ТЕКСТИЛ И ОБЛЕКЛО

10
2024
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TEXTILE AND GARMENT MAGAZINE

Scientific Engineering
Union of Textiles, Garment
and Leathers
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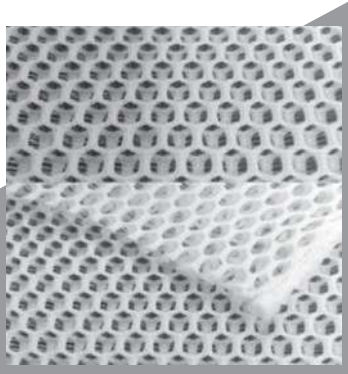
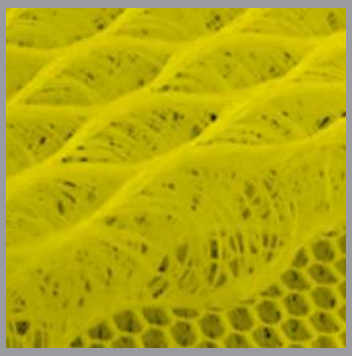
BOOK OF ABSTRACTS

NATIONAL TEXTILE CONFERENCE - 2024

XXVIbgNTC2024





ISSN 1310-912X (Print)
ISSN 2603-302X (Online)
www.bgtextilepublisher.org
https://doi.org/10.53230/tgm.1310-912X.2024.1000

НАУЧНО-ТЕХНИЧЕСКИ СЪЮЗ
ПО ТЕКСТИЛ, ОБЛЕКЛО И КОЖИ

ОРГАНИЗИРА

XXVI НАЦИОНАЛНА ТЕКСТИЛНА КОНФЕРЕНЦИЯ 2024 "ТРАДИЦИИ И ИНОВАЦИИ В ТЕКСТИЛА И ОБЛЕКЛОТО"

С ВОДЕЩАТА РОЛЯ НА

Институт по отбрана
„проф. Цветан Лазаров" – София,
подкрепата на фонд „Научни изследвания",
с домакинството на община Копривщица и със
сътрудничество с катедрите по текстил и дизайн
в обучителното звено «Жив музей» - Копривщица

ФОНД НАУЧНИ ИЗСЛЕДВАНИЯ

17-19 октомври 2024 г., Копривщица

Тематични направления:

- нови влакнести суровини, химична обработка и изделия (нанотехники в текстила);
- технология на текстилните материали: предачество, тъкачество и трикотаж;
- технология на шевното производство;
- текстилно изкуство, мода, композиция и представяне на текстилни изделия;
- машинна поддръжка на текстилна техника;
- управление и маркетинг в съвременното текстилно производство;
- съвременна дидактика и методика на текстилното обучение.

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ВАРНЕНСКИ СВОБОДЕН УНИВЕРСИТЕТ ЧЕРНОРИЗЕЦ ХРАБЪР

ТЕХНИЧЕСКИ УНИВЕРСИТЕТ СОФИЯ

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SPECIAL ISSUE 10/2024

BOOK OF ABSTRACTS

NATIONAL TEXTILE CONFERENCE - 2024

Traditions and Innovations in Textiles and Clothing

Present abstracts collection was issued with the kind support of National SCIENTIFIC RESEARCH FUND under grant No. KP-06-MNF/24 dated August 12th 2024

Address:
Bulgaria,1000 Sofia, 108 G. S. Rakovski str., room 407, tel. +359 2 980 30 45
e-mail: textilejournal.editor@fnts.bg
www.bgtextilepublisher.org

ISSN 1310-912X (Print)
ISSN 2603-302X (Online)
https://doi.org/10.53230/tgm.1310-912X.2024.1000

Bank account:
Scientific Engineering Union of Textile, Garment and Leathers
VAT identification number: BG 121111930
Account IBAN: BG43 UNCR 9660 1010 6722 00

Textile and Garment Magazine
ISSUE 10/2024

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General style and layout

Volume of a manuscript submitted should not exceed 12 standard journal pages in single column (3600 characters per page), including tables and figures. Format is MS Office Word (normal layout). The editors reserve the right to shorten the article if necessary as well as to alter the title.

Title of a manuscript should not exceed 120 characters.

Full names and surnames of the authors, as well as **full names of the authors' affiliation** – faculty, department, university, institute, company, town and country should be clearly given. Corresponding author should be indicated, and their e-mail address provided.

Abstract of a manuscript should be in English and no longer than one page.

Key-words should be within 4-6 items.

For papers submitted in English (any other working language), the authors are requested to submit a copy with a title, abstract and key words in Bulgarian.

Figures and illustrations with a title and legend should be numbered consecutively (with Arabic numerals) and must be referred in the text. Figures should be integrated in the text with format **JPG at 300 dpi minimum**, and in editable form.

Tables with a title and optional legend should be numbered consecutively and must be referred in the text.

Acknowledgements may be included and should be placed after Conclusions and before References.

Footnotes should be avoided.

References (bibliography) should be cited consecutively in order of appearance in the text, using numbers in square brackets, according to the Vancouver system.

XXVI National Textile Conference: Traditions and Innovations in Textiles and Garment

From October 17 to 19, 2024, the city of Koprivshtitsa hosted the XXVI National Textile Conference with international participation, dedicated to the theme "Traditions and Innovations in Textiles and Garment". In the "Living Museum" Training Unit, the forum brought together experts and scientists from Bulgaria and abroad, including representatives of higher education institutions from France, Serbia, Turkey, Tunisia, the United States, Germany and Belgium.

The conference, which is held annually, is organized by the Scientific Engineering Union of Textiles, Garment and Leathers, with the cooperation of the Departments of Textiles and Design from higher education institutions in Bulgaria and with the leading role of the Defense Institute "Prof. Tsvetan Lazarov" - Sofia.

More than 70 students, doctoral students, specialists, lecturers, teachers and scientists from higher schools at home and abroad, from vocational high schools in design, textiles and garment participated in the scientific forum, with direct personal presence.

The most representative of the university units were the teams of the "Textiles, Leather and Fuels" department of the UCTM - Sofia, headed by Prof. Desislava Grabcheva; at the Department of "Mechanical Engineering and Technologies" headed by Prof. Snezhina Andonova and the Department of "Fine Art" headed by Assoc. Prof. Diana Zaharieva from SWU Neophyt Rilski - Blagoevgrad; of the Defense Institute "prof. Tsvetan Lazarov" - Sofia with director Col. Assoc. Prof. DSc Borislav Genov and from the Laboratory of Bioactive Polymers at the Institute of BAS - Sofia with lead researcher Assoc. Professor Maria Spasova.

The invited foreign speakers represented renowned higher schools such as: the University of Haute-Alsace in Mulhouse, France; ENIM in Monastir, Tunisia; Istanbul University of Technology, Turkey; Hanoi University of Science and Technology in Vietnam, University of St. St. Cyril and Methodius" in Skopje, Republic of Macedonia; Technical University of Dresden, Germany; University of Nis, Serbia; Drexel University in Philadelphia, USA and the School of Artistic Weaving in Pen d'Agen, France.

The significance of this traditional scientific forum for all specialists in the field of design, textiles and clothing in our country is also due to the collective support of large textile enterprises such as "E. Miroglio EAD - Sliven, Pirintex EOOD - Gotse Delchev, Lemprier Wool EOOD - Sliven, Picanol n.v. - Belgium, as well as the authentic revival environment created by the hosts.

The work of the conference began with a review of the XV National Youth Competition "Best educational development in the field of textiles and garment" and continued with a round table on the topic "Staffing of the textile profession".

The event opened with an impressive fashion show held on the summer stage in the courtyard of the old school "St. St. Cyril and Methodius". The show featured unique designs and fashion looks based on folk motifs and traditional fabrics. The participants in the review were students from higher education

institutions majoring in “Fashion and Design”, “Clothing and Textile Technologies”, as well as students from vocational high schools in textiles from all over the country: PGD “Princess Maria Louisa” and PGD “Elena Vazova” from Sofia; Secondary school “M. Draginov” from the village of Draginovo, Velingrad municipality.

The conference was officially opened by Assoc. Prof. Ivelin Rahnev, who emphasized the importance of the forum for the development of the textile industry. On behalf of the Municipality of Koprivshtitsa, the participants were also welcomed by the secretary of the municipality, who expressed gratitude for choosing the city as the host of this prestigious event. Associate Professor Petya Nedyalkova from the Institute of Defense “prof. Tsvetan Lazarov” welcomed the conference participants.

Among the official guests of the conference were Mrs. Fani Todorova from the Ministry of Education and Science, Assoc. Professor Ivaylo Stefanov from the Ministry of Economy and Assoc. Professor Kremena Dedelyanova, President of the Federation of Scientific Engineering Unions in Bulgaria. The guests delivered congratulatory addresses to the participants and expressed their support for the forum.

One of the main topics of the conference was the discussion of the problems in professional education and staffing of the textile industry. During the round table, Mr. Bertram Rollmann, manager of Pirin TEX EOOD from Gotse Delchev, made a thorough analysis of the challenges related to securing young and qualified personnel in production. Attention was also paid to the digitization process in the sector, which is of key importance for its future development.

Over 38 papers related to new fibrous raw materials (nanotechnologies in textiles) were presented in the scientific sessions; antimicrobial textiles and other innovative technologies in textile and sewing production; contemporary textile art, fashion, composition; management, marketing and sustainable development in modern sewing and textile production, as well as current methods and forms of training in the field of textiles and clothing.

The 26th NTK’2024 was held with the support of the “Scientific Research” Fund under a project from the program for International Scientific Forums under Contract KP-06-MNF/24 of 2024.

