-vegetable tanned pig skin (fodra) without finish has significantly lower results than the other two samples, especially when subjected to wet rubbing and those with sweat and alcohol.

The water and vapour permeability of the samples indicates that it is much higher in pig lining. This is probably due to the differences in the structure of the skin tissue in different samples. The way of tanning may also have an impact. The effect of the finish on pig skins is not considered. The same tendency is observed in the absorption index. The vapour permeability of pig skins is significantly higher. This also determines their good sanitary and hygienic properties. The retention of water vapour in the skin tissue is significantly lower and leads to greater comfort with prolonged use of the articles

Conclusion

1. According to the requirements of the colour fastness standard, sample 3 has the best performance for lining and insocks.

2. According to the requirements of the standard for water permeability and absorption, sample 3 has the best performance.

3. According to the requirements of the standard of perspiration resistance, sample 1 - cattle leather is the most suitable for lining and insocks.

4. Both the type of skin and hide, as well their treatment - tanning and finishing have an impact on the results.

5. In accordance with the requirements of EN ISO 17700, BDS 9056-71, BDS EN 12801, the most suitable lining and insocks is the sample 3 - chrome-syntan tanned pig skin (fodra) with finish

Keywords: footwear test methods, uppers, lining, insocks

UDC678

NEW POLY(PROPYLENE IMINE) DENDRIMER MODIFIED WITH 4-NITROBENZOFURAZAN. SENSOR AND ANTIMICROBIAL ACTIVITY

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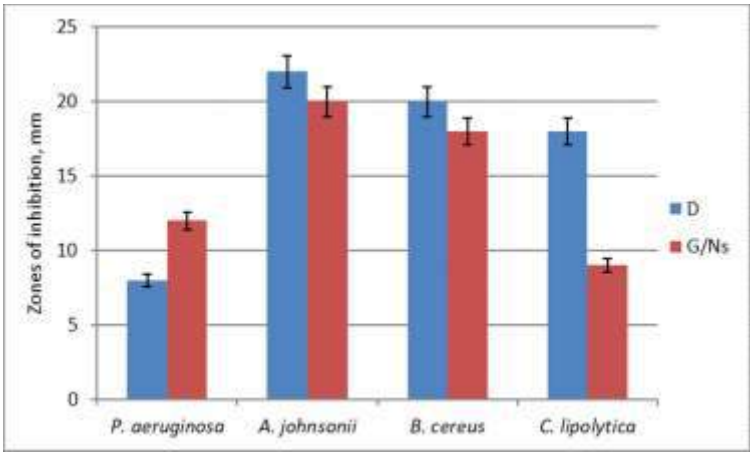
4-chloro-7-nitrobenzofuranzan has been used for the first time for peripheral modification of a second generation poly(propylene imine) dendrimer. In organic solvents this dendrimer exhibits a deep yellow color and emits a yellow-green fluorescence whose intensity depends strongly on the medium polarity. This effect can be explained by a possible occurrence of a PET effect. The sensory activity of the new fluorescent dendrimer has been investigated against different metal ions (Ag(I), Co(II), Sr(II), Pb(II), Mg(II), Cu(II) and Fe(III). It has been found that the best detecting activity of the dendrimer is with respect to Fe(II) ions, while regarding the other tested ions it exhibits a week sensory activity. That indicates the capacities of the dendrimer to act as a selective sensor for detecting Fe(III) ions. In alkaline medium, the new dendrimer has been found to have low fluorescence intensity, whereas in an acidic medium it increases many times. Hence, it can also be used as a detector of pH changes in the environment. The results from microbiological study have showed good antimicrobial activity of dendrimer against B. cereus and A. johnsonii and moderate against P. aeruginosa.

Chemical structure of dendrimer



Zones of inhibition of the test bacteria and yeasts by 0,2mg of the investigated dendrimer D

Keywords: Dendrimer; poly(propylene imine); 4-chloro-7-nitrobenzofuranzan; Antimicrobial activity; Antibacterial cotton fabric

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UDC678

DEPOSITION OF NIOBIUM COATINGS ON TEXTILE FIBRE SUBSTRATES BY MEANS OF ION-BEAM SPUTTERING IN A VACUUM MEDIUM

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The experiments carried out show that the deposition of metallic coatings in particular niobium on textile substrates in a vacuum environment by means of an ionic plasma beam is possible and feasible. The main task, namely the deposition of thin-film silver coatings on textile fibres in the vacuum environment, was successfully achieved.

The preliminary experiments carried out in the dissertation show that the deposition of electrically conductive materials, pure niobium 99, 99% on textile panels, yarns and tapes is possible, but the established electrical conductivity is insufficient to obtain low electrical resistance.

The results of the metallised fibres tests showed the preservation of the qualitative characteristics of the substrates after the ion metal metallisation, namely their flexibility, plasticity and softness typical of the textile fibres.

The plasma finishing in the vacuum medium then not only complements the final cleaning of the fibres, but also contributes to the activation of the surface of the fibre mass. The extraction voltage should not exceed 100 V, and the plasma etching time should not be longer than 3 min.

The thickness of the metallic coating ensures the maintenance of the technical and mechanical characteristics of the fibres. The morphological and chemical analyses of the deposited coatings confirm the results obtained and facilitate the establishment of specific and strictly validated process parameters to achieve permanent metallisation and good adhesion performance.

Clear and accurate vacuum deposition parameters have been developed that can be repeatedly reproduced. Ionic plasma deposition under vacuum was the correct method for metallisation of substrates that cannot be subjected to high temperature loads by another vacuum plasma method. Because of the low process deposition temperature, this metallization method is particularly distinguished from the other methods known and described in this dissertation thesis. The experimental results presented in this dissertation thesis can be fundamental for further research on metallised textile fibres and their derivatives.

Prüfbedingungen	Kenn-werte	Ein-heiten	Nr.1: PES beschichtet Versuch 1	Nr.2: PES beschichtet Versuch 2	Nr.3: PES unbeschichtet
Probenzustand: klimatisiert	Feinheit				
	x̄	dtex	3,43	3,32	3,27
Einspannlänge: 20 mm	s	dtex	0,32	0,32	0,23
	V	%	9,32	9,71	7,02
Verformungsgeschwindigkeit: 20 mm/min	±W(95 %)	dtex	0,10	0,09	0,07
	Höchstzugkraft				
	x̄	cN	12,3	12,5	13,2
Vorspannkraft: 200 mg	s	cN	1,0	1,1	0,9
	V	%	8,13	9,14	6,82
	±W(95 %)	cN	0,3	0,3	0,3
Klemmenbrüche: keine	Höchstzugkraftdehnung				
	x̄	%	31	30	40
	s	%	5	5	8
	V	%	15,9	17,7	18,8
n= 50	±W(95 %)	%	1	2	2
	Feinheitsbezogene Höchstzugkraft				
	x̄	cN/tex	35,9	37,6	40,6
Bemerkungen: keine					

Keywords: polyester fibres, niobium coating, ion-beam sputtering, vacuum.

UDC678

Център за професионално обучение
към
Федерация
на научно-техническите съюзи

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РАЗВИТИЕ НА
ЧОВЕШКИТЕ РЕСУРСИ

Изберете нашите обучения по Оперативна програма "Развитие на човешките ресурси" 2021-2027 г. по направление: "Производствени технологии - текстил, облекло, обувки и кожи"

- Професия "Оператор в текстилно производство"
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