Sofia, October 21st 2024

SEUTGL

РЕПУБЛИКА БЪЛГАРИЯ

Министерство на икономиката и индустрията

ДО
ДОЦ. ИВЕЛИН РАХНЕВ
ПРЕДСЕДАТЕЛ
НА НАУЧНО-ТЕХНИЧЕСКИ СЪЮЗ
ПО ТЕКСТИЛ, ОБЛЕКЛО И КОЖИ

УВАЖАЕМИ ГОСПОДИН РАХНЕВ,

Приемете моите най-искрени поздравления за организацията на 26-то издание на Националната текстилна конференция с международно участие.

Текстилната промишленост е ключов отрасъл за българската икономика, тя заема важно място в производствената структура и има голямо значение за експортния профил на страната. Благодарение на високото качество на продукцията на текстилната промишленост България е сред водещите партньори на най-известните европейски производители.

Вярвам, че форумът ще даде възможност за обсъждане на всички стоящи пред сектора актуални въпроси, като необходимостта от модернизация и иновации за увеличаване на производителността, повишаването на конкурентоспособността и подобряването на пазарните им позиции на предприятията от бранша у нас и в чужбина.

Пожелавам успех на конференцията!

С уважение,

Д-Р ПЕТКО НИКОЛОВ
Министър на икономиката и индустрията

РЕПУБЛИКА БЪЛГАРИЯ
Министерство на образованието и науката

ДО ДОЦ. Д-Р ИВЕЛИН РАХНЕВ
ПРЕДСЕДАТЕЛ НА НАУЧНО-ТЕХНИЧЕСКИЯ
СЪЮЗ ПО ТЕКСТИЛ, ОБЛЕКЛО И КОЖИ

ПОЗДРАВИТЕЛЕН АДРЕС

УВАЖАЕМИ ДОЦЕНТ РАХНЕВ,

От името на Министерството на образованието и науката и от мое име най-сърдечно Ви приветствам за организирането и провеждането на XXVI Национална текстилна конференция „Традиции и иновации в текстила и облеклото".

Разбирането на важността и необходимостта от синхронизираните усилия на всички заинтересовани страни в търсенето на сътрудничество и обсъждането на механизми за развитие на бранша е важно условие за подготовката на специалисти. За развитие на професионалните умения в съответствие с потребностите на пазара на труда е ключово да се работи в партньорство.

Темата за бъдещето на кадрите в сектор лека промишленост – тяхното образование, допълнителна квалификация, професионално развитие и мотивация, е особено актуална на фона на многобройните дискусии, посветени на образованието в България и свързаните с него необходими промени, продиктувани от европейските и световните тенденции.

Убедена съм, че дискусиите в рамките на настоящия и бъдещи такива форуми, подкрепата и ангажираността на държавни и общински институции ще помогнат за приемането на решения и за съответните действия, които да гарантират бъдещото дългосрочно развитие на сектора.

Желая ползотворна работа на всички участници в националния форум.

С уважение,
ВАНЯ ТИВИДОШЕВА
Директор на дирекция
„Професионално образование и обучение"

ФЕДЕРАЦИЯ НА НАУЧНО-ТЕХНИЧЕСКИТЕ СЪЮЗИ В БЪЛГАРИЯ
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тел.: +359 2 987 7230; факс: +359 2 987 9360;
E-mail: info@fnts.bg; www.fnts.bg

До
участниците в
XXVI Национална текстилна конференция с международно участие 2024 “Традиции и иновации в текстила и облеклото”

ПОЗДРАВИТЕЛЕН АДРЕС

Уважаеми доц. Рахнев,
Уважаеми участници,

Имам удоволствието да ви поздравя от името на Федерацията на научно-техническите съюзи в България и лично от мое име за организацията и провеждането на ***XXVI Национална текстилна конференция с международно участие 2024 “Традиции и иновации в текстила и облеклото”****.*

Поздравявам главния организатор на форума Научно-техническия съюз по текстил, облекло и кожи - член на ФНТС и съорганизатора - Института по отбрана „проф. Цветан Лазаров“, гр. София.

Провеждането на този форум за 26-ти пореден път е доказателство за неговата необходимост и полезност, а докладите и презентациите по тематичните направления на конференцията в програмата са добър атестат за актуалността на форума.

Заслужава да се отбележи и значимото младежко присъствие в конференцията в младежкия конкурс и младежкото изложение, което означава, че принципите и идеите, които въплъщават нашите организации се разпознават и приемат от младото поколение.

Надявам се в трите дни на конференцията да се обсъдят интересни доклади в научните сесии, да бъде споделен практически опит, да бъдат представени иновативни решения от младите хора и да се създадат нови професионални и лични контакти.

Желая здраве на всички участници и успех на конференцията!

Председател:

доц. д-р инж. Кремена Деделянова

Scientific Engineering Union of Textile, Garment and Leathers
PRESENTERS LIST
26th National Textile Conference 2024 in the EU "Living Museum" - Koprivchitsa, 17-19.10.2024

№	Presenter	Report Tituli / Acronym	date	hour	Session chair
1	**A. Sezai Sarac**	Magnetic Nanoparticles Confined Polyacrylonitrile Nanofibers	17/10/2024	16:15	prof. Ivo Grabchev
2	**Dragan Djordjevic**	Recent Knowledge about Dyeing Textiles with Dyes of Natural Origin		16:45	
3	**Saber Ben Abdessalem**	Ballistic Protection Materials		17:30	
4	**David Breen**	Yarn-Level Modeling of Knitted Fabrics		18:00	prof. A. S. Sarac
5	**Neşe SARAC**	"Pastel techniques as a lyric expression in the 19th century painting		18:45	
5	**Ivelin Rahnev**	Uniform Distribution of Potential Energy of Elastic Deformation in a Twisted fibrous Sheaf	18/10/2024	8:15	prof. Saber Ben Abdessalem
6	**Maria Rosenova Sybeva**	NANOSTRUCTURED MATERIALS WITH POTENTIAL APPLICATIONS IN REGENERATIVE MEDICINE		8:30	
7	**Marin Rashev Marinov**	Jacquard Fabrics Embroidery with Application for Decoration of Traditional Bulgarian National Costumes		8:45	
8	**Tashka Ivanova Koleva**	Working Procedures for Qualitative Assessment of Quantitative Indicators of Woven Fabrics with Normal and Poisson Distribution		9:15	prof. Dragan Djordjevic
9	**Milka Alexandrova**	NANOSTRUCTURED MATERIALS WITH POTENTIAL APPLICATIONS IN REGENERATIVE MEDICINE		9:30	
10	**Asya Ivova Ivanova**	DRESIGNING A MODERN WOMEN`S DRESS WITH ELEMENTS OF THE BULGARIAN FOLK COSTUME-A DOUBLE APRON COSTUME		9:45	
11	**Sarina Vasileva Petrova**	WOMEN'S 70'S STYLE DRESS		10:15	prof. David Breen
12	**Elka Tzankova Dzhurakova**	MAKING A WOMEN'S BLOUSE ACCORDING TO A PATTERN		10:30	
13	**Diana Zaharieva**	Influence of textile traditions in modern fine arts		10:45	
14	**Nezabravka Popova-Nedyalkova**	THE JOURNEY OF COLOURS: FROM NATURE TO SCIENCE; METHODS FOR EXTRACTING NATURAL DYES: TRADITIONAL AND MODERN APPROACHES	18/10/2024	11:15	prof. Snezhina Andonova
15	**Hamid Benvedi**	Vocational Education and Training Opportunities for Foreign Workers in Textile and Sewing Enterprises		11:30	
16	**Umme Kapanyk**	Two-way analysis of the variance to determine the significance of the influence of factors „sled load" and „areal mass" on the static coefficient of friction at rest, for cotton-type fabrics		11:45	
17	**Desislava Grabcheva**	CHITOSAN MODIFIED WITH 1,8-NAPHTALIMIDE TO GIVE NEW PROPERTIES TO POLYESTER FABRIC		12:00	
18	**Milena Veliova**	INTEGRATION OF BULGARIAN FOLKLORE COSTUME ELEMENTS IN CONTEMPORARY FASHION GARMENTS		13:00	
19	**Milena Perchinkova**	A MODERN INTERPRETATION OF A WOMEN'S SKIRT AND A WOMEN'S TANK TOP		13:15	prof. Desislava Grabcheva
20	**Ivo Grabchev**	TEXTILE MATERIALS WITH ANTIMICROBIAL PHOTODYNAMIC ACTIVITY		13:30	
21	**Desislav Berov**			13:45	
22	**Rositsa Ruskova**	METROLOGICAL SELECTION OF WOOD FOR MAKING A HAND WEAVING LOOM WITH A SUSTAINABLE STRUCTURE		14:15	
23	**Rositsa Rangelova**	CHILDREN'S CLOTHING IN THE BULGARIAN MONARCHIES		14:30	

24	**Maria Georgieva**	PROTECTIVE CAMOUFLAGE EQUIPMENT IN TEMPERATE CONTINENTAL CLIMATE AREAS		14:45	Associate prof. Maria Spasova
25	**Snezhina Andonova**	APPLICATION OF MATHEMATICAL METHODS IN THE STUDY OF OCCUPATIONAL SAFETY AND ERGONOMICS IN THE LIGHT INDUSTRY		15:00	
26	**Daniela Yordanova Atanasova**	Modified POLYESTER FABRIC AS ADSORBENT AND PHOTOCATALYST		15:30	
27	**Tatyana Hristova-Popovska**	Application of creative endeavors within technological limitations in textile production		15:45	Associate prof. Iva Dragostinova
28	**Iva Dragostinova**	APPLICATION OF TEXTILES IN EXHIBITION DESIGN	18/10/2024	16:00	
30	**Maria Spasova-Todorova**	ELECTROSPUN POLYMER MATERIALS AS CARRIERS FOR BIOAGENTS		16:15	
31	**Raya Stoyanova**	RESEARCH THE CHANGE IN THE THICKNESS OF TWO LAYERS OF COTTON FABRIC, IN RELATION TO THE PRESSURE ON THEM		16:45	
32	**Tsvetanka Hristova**	RECYCLING OF HIGH-PERFORMANCE BALLISTIC FIBERS AS PART OF SUSTAINABLE MANAGEMENT CAPABILITY FOR MILITARY PERSONAL PROTECTIVE EQUIPMENT		17:00	Associate prof. Darina Zheleva
33	**Darina Zheleva**	PROTECTIVE PROPERTIES OF CLOTHING IN THE SECURITY SECTOR		17:15	
34	**Nasko Nachev**	ELECTROSPUN POLYMER HYBRID MATERIALS AS BIOCONTROL AGENTS WITH APPLICATION IN ECO-AGRICULTURE		17:30	
35	**Milena Nacheva**	ANALYSIS AND COMPARISON OF POPULAR PATTERNMAKING SYSTEMS: MÜLLER AND ESMOD	19/10/2024	9:00	
36	**Daniela Angelova Atanasova**	TEXTILE MODIFIED WITH A PHOTOACTIVE AGENT FOR FUEL DESULFURIZATION		9:15	Associate prof. Diana Zaharieva
37	**Desislava St. Angelova**	STUDY OF THE PHYSICO-MECHANICAL PROPERTIES OF PIG LEATHER WITH ANTIBACTERIAL COATING FOR SHOE INSOLE MATERIALS		9:45	
38	**Ina Anastasova**	IMPARTING PHOTOCATALYTIC AND ANTIOXIDANT PROPERTIES TO ELECTROSPUN POLY(L-LACTIDE-CO-D,L-LACTIDE) MATERIALS		10:00	
39	**Vladimir Krystev**	ELECTROSPUN POLY(3-HYDROXYBUTYRATE) MATERIALS WITH DESIRED FIBERS ALIGNMENT AND TARGETED MECHANICAL PROPERTIES		10:15	
40	**Boyan Koev**	Influence of Handloom Ergonomic Parameters on Weaving Cycle Duration		10:30	Dr. Nezabravka Popova - Nedyalkova
41	**Alexander Gerginov**	Reflections and References to Bulgarian Folklore in Fashion Illustration in Bulgaria		11:00	
42	**poster session**			11:15	
43	**poster session**			11:30	

SCIENTIFIC COMMITTEE

of the 26th National Textile Conference with international participation, Koprivshtica, Bulgaria
October 17th to 19th 2024

INVITED LECTURERS

1. Prof. Ivo GRABCHEV, DSc, University of Sofia
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3. Prof. Hristo PETROV, PhD, Technical University – Sofia
4. Prof. Emil KUKOV, PhD, South-West University – Blagoevgrad
5. Prof. Margarita NEZNAKOMOVA, PhD, Technical University – Sofia
6. Prof. Maya BOGDANOVA, National Academy of Arts (NAA) – Sofia
7. Assoc. Prof. Rumen RUSSEV, PhD, Trakia University – Stara Zagora

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Sofia, May 2024
On behalf of the Scientific engineering union of Textile, Garment and Leathers:

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Chair

DAILY SCHEDULE

XXVI NATIONAL TEXTILE CONFERENCE 2024,

"Traditions and Innovations in Textile and Garment",

October 17-19 2024, Education unit "Living museum", Koprivshtitsa, Bulgaria

		1. First Day: 17.10.2024	**Hall**
1.1.	12:00	Accommodation in hotel EU Living museum	***reception***
1.2.	12:30 – 13:00	Registration in NTC24	conference hall
1.3.	13:00 - 14:30	Visit to the models review of NY Competition 2024	conference hall
1.4.	*14:30 – 14:45*	*Coffee-break with poster session*	*central foyer*
1.5.	14:45 – 16:00	Workshop „Textile profession Staffing"	***central foyer***
1.6.	*16:00– 16:15*	*Coffee-break with poster session*	*central foyer*
1.7.	16:15 – 17:15	2 presentations x 30 minutes, 2 plenary lectures	conference hall
1.8.	*17:15– 17:30*	*Coffee-break with poster session*	*central foyer*
1.9.	17:30 – 18:30	2 presentations x 30 minutes, 2 plenary lectures	conference hall
1.10.	*18:30– 18:45*	*Coffee-break with poster session*	*central foyer*
1.11.	18:45 – 19:15	1 presentation1 x 30 minutes, 1 plenary lecture	conference hall
1.12	***19:15 – 21:00***	***Welcome cocktail of the NTC24***	***April 20th restaurant***
		2. Second Day: 18.10.2024	
2.1.	*08:00 – 08:15*	*Registration in NTC24*	conference hall
2.2.	08:15 – 09:45	6 presentations x 15 minutes, 5 reports	conference hall
2.3.	*09:45 – 10:00*	*Coffee-break with poster session*	conference hall
2.4.	10:00 – 11:00	4 presentations x 15 minutes, 4 reports	conference hall
2.5.	*11:00 – 11:15*	*Coffee-break with poster session*	conference hall
2.6.	11:15 – 12:15	3 presentations x 15 minutes, 3 reports	conference hall
2.7.	***12:15 – 13:00***	***Working lunch***	***April 20th restaurant***
2.8.	13:00 – 14:00	4 presentations x 15 minutes, 4 reports	conference hall
2.9.	*14:00 – 14:15*	*Coffee-break with youth's exposition*	conference hall
2.10.	14:15 – 15:15	4 presentations x 15 minutes, 4 reports	conference hall
2.11.	*15:15 – 15:30*	*Coffee-break with youth's exposition*	conference hall
2.12.	15:30 – 16:30	4 presentations x 15 minutes, 4 reports	conference hall
2.13.	*16:30 – 16:45*	*Coffee-break with youth's exposition*	conference hall
2.14.	16:45 – 17:45	4 presentations x 15 minutes, 4 reports	conference hall
2.15.	17:45 – 19:15	Visit to the youth's exposition	conference hall
2.16	***19:30 – 22:00***	***Gala dinner***	***April 20th restaurant***
		3. Third Day: 19.10.2024	
3.1.	08:00 – 08:15	*Registration in NTC24*	conference hall
3.2.	08:15 – 09:30	5 presentations x 15 minutes, 4 reports	conference hall
3.3.	*09:30 – 09:45*	*Coffee-break with youth's exposition*	conference hall
3.4.	09:45 – 10:45	4 presentations x 15 minutes, 4 reports	conference hall
3.5.	*10:45 – 11:00*	*Coffee-break with youth's exposition*	conference hall
3.6.	11:00 – 12:00	4 presentations x 15 minutes, 3 reports	conference hall
3.7.	***12:00 – 12:30***	***Working lunch***	***April 20th restaurant***
3.8.	12:30 – 13:15	Poster session and youth's exposition	conference hall
3.8.	12:30 – 13:15	Award ceremony of the youth competition – 2024	***central foyer***
3.9.	***14:00 – 14:15***	***Closing the conference***	***central foyer***

Form 01.04: Conference Invitation

Scientific Association:

Technical University of Sofia

University of Chemical Technology and Metallurgy of Sofia

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Technical University of Gabrovo

Trakia University, FTT – Yambol

South-West University of Blagoevgrad

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SCIENTIFIC ENGINEERING UNION OF TEXTILE, GARMENT AND LEATHER, BULGARIA

With leaderships of the Defence Institute "prof. Tsvetan Lazarov" - Sofia,

the support of Scientific Research Fund,

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and in collaboration with the Departments of Textiles and Design

organize

XXVI NATIONAL TEXTILE CONFERENCE 2024

"Traditions and Innovations in Textile and Garment"

October 17-19 2024

Educational unit "Living Museum"
Koprivshtitsa
Bulgaria

Main Topics:

- Fibres and Yarns; Chemical Technologies; Nanotechnologies
- Textile Technologies: Spinning, Weaving, and Knitting
- Apparel Technology
- Textile art and Fashion Design
- Textile Machinery and Equipment
- Textile Management, Marketing and Sustainability
- Innovations in Textile Education

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Templates are available online at:
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- **Presentation:**
  - Maximum 14 slides
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  - Format A2

- **Paper:**
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  - The paper should to be prepared according to the paper template and should be restricted to maximum 12 pages
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DEADLINES

- Abstracts submission – **September 27th 2024**
- Papers submission – **November 29th 2024**
- Registration – **October 17th 2024**

Languages: Bulgarian and English

XXVI National Textile Conference 2024
17-19 October 2024, Koprivshtitsa, Bulgaria

Defence Institute "prof. Tsvetan Lazarov" - Sofia
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СЪДЪРЖАНИЕ

Topic №1, Fibres and Yarns; Chemical Technologies; Nanotechnologies

Topic №2, Textile Technologies: Spinning, Weaving, and Knitting

Topic №3, Apparel Technology

Topic №4, Textile art and Fashion Design

Topic №5, Textile Machinery and Equipment

Topic №6, Textile Management, Marketing and Sustainability

Topic №7, Innovations in Textile Education

ФНИ проект КП-06-МНФ/24 от 12.08.2024
Bulgarian National Science Fund (Grant KP-06-MNF/24 - 2024)

Topic №1
Fibres and Yarns; Chemical Technologies; Nanotechnologies

UDC 678
Industry of High Molecular Substances. Rubber industry. Plastic industry

https://doi.org/10.53230/tgm.1310-912X.2024.1001.01

RECENT KNOWLEDGE ABOUT DYEING TEXTILES WITH DYES OF NATURAL ORIGIN

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The textile industry is one of the largest consumers of water, which is especially present in dyehouses where synthetic chemicals and dyes are used. Natural dyes are generally environmentally friendly and have certain advantages over synthetic dyes in terms of production and application. In recent years, there has been interest in the application of these dyes due to their biodegradability and high compatibility with the environment. The paper discusses the review of the work of researchers in 2024. in the field of applying dyes from natural sources that can be used to dye textile material. From an ecological point of view, replacing chemical dyes with "natural products" for dyeing textiles can be convenient and can represent a strategy to reduce risks and pollutants. Also, it is an opportunity for new markets and new businesses that can be developed by including ecology in the market policy.

Although natural dyes cannot be an alternative to synthetic ones, today in recent scientific literature there are more and more works on their application, which is closely related to environmental problems. Accordingly, synthetic dyes with better dyeing properties, better substantivity, and dyeing procedures that require less energy and water consumption were also developed.

Today, there is a conflict between the interests of ecologists and manufacturers of synthetic dyes. The opinion of ecologists is to reject all "chemical" and "synthetic" products and replace them with "bio", "eco" and "natural" products. On the other hand, producers of synthetic dyes say that natural dyes cannot be an alternative due to the lack of natural resources, the depletion of nature, the impossibility of dyeing synthetic fibers, ecologically questionable and demanding dyeing procedures, the impossibility of textile dyeing in industrial processes, weaker color fastness, higher dyeing costs and production etc.

Dyes that come from natural sources and can be used in textile dyeing will represent an important factor in the future, as a competitor to conventional dyeing procedures with synthetic dyes. The reasons are very significant, and they primarily concern ecology and health.

Namely, textiles, as an object with a greater or lesser degree of "closeness to the skin", can be risky (allergies), while on the other hand, the classic dyeing of textiles with synthetic dyes is characterized by high environmental pollution and a high health risk for people who handle harmful substances.

In order to reduce the high pollution that characterizes modern textile dyeing processes, the partial replacement of synthetic dyes with natural dyes in textile production can represent a risk and pollutant reduction strategy.

Keywords: *natural dyes, textiles, dyeing, ecology.*

https://doi.org/10.53230/tgm.1310-912X.2024.1001.02

IMPARTING PHOTOCATALYTIC AND ANTIOXIDANT PROPERTIES TO ELECTROSPUN POLY (L-LACTIDE-CO-D,L-LACTIDE) MATERIALS

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Introduction Electrospinning is a simple and low-cost technique for fabrication of polymer fibers with multiple applications. Poly(L-lactide-co-D,L-lactide) (PLDLLA) is biodegradable and biocompatible, amorphous copolymer, which degrades faster than the homopolymer. Zinc oxide (ZnO) is biocompatible, has low toxicity and good antimicrobial activity against a number of pathogens. Moreover, ZnO shows excellent UV-absorption and photocatalytic activity. Despite these promising properties, freely suspended ZnO particles are difficult to separate from the reaction medium, leading to secondary pollution. Thus, in this study we have chosen to avoid the difficulty in the removal of the particles and to combine the properties of PLDLLA and ZnO, in order to prepare hybrid fibrous materials with purposely tailored design for photocatalytic water purification.

Experimental part PLDLLA was kindly donated by Boerhinger-Ingelheim. Commercially available ZnO (Zano®20, Umicore Zinc Chemicals) was used as received. The quaternized N,N,N-trimethyl chitosan iodide (QCOS) was synthesized from chitosan oligomer (COS, 10000 g/mol, Kitto Life Co. LTD, Korea).

Results Simultaneous electrospinning of PLDLLA (5% w/v) solution and electrospraying of an aqueous ZnO dispersion (1 wt%) resulted in fabrication of materials with design type “on”. The electrospraying was conducted at a 5 cm tip-to-collector distance and 1 mL/h flow rate [1]. In the electrosprayed dispersion, the QCOS serve as excellent stabilizing agent for ZnO and as sticking agent for the fixation of ZnO particles onto PLDLLA fibers.

Discussion The morphology of the electrospun materials was observed by SEM, equipped with EDX and TEM. TGA and XRD analyses show that the presence of inorganic particles had an impact on the thermal properties and crystallinity of the fibrous PLDLLA materials. It was shown that the presence of ZnO onto the surface of the PLDLLA fibers considerably increased their antioxidant activity, determined by the DPPH free radical assay, and their photocatalytic activity, determined by the degradation of the model organic pollutant methylene blue (MB) dye under UV-light irradiation.

Conclusions Purposely tailored design type “on” provided improved antioxidant activity and excellent photocatalytic degradation of model organic pollutant MB under UV light irradiation even after 5-fold use. Therefore, the prepared electrospun hybrid materials based on PLDLLA are promising for water purification from organic pollutants and dyes by heterogeneous photocatalysis.

Keywords: *electrospinning, electrospraying, PLDLLA, ZnO, antioxidant activity, photocatalytic activity*

[1] Anastasova, I.; Tsekova, P.; Ignatova, M.; Stoilova, O. Imparting Photocatalytic and Antioxidant Properties to Electrospun Poly(L-lactide-co-D,L-lactide) Materials. Polymers 2024, 16, 1814.

Acknowledgment: Some of the research equipment of Distributed Research Infrastructure INFRAMAT (part of the Bulgarian National Roadmap for Research Infrastructures), supported by Bulgarian Ministry of Education and Science, was used in this study.

https://doi.org/10.53230/tgm.1310-912X.2024.1001.03

TEXTILE MATERIALS WITH ANTIMICROBIAL PHOTODYNAMIC ACTIVITY

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In recent years, the resistance of bacteria to the antibiotics used in clinical practice has increased to dangerously high levels in many parts of the world. New mechanisms of resistance have emerged and spread, leading to the inability to treat common infectious diseases since the antibiotics administered are becoming less effective. That necessitates the search for new compounds with good antimicrobial activity as well as inventing new strategies for their usage.

Antimicrobial photodynamic therapy is a new method for inactivating a wide range of microorganisms that are highly resistant to antimicrobial substances used in practice. The method uses special compounds, called photosensitizers (PS), which during the irradiation with sunlight in the presence of molecular oxygen (O2) generate highly cytotoxic reactive oxygen species (ROS) and in particular singlet oxygen (1O2), that reacts with the cytoplasmic membrane and the cell walls of microorganisms, thus inactivating them, hence eliminating the possibility of photoresist strains occurrence.

This work describes the use of different PS deposited on textile materials and their antibacterial activity in the dark and under sunlight exposure against Gram-positive and Gram-negative bacteria. The light sources used are also the focus of the present presentation.

Keywords: *textile, antimicrobial, photodynamic therapy, photosensitizers*

Acknowledgements: This study is financed by the European Union Next Generation EU, through the National Recovery and Resilience Plan of the Republic of Bulgaria, project № BG-RRP-2.004-0008-C01

https://doi.org/10.53230/tgm.1310-912X.2024.1001.04

CHITOSAN MODIFIED WITH 1,8-NAPHTALIMIDE TO GIVE NEW PROPERTIES TO POLYESTER FABRIC

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Chitosan was modified with 4-substituted-1,8-naphthalic anhydride. The structure of the obtained product was confirmed by infrared and NMR spectroscopy. Its photophysical characteristics were investigated by fluorescence analysis. The amount of acetic acid needed to dissolve the obtained chitosan in water was determined. A solution of the commercial chitosan and the modified chitosan was also obtained, and the conditions under which the application of the polymers resulted in uniform dyeing of polyester fabric were determined. One sample was treated only at room temperature, and the other was processed at high temperature. The colour characteristics of the resulting fabric were also compared with those of the original fabric. The distribution of the polymer layer on the fibres was determined using an optical microscope. The change in the contact angle of a drop of water on the surface of the resulting fabrics relative to the starting fabric was measured to determine the influence of modification on the surface properties.

Keywords: *1,8-naphtalimide, polyester fabric, chitosan, dyeing*

Acknowledgements: The authors thank Grant № 239-37/2024, Scientific Research Sector of University of Chemical Technology and Metallurgy.

https://doi.org/10.53230/tgm.1310-912X.2024.1001.05

MODIFIED POLYESTER FABRIC AS ADSORBENT AND PHOTOCATALYST

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Polyester fabric was modified with blend of chitosan and fluorescent chitosan, resulting in three distinct samples with varying concentrations of the latter. These samples were then characterized using an iodometric method to measure the production of singlet oxygen 1O2 under irradiation with visible light. The decolourization of a model solution of a reactive dye was investigated in the presence of the modified fabrics, both in the dark and under visible light. The influence of the concentration of the dye solution and the amount of fabric on the adsorption and photocatalytic reaction was determined. The mechanism of the decolourization has been proven by determining the isotherm, kinetic models, and thermodynamic parameters. The stability and reusability of the materials as a singlet oxygen generator were also investigated.

Keywords: *polyester fabric, adsorbent, photocatalyst, reactive dye, singlet oxygen*

Acknowledgements: The authors thank Grant № 239-37/2024, Scientific Research Sector of the University of Chemical Technology and Metallurgy.

https://doi.org/10.53230/tgm.1310-912X.2024.1001.06

TEXTILE MODIFIED WITH A PHOTOACTIVE AGENT FOR FUEL DESULFURIZATION

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The presence of sulphur compounds in fuels is ecologically dangerous because they can be converted to sulphur dioxide (SO2) during processing and combustion. Sulphur dioxide forms with water vapour acid rain, which harms agriculture, buildings, and all ecosystems. The removal of aromatic sulphur compounds is most often done by oxidation. These processes convert them to water-soluble sulphones that can be easily removed by extraction with water.

Singlet oxygen reacts with unsaturated and aromatic compounds and oxidizes compounds containing sulphur, selenium, phosphorus, and nitrogen.

Under specific conditions, such as exposure to light, photosensitive compounds react with oxygen to produce reactive oxygen species. One of the resultant products under these conditions is singlet oxygen.

Textile materials offer a range of benefits when used as carriers of photoactive compounds. The resulting composites are lightweight, flexible, and easy to apply. Importantly, they do not require hydrogen peroxide, ozone, or other oxidants, and their action can be controlled over an extended period. Polyester materials, with their excellent chemical resistance, are particularly suitable as a matrix for photosensitizers. They are commonly used in the production of filters, where strength, flexibility, and stability are crucial. Their key advantage is the possibility of recovering from the treated fuel and reusing it.

This study aims to prepare a new textile material modified with a photoactive agent and to investigate its application for fuel desulfurization.

Keywords*: textile, desulfurization, fuel, singlet oxygen.*

Acknowledgements: The authors thank Grant № 239-37/2024, Scientific Research Sector of University of Chemical Technology and Metallurgy.

https://doi.org/10.53230/tgm.1310-912X.2024.1001.07

ELECTROSPUN POLY(3-HYDROXYBUTYRATE) MATERIALS WITH DESIRED FIBERS ALIGNMENT AND TARGETED MECHANICAL PROPERTIES

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Introduction Fibrous materials produced by electrospinning offer unique properties and versatile possible applications. However, despite the progress gained in terms of the electrospinning process, finding possibilities for tuning and improving the mechanical properties of these materials still remains a major challenge. In this respect, the focus of the present study is on the fabrication of electrospun poly(3-hydroxybutyrate) materials with controlled fibers alignment and desired mechanical properties.

Experimental part Poly(3-hydroxybutyrate) (PHB), chitosan and cellulose acetate (CA) were of analytical grade. By means of electrospinning onto rotating collectors – drum (smooth), blade and grid (patterned), the PHB fibers alignment was purposely tailored. Additional fibers alignment in the direction of collector rotation was achieved by increasing the collector speed from 600 rpm to 2200 rpm. Moreover, the effect of the coating of the electrospun PHB mats with chitosan or cellulose acetate on their mechanical properties was also assessed.

Results The detailed surface morphology, thermal behaviour and crystallinity of the PHB materials were characterized by SEM, DSC and XRD. It was shown that patterned collectors had a significant impact on fibers alignment only at lower rotation speed, whereas with the increase in the collector speed the fibers alignment increased in the direction of collector rotation. The materials strength was evaluated by tensile tests and indicated that PHB materials fabricated at lower collector rotation speed exhibited isotropic mechanical properties, whereas those at higher collector rotation speed – anisotropic. In addition, coating of PHB materials with chitosan or cellulose acetate enhanced their mechanical properties.

Discussion It was demonstrated that at lower rotation speed the collector type had influence on the fibers alignment, whereas the higher rotation speed led to their alignment in the direction of collector rotation. In addition, coating with chitosan or CA preserve the fibrous structure of the PHB mats. The obtained DSC results indicated that regardless of the mats morphology and fibers alignment PHB preserved its crystallinity.

Conclusions Both the collector type and rotation speed affected the PHB fibers alignment. This further had an impact on the crystallinity and the mechanical properties of the PHB mats. The tensile tests indicated that electrospun at lower collector speed PHB mats revealed isotropic mechanical properties, whereas those at higher collector speed – anisotropic. Coating of the PHB mats with chitosan significantly increased the Young's modulus, while the coating with CA results in improvement of the elongation at break.

Keywords: *electrospinning, patterned collectors, coatings, mechanical properties*

Acknowledgment Some of the research equipment of Distributed Research Infrastructure INFRAMAT (part of the Bulgarian National Roadmap for Research Infrastructures), supported by Bulgarian Ministry of Education and Science, was used in this study.

https://doi.org/10.53230/tgm.1310-912X.2024.1001.08

ELECTROSPUN POLYMER HYBRID MATERIALS AS BIO-CONTROL AGENTS WITH APPLICATION IN ECO-AGRICULTURE

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Introduction Plant diseases are a great threat to humans because they destroy plants and plant products on which humans rely for food. A wide variety of dangerous plant diseases are caused by fungi, which make up the majority of plant pathogens. Cultivated plants are generally more prone to disease than their wild counterparts. The use of synthetic pesticides in agriculture resulted in long-term harmful consequences on humans and nature. Therefore, the development of more environmentally friendly approaches is necessary. Eco-agriculture combines innovative methods and science-backed research without endangering the environment. Electrospinning is an effective and promising process to obtain materials for application in eco-agriculture.

Experimental part Biocompatible thermoplastic polyester, aminopolysaccharide and a beneficial microorganism were used as materials. Organic solvents of an analytical grade of purity were used as received, as well.

Results and Discussion Fibrous materials were prepared by electrospinning of polyester solutions in chloroform. The obtained polyester mats were coated with a film of the aminopolysaccharide (with different molecular weights) and spores of the beneficial microorganism. Contact angle measurements of the resulting materials were carried out. The fibrous mat based on neat polyester had a water contact angle of ~110°, possessing a hydrophobic surface. The coating on the polyester mat with the aminopolysaccharide film resulted in a decrease of the water contact angle to ~77°. The hybrid biomaterials, containing the beneficial microorganism, were tested for their ability to inhibit the growth of the different fungal species that are considered to be the main causative agents of widespread plant diseases. The polyester mat coated with the low molecular weight aminopolysaccharide and containing the microorganism's spores was the most effective in suppressing the pathogenic fungi. The whole Petri dish surface was covered with the beneficial microorganism, completely hampering the growth of the pathogenic fungi.

Conclusions Novel hybrid biomaterials based on biocompatible thermoplastic polyester, an aminopolysaccharide and a beneficial microorganism were successfully developed. The spores of the beneficial microorganism were successfully incorporated into electrospun fibers to obtain biohybrid materials for plant biocontrol.

Keywords: *electrospinning; eco-agriculture; polyester; aminopolysaccharide; beneficial microorganism; plant diseases;*

Acknowledgments: This research was funded under the Project BG-RRP-2.011-0005-C01 with the financial support by the European Union - NextGenerationEU, Investment C2.I2 "Increasing the innovation capacity of the Bulgarian Academy of Sciences in the field of green and digital technologies". Some of the research equipment of Distributed Research Infrastructure INFRAMAT (part of the Bulgarian National Roadmap for Research Infrastructures), supported by Bulgarian Ministry of Education and Science, was used in this study.

https://doi.org/10.53230/tgm.1310-912X.2024.1001.09

STUDY OF THE PHYSICO-MECHANICAL PROPERTIES OF PIG LEATHER WITH ANTIBACTERIAL COATING FOR SHOE INSOLE MATERIALS

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Shoe lining plays an important role in ensuring comfort and durability, strengthening the base of the shoes, retaining heat, and ensuring hygiene. Natural pig leather is the most often used natural material for shoe linings. Due to its ability to absorb moisture this material provides a high degree of comfort and durability improving sanitary-hygienic properties. So, the main component in leather structure is protein, which makes it an easy growth substrate for microorganisms such as bacteria and fungi. Often when bacteria proliferated on the shoes causes unpleasant odors and skin diseases on human foot.

Numerous research studies have been directed at resolving this problem. In the leather industry, nanotechnology is at an early stage and has not yet reached wide applications. Nanometal oxides are being investigated for application in different fields, which also include leather materials. It has been shown that some nanometal oxides such as Ag2O, ZnO, MnO2, CuO, etc. lead to rupture of the bacterial cell wall. TiO2, CuO and Fe3O4 nanoparticles have a great ability to penetrate the cell membrane, MgO and CaO nanoparticles are highly alkaline, causing damage to the cell membrane. TiO2 and ZnO nanostructures have been widely studied as antimicrobial agents due to their photocatalytic activity under UV light and possess excellent antibacterial properties.

The present research is focused on the investigation of the physico-mechanical properties of pig leather with finishing coating including metal oxides.

It was found that there was no significant change in the physico-mechanical characteristics of the treated shoe lining materials with the antibacterial finishing coating compared to the untreated pig leather samples. No deterioration in tear strength properties. The experimental data have been compared with the requirements of the ISO standards for shoe lining materials and they fully meet these requirements.

Keywords: *leather insole, antibacterial finishing, physico-mechanical characteristics*

https://doi.org/10.53230/tgm.1310-912X.2024.1001.10

ELECTROSPUN POLYMER MATERIALS AS CARRIERS FOR BIOAGENTS

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Introduction Every year, plant diseases cause huge losses on agricultural crops all around the world. Numerous plant pathogens are the primary sources of this kind of diseases. Currently, chemical pesticides are widely used to combat plant diseases. However over the years, their overuse pollutes the air, water, and soil, harms animals, birds, and insects, and may even be harmful to human health. Thus, it is necessary to implement so-called "eco-friendly agriculture" in large quantities in order to gradually eliminate the usage of chemical pesticides. The use of microorganisms to manage pests or plant diseases is known as biocontrol. In nature, bacteria, fungus, viruses, yeasts, and protozoa are commonly found and are referred to as "biocontrol agents" because they have the ability to either directly or indirectly control plant diseases. Encapsulation of selected bioagents into targeted designed polymer carriers is a rational way to develop innovative biohybrid materials as biocontrol formulations.

Experimental part The following materials were used: poly(3-hydroxybutyrate) (PHB) with an average Mw 330,000 g/mol and 2-hydroxyethyl cellulose (HEC) with three different molecular weights: low (HEC-L), middle (HEC-M) and high (HEC-H). The beneficial microorganisms were obtained from the collection of Biodinamika Ltd., Plovdiv, Bulgaria.

Results and Discussion The electrospinning of the PHB solution under the selected conditions prior to dip-coating resulted in the formation of uniform and defect-free fibers. Following dip-coating in HEC solutions or HEC/bacterial suspension, the fibrous structure remained intact. The study examined the effects of the type and molecular weight of these cellulose derivatives on film formation, mechanical properties, bacterial encapsulation, and growth. Morphological studies revealed that the incorporated bacterial cells were uniformly distributed throughout the biohybrid material. Microbiological tests confirmed that bacterial cells embedded in electrospun PHB mats coated with HEC remained viable and grew normally. After 72 h of incubation, bacterial growth from the hybrid materials covered the entire Petri dish. These novel biocontrol formulations hold significant potential for sustainable eco-agriculture, providing effective solutions for plant protection and growth promotion.

Conclusion Eco-friendly biohybrid materials were successfully obtained using a simple and effective approach that combines the advantageous properties of electrospun PHB materials, cellulose derivatives and beneficial microorganisms. Due to their valuable properties the obtained biohybrid materials possess significant promise as biocontrol formulations for plant protection and growth promotion in sustainable agriculture.

Keywords: *electrospinning; dip-coating; PHB; 2-hydroxyethyl cellulose; beneficial microorganism; eco-agriculture;*

Acknowledgments: This research was funded under the Project BG-RRP-2.011-0005-C01 with the financial support by the European Union - NextGenerationEU, Investment C2.I2 "Increasing the innovation capacity of the Bulgarian Academy of Sciences in the field of green and digital technologies". Some of the research equipment of Distributed Research Infrastructure INFRAMAT (part of the Bulgarian National Roadmap for Research Infrastructures), supported by Bulgarian Ministry of Education and Science, was used in this study.

https://doi.org/10.53230/tgm.1310-912X.2024.1001.11

PROTECTIVE PROPERTIES OF CLOTHING IN THE SECURITY SECTOR

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Developments in the field of technical or high-performance textiles have led to the production of clothing, protecting the human body from various impacts. Protective clothing must be made of such fabric or material as to be resistant to the effects, for example, fire, radiation, hazardous chemicals.

Textiles are an important part of most protective equipment. Aramid fibers are mainly used. The essential thing about them is that they are extremely strong and have high heat resistance, they are used in aviation and military applications, for ballistic body armor. Kevlar is a para-aramid fiber that exhibits moisture and rot resistance, is characterized by exceptional strength and heat resistance properties and is indispensable in the production of body armor and worker clothing. Unlike Kevlar, Nomex fibers have a lower modulus of elasticity, but are nevertheless characterized by excellent thermal, chemical and radiation resistance. Twaron is p-phenylene terephthalamide (PpPTA), a para-aramid, and has applications in the aerospace industry and the military, for example in modern body armor.

The main advance in ballistic performance is attributed to PBO (poly(p-phenylene-2,6-benzobisoxazole) fibers, which are trademarked by Zylon. This fiber allows the design of a soft body armor that is 30–50% lower in mass compared to aramid and UHMWPE materials. Akzo-Magellan (now DuPont) teams are working on fibers called M5 fibers. A material developed by the Israeli company ApNano, which is a nanocomposite based on tungsten disulfide nanotubes, is able to withstand impacts generated by a steel projectile moving at speeds of up to 1.5 km/s. In recent years, the application of graphene as a material for body armor has begun. Graphene has become a valuable and useful nanomaterial due to its extremely high tensile strength, electrical conductivity, transparency, and being the thinnest two-dimensional material. The Gore-Tex trademark material is a waterproof, breathable fabric membrane suitable for protective heat-resistant clothing and at the same time for durable weather protection.

The selection of materials is extremely important to protect the human body from various harmful and dangerous effects. For example, aramid textile materials such as Kevlar and Nomex are suitable for firefighting and military clothing due to their exceptional resistance to high temperatures. The material Gore-Tex is a composite material consisting of several separate layers; it is applied not only in sports equipment, in medicine, but also in protective clothing. In addition to protecting against extreme climatic conditions, this material is resistant to chemical, biological and thermal effects.

Keywords: *protective clothing, textiles, composite materials*

https://doi.org/10.53230/tgm.1310-912X.2024.1001.12

NANOSTRUCTURED MATERIALS WITH POTENTIAL APPLICATIONS IN REGENERATIVE MEDICINE

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A number of causes such as chronic diseases (including autoimmune), physical trauma, cancers and viruses (e.g. SARS-CoV-2) can severely damage human tissues. The body is rarely able to repair acute injuries without external intervention, most commonly a transplant from a donor. Transplants often result in a strong immune response from the recipient, which can cause rejection of the donor tissue and even further damage to peripheral tissues and organs.

Nanobiotechnology is developing innovative methods to regenerate tissues damaged by various diseases or chemical and physical factors. At the core of these methods are nanoscaffolds based on various polysaccharides and nanocomposites. They have the potential to advance tissue engineering and drug delivery. Various basic scaffold materials have been tried in the past decades. One of the most versatile, antibacterial and biocompatible is a polymer called chitosan. Some of the most common methods for synthesizing nanoscaffolds are solvent casting, salt leaching, gas foaming, freeze drying, phase separation, electrospinning, and 3D printing.

The goal of each nanoscaffold is to mimic the extracellular matrix (EM). EM differs greatly depending on the needs of the cells which it surrounds. These differences can be biochemical, physical like electrical conductivity for muscle cells and high piezoelectric conductivity for lung tissue, or structural. These specific requirements can be met by adding specific particles to the nanocomposite that makes up the nanoscaffold. Another challenge that comes up when designing a scaffold is the fact that sometimes when different materials are added to a particular biopolymer, the 3D structure becomes brittle and cannot withstand the cells that must grow on it.

Nanomedicine allows more precise study of biomolecules and their interactions, as well as facilitated delivery of compounds with different carriers such as quantum dots, metal oxides, and others. Nanomaterials have a flexible design and small size, making them easily modifiable and compatible with the target area.

The properties of chitosan as an accessible, antibacterial and biodegradable biopolymer complement the versatility of nanomaterials, enabling the use of conventional scaffold fabrication methods for specific biomedical needs. The mechanical strength of graphene oxide (GO) and the antimicrobial properties of silver nanoparticles (Ag NPs) can be studied together to address critical challenges in traditional scaffold design. Based on this approach, fabrication of chitosan scaffolds combined with varied concentrations of GO and Ag NPs is planned. The materials will be synthesized by sol-gel method, electrospinning, or a combination of both. Their antibacterial properties and potential applications in regenerative medicine will be studied.

Keywords: *nanocomposites, nanoscaffolds*

https://doi.org/10.53230/tgm.1310-912X.2024.1001.13

MAGNETIC NANOPARTICLES CONFINED POLYACRYLONITRILE NANOFIBERS

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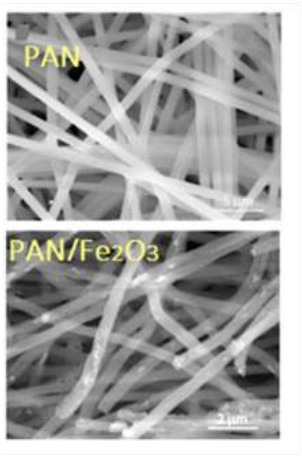

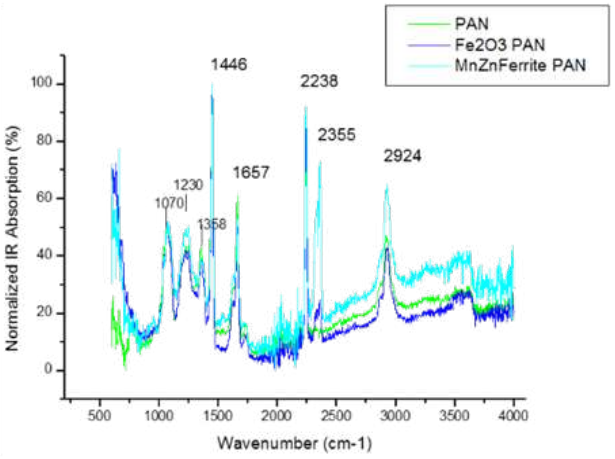

Introduction Electrospinning employs electrical forces to create micro- and nanofibers from polymer solutions[1-3],with the ability to produce diverse forms of polymeric fibrous assemblies.The remarkable specific surface area and high porosity make electrospun nanomaterials highly attractive to ultrasensitive sensor technologies and increase their importance in nanotechnological applications,and i.e.,filtration ,biotechnology ,and environmental engineering.In particular, smart textile products i.e.,medical textiles used in wound dressing, tissue engineering, and drug delivery,protective clothing,energy storage, catalysts, electric double-layer capacitors .In this study, production and advanced experimental characterizations and interfacial interaction of confined and homogenously dispersed magnetic nanoparticles of iron oxide(Fe2O3) and mangan zinc ferrite(MnZnFerrite) in polyacrylonitrile (PAN) matrix as in the nanofiber form are studied in detail [4].

Experimental part Polymer mixtures were electrospun at ambient temperature with driving voltages of 10-15 kV,with a constant distance of ~15 cm between the capillary tip and the collector, and the feed rate was 1 mL/h. Metal oxide nanoparticle(MeONP) contents are prepared as 10% PAN/DMF solution(5% w/w, MeONP /PAN).DMA experiments were performed using Perkin Elmer DMA-8000 between 300 K – 800 K with a heating rate of 5 K min–1 and at 0.5 to 15 Hz. XRD was performed with a Bruker D2Phaser diffractometer(Co Kα, λ = 0.1790) with an LYNXEYE-2 detector. Morphological characteristics of the produced nanofibers were examined by SEM and integrated energy-dispersive X-ray (EDX) analysis.

Results & Discussion Electrospun nanofibers blended with MeONPs were thermomechanical, morphological, and spectroscopically characterized .By the application of an external magnetic field in the course of dynamic mechanical analysis(DMA) under tension, the storage modulus of the glass transition (Tg) of Fe2O3/PAN rises at the expense of the loss modulus, and a new peak emerges at ~350 K. For the MnZn Ferrite/PAN nanofibers a relatively larger shift in Tg is observed, emphasizing that in comparison to Fe2O3, in MnZnFerrite nanoparticles Mn increses the magnetic response of the material.

HRSEM, XRD, spectroscopic and thermomechanical results enlighten the mechanism of interaction between nanoparticle-polymer matrix through the determination of the morphology, interactions, and the crystallinity of the synthesized fibers with the presence of nanoparticles. SEM imaging and EDX mapping indicate NPs are well dispersed in PAN composite nanofibers with minimum bead formation. MeONPs embedded in the polymer matrix hinder cross-linking throughout the network and enhance the inter-chain interactions. For the Fe2O3-containing PAN, the main peak splits into two peaks under the external magnetic field.

Keywords: *Electrospun nanofibers,magnetic nanoparticles , polyacrylonitrile*

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Topic №2
Textile Technologies: Spinning, Weaving, and Knitting

UDC 677
Textile Industry. Technology of textile materials

https://doi.org/10.53230/tgm.1310-912X.2024.1002.14

BALLISTIC PROTECTION MATERIALS

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Ballistic vests are composed of particular high performance clothing. They could be reinforced by one or two armor panels according to the protection level and are designed to resist to attacks intended to upper parts of the body to save lives of its wearers. The resistance behavior of ballistic body armor depends on several factors related to the ballistic fabric properties. The type of fabric, its thickness, its structure, its strength and strain, and the type of the employed resin are the most important factors. In this paper, the factors influencing the ballistic performances of soft armor panel and hard armor panel are presented. It also reports the various methods developed by the researchers to improve the performance of ballistic materials.

Keywords: *Ballistic materials, Kevlar fiber, UHMWPE fiber, ballistic impact, shear thickening fluid*

https://doi.org/10.53230/tgm.1310-912X.2024.1002.15

YARN-LEVEL MODELING OF KNITTED FABRICS

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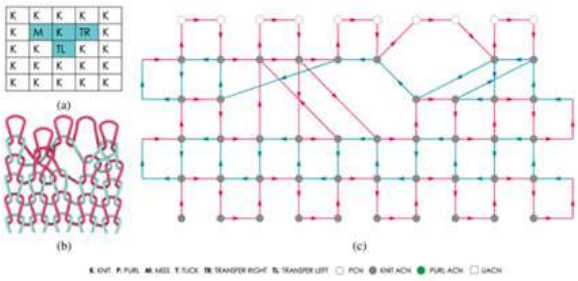

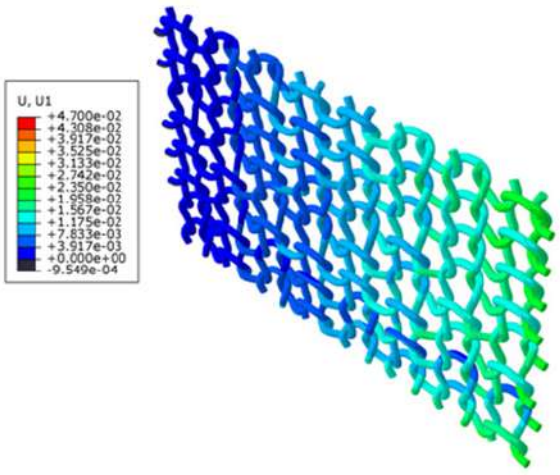

In an effort to develop computational models that can predict the properties and behaviours of weft-knitted fabrics, two low-level models have been developed that represent the topology and geometry of the yarns in these types of fabrics. TopoKnit is a system that is capable of generating a yarn topology graph directly from a stitch pattern of a weft-knitted fabric consisting of Knit, Purl, Transfer, Miss and Tuck stitches.[1] Via an application of an optimization process, solid geometric models of the yarns in a weft-knitted fabric may be generated. The resulting geometric models meet the strict contact constraints between adjacent yarns required by downstream Finite Element Modeling (FEM) simulations.[2]

Our topology work focuses on modelling knitted textiles within a process space. Process space models the abstract processes that lead to the formation of the material. In our work we focus on the processes that locally manipulate yarn loops at the stitch command level. The two critical components of the material that play a central role in this process are the yarn and the yarn intertwining where the yarns connect with each other.

Producing geometric models of yarns suitable for FEM is framed as an optimization problem. A "cost" function is specified in such a way that finding the variable values that produce a minimum function evaluation generates the desired geometric result. The features incorporated into our cost function include maintaining yarn rest length, minimizing curvature and creating contact points between crossing yarns. The variables that are modified to minimize the cost function are the spline control points that define the centerlines of the tubes used to represent the yarns.

Both models have been implemented and compared against other computational models and actual knitted fabrics to verify their accuracy. The yarn-level geometric models have been employed in FEM simulations that compute the out-of-plane motion and reaction forces resulting from in-plane strain. In current work, the yarn topology graphs are being used for both flow simulations and permeability analysis of knitted fabrics.

Keywords: *weft-knitted fabrics, yarn topology models, solid geometric models, FEM simulation, flow and permeability analysis.*

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https://doi.org/10.53230/tgm.1310-912X.2024.1002.16

UNIFORM DISTRIBUTION OF ELASTIC DEFORMATION POTENTIAL ENERGY IN A TWISTED FIBROUS SHEAF

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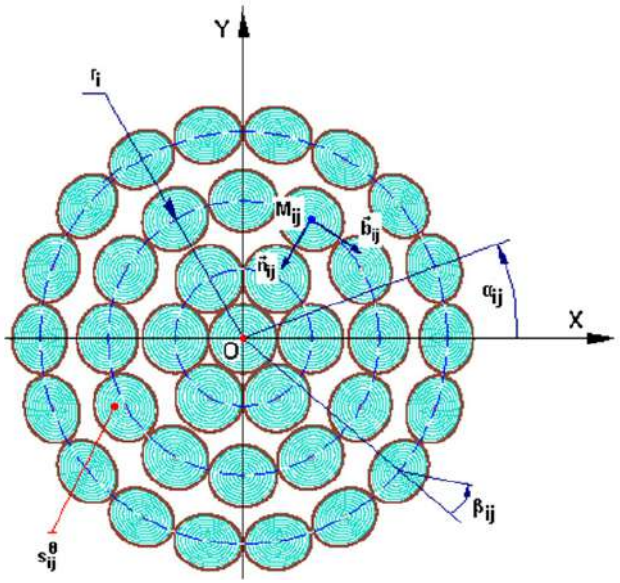

The uniform distribution of stresses and strains in the stretched fibrous sheaf is spread over its cross-section and longitudinally along the axis. The cross-section of the virtual sheaf represents a hexagonal matrix with concentric layers in which the fibres are arranged. The real fibrous sheaf has the structure of a three-phase fluid, in which the main phases are: the single fibres with the characteristics of ideal solid bodies; the air between the fibres and the contact area between them.

Since the fibres are the carriers of the mechanical behaviour of the sheaf, the structural analysis is focused on them. The cross-section of the fibre can be viewed in a similar hexagonal matrix. The virtual circle of the cross section is divided into a finite number of concentric sectors. The number of sectors can be increased until their thickness equals the thickness of the micro-fibrils or macromolecular chains of the fibre-forming polymers.

An optimal fibre cross-section division can always be found that balances calculation time and accuracy, but the number of sectors must be equal to and greater than the number of fibrous layers in the sheaf. The hexagonal division of the sectors progressively increases from the first to the peripheral fibrous layer. Thus, all tiles bounded in the sectors and between two virtual radii have the same area. Their shape is trapezoidal, but given their small size, it can be considered square. Virtual cells occupy the volume between two tiles, the distance between which is equal to the thickness of the sector.

Because of this separation of the virtual cells, each of them represents a finite element with definable metric parameters. This allows the application of the tensor determination of the stress state in a certain volume of the fibrous sheaf, which depends only on the location of the fibre and the cell in the cross section. Finally, the balance between the accumulated potential energy of elastic deformation and the virtual work from external torsion or elongation is based on the uniformly distributed state in the volume of the fibrous sheaf.

The subject of the article is the determination of the finite element of the fibre volumes according to the structure of the fibrous sheaf. The goal is to establish a uniform calculation of the stress state parameters in the twisted fibrous sheaf.

Keywords: *textiles, fibrous sheaf, stain-stress tensor fields.*

https://doi.org/10.53230/tgm.1310-912X.2024.1002.17

PROTECTIVE CAMOUFLAGE EQUIPMENT IN TEMPERATE CONTINENTAL CLIMATE AREAS

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Ensuring national and global security, especially in the context of increasing global conflicts, brings into sharp focus the critical issue of protecting military personnel on the battlefield. Modern military conflicts require the implementation of measures that ensure safety, communication, comfort, and maintain the effectiveness of military apparel. In this context, the integration of smart and multifunctional textiles, next-generation materials, and systems with diverse properties plays a crucial role in providing protection and comfort to military personnel during combat operations and training. Equally important is the need to provide reliable camouflage gear for various climate zones, as well as the selection of fabrics and systems that ensure comfort in different climatic conditions.

This article reviews protective camouflage equipment designed for temperate continental climates. Military gear must provide effective protection and concealment amid seasonal changes, including varying temperatures, humidity, and shifts in natural hues. The color palette typically features shades of green, brown, yellow, and gray, reflecting nature's transformations—from the lush green forests of late spring and summer to the brown leaves of autumn and the bare trees of winter. Camouflage patterns are selected based on climatic zones to adapt appearance and materials to different environmental elements across seasons. The equipment should balance durability, strength, and lightweight design while ensuring thermal comfort and protection against rain, snow, and wind.Military clothing must enable physically demanding tasks while maintaining endurance and mobility. Functional textiles enhance garments with properties such as mechanical resistance, water and dirt repellency, fire resistance, antibacterial features, and UV protection. Smart and multifunctional textiles create opportunities for high-tech garments that integrate multiple functions. In addition to camouflage, the gear often includes thermal protection for varying temperatures and noise reduction during movement. This equipment is essential for operations in temperate continental regions, ensuring effective concealment in changing conditions.To create military gear for a temperate continental climate, it is important to conduct tests for each of the climate's characteristics to ensure protection of the fighter's body from both freezing and overheating. The CLO rating has been introduced to determine the ergonomic comfort of each piece of equipment, helping to measure the thermal insulation properties of clothing. The standard used for measuring the thermal insulation properties of clothing with the CLO rating is BDS EN ISO 9920:2009 "Ergonomics of the Thermal Environment. Assessment of Thermal Insulation and Evaporative Resistance of Clothing Ensembles." This standard introduces methods for evaluating the thermal insulation and evaporative resistance of clothing, as well as measuring the insulation properties in various layers and combinations of clothing, using both static and dynamic testing methods. It is suitable for researching thermal comfort in work environments, sports, and everyday clothing use. The standard shows how well a given garment or layer of clothing can retain body heat and provide comfort in cold conditions. The higher the CLO rating, the better the insulation of the clothing. One CLO (from "clothing") is defined as the amount of insulation required to keep a person seated in an environment with a temperature of around 21°C with minimal physical activity, in comfort.

Keywords: *Equipment, temperate continental climate, field combat uniform.*

https://doi.org/10.53230/tgm.1310-912X.2024.1002.18

TWO-WAY ANALYSIS OF THE VARIANCE TO DETERMINE THE SIGNIFICANCE OF THE INFLUENCE OF FACTORS „SLED LOAD“ AND „AREAL MASS“ ON THE STATIC COEFFICIENT OF FRICTION AT REST, FOR COTTON-TYPE FABRICS

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With our multifaceted activity, we discover more and more diverse textile materials in terms of composition and structure. The degree of their knowledge is an essential stage that leads to the study of the possibilities of different tissues. Of particular interest is the influence of various technological factors separately and jointly on the static coefficient of friction. In the present work, priority is given to the load on the sled and the areal mass of the textile materials, as the main technological factors influencing the friction processes in textile and sewing production.

In recent years, natural textile materials have gained special relevance. This motivated the conduct of the present research with one of the most widely used natural textile materials, namely cotton type fabrics.
In the context of the above, the purpose of the present work is to establish the significance of the influence of the factors:

- Fa – sled load, g
- Fb – surface mass of cotton-type textile materials, g/m², on the static coefficient of friction.

To achieve this goal, a statistical-mathematical method of analysis and evaluation – two-factor variance analysis was applied, as it is particularly effective in studying the influence of several factors separately and jointly.
Cotton-type textile materials with a composition of 50% cotton – 50% polyester were used for the research. As a results of the research and analysis, it has been determined how significant the influence of the factors „sled load, g and „area mass of cotton-type textile materials, [g/m2] separately and jointly on the static coefficient of friction is.

Keywords: *static coefficient of friction, areal mass, sled load, two-factor analysis of variance*

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APPLICATION OF MATHEMATICAL METHODS IN THE STUDY OF OCCUPATIONAL SAFETY AND ERGONOMICS IN THE LIGHT INDUSTRY

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One of the main branches of the light industry, which has a particularly wide social significance in Bulgaria, is the sewing industry. Therefore, the subject of research in this work will be basic technological parameters of the working environment that affects the safety performance and ergonomics in the sewing industry.
As a summary of the conducted study, it can be summarized that a number of studies have been carried out on the influence of individual work environment factors on safety and ergonomics in different areas of the light industry. For a large number of industrial production types individual technological parameters have been found to influence the increase in safety and ergonomics performance. With regard to the sewing industry, the influence of individual basic factors of working conditions on occupational safety and ergonomics has also been investigated. It is important to note, however, that the issue of deriving the degree of influence of individual factors determining working conditions that affect occupational safety and ergonomics in the sewing industry has not been studied in sufficient depth in Bulgaria.

In the context of the above, the aim of the present work is to investigate the importance of the numerous factors of working conditions in the sewing industry affecting occupational safety and ergonomics and to sift out the most significant of them by ranking (ordering) them.

In order to realize this goal, a ranking experiment is planned. On the basis of the research and analysis, a questionnaire was created, which included 9 generalized factors affecting occupational safety and ergonomics in the sewing industry. An expert survey was conducted on the priority importance of these factors. A Kendall's tau and scatterplot experiment was conducted, as a result of which the factors influencing occupational safety and ergonomics in the sewing industry were ranked by priority importance. The factors that most significantly (with the highest priority) influence occupational safety and ergonomics in the sewing industry are identified.

The obtained results give grounds to specify the priority importance of these factors. This greatly refines and simplifies the work in the expert analysis of occupational safety and ergonomics in the sewing industry.

Keywords: *technological parameters, work safety, distraction experiment.*

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https://doi.org/10.53230/tgm.1310-912X.2024.1002.20

IMPACT OF THE COEFFICIENT OF FRICTION ON THE SEAM QUALITY OF DENIM JEANS

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The so called "blue jeans" were invented in the far 1873 and remain modern nowadays. Their quality is determined by the properties of the fabric and that of the seams. The quality of the seam depends on many factors, one of which is the coefficient of friction between the fabrics that influences the slippage of the layers each to other during the sewing process. The value of the friction coefficient depends on the material used, the linear density and the twist of the warp and weft threads, the weave, the density of the threads, and the finishing treatment. In order to increase the friction forces between the fabric layers, a pressure by means of a presser foot is exerted on them.

In the sewing industry, the quality of a product is defined by a set of product properties that satisfy certain consumer needs and/or requirements.

Some authors supplement these approaches with another one: the "21st Century Approach", in which to the professionals, managers and workers, the scientists are added as an important factor in the quality and reliability management system (Tasev, 1996), (Tasev, 2002).

In the context of this study, the authors support the "21st Century Approach" involving as well scientists in the quality management. The main reason for such decision is that research is moving at a fast pace, ahead of business. The complexity of quality management in this process makes the participation of scientists, both in quality management and in technological processing (Andonova, 2004) mandatory.

Many scientific publications have been published indicating the basic functional, constructive, technological, economic, aesthetic, ergonomic, hygienic, social, etc. quality characteristics of the sewing products (Andonova, 2017), (Germanova-Krasteva, D. & Petrov, Ch., 2008). The quality characteristics of the sewing products are formed at the stage of their technological processing.

In this article, we focus on the importance of the coefficient of friction on the qualitative performance of the sewing operations, especially for clothing. The quality of a garment is also judged not only by the sewing materials – fabric, threads, buttons, zippers, adhesive materials, etc., but as well by the quality of the seam – an indicator which is often overlooked.

When joining two pieces of clothing, there should be no mutual displacement, i.e. when making the stitches of the seam, one layer to be stretched and the other one – puckered (Figure 1a) (COATS - Eliminating Seam Puckering). When making a hem, there must be no twist of the hem. Often, when attaching the sleeves to the armholes of the garment, there are displacements, which lead to twisting of the sleeves and discomfort when the clothing is being worn. Such effect could appear when sewing the legs of the jeans (Figure 1b) (Seam Defects | Common Seam Quality Defects in Garments).

The study is carried out for denim fabrics made of 100% cotton in twill weave. The static and dynamic coefficients of friction before and after finishing at different pressure levels are determined.

Keywords: *Static and dynamic coefficients of friction, Denim fabrics, Finishing, Seam quality.*

https://doi.org/10.53230/tgm.1310-912X.2024.1002.21

RESEARCH THE CHANGE IN THE THICKNESS OF TWO LAYERS OF COTTON FABRIC, IN RELATION TO THE PRESSURE ON THEM

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The present study is a continuation of the author's previous scientific publications, developed both independently and as a team. The purpose of the study is to establish the type of graphic dependence - change in the thickness of two layers of one cotton fabric in the warp-warp direction from the facing side about the pressure - at 200 g, 300 g, and 400 g. Apart from that, the aim is to use the Trend line function through graphic forecasting in Excel to establish the trend of the graphic dependence - change in the thickness of two layers of fabric in the direction base-base and front side and at pressure values that were not used in the experiment – less than 200 g and more than 400 g.

Measurements were made with a Textil-Dikenmesser J-40-T digital indicator. The thickness of one layer of fabric and the thickness of two layers of fabric in the warp direction from the facing side of one layer of the fabric on the warp facing side for the other fabric layer are measured. The contact area of the pressure disc of the digital calliper is 20 cm2, the mass of the digital watch with the pressure disc is 0.200 kg. Measurements were made at normal pressures of 200 g (own mass of the pressure disc), 300 g (+100 g) and 400 g (+200 g). By placing additional weights of 100 g, the pressure changes.

The experimental study was carried out with cotton fabrics 100% cotton, with different weave, basis weight, etc. differences. The fabrics are produced in Strumatex factory - Blagoevgrad, Bulgaria.

As a result of the experiment, it is established:

When analysing the graphic dependencies, it is found that a logarithmic function - close to the linear one - perfectly describes the dependency - a change in the thickness of two layers of fabric in the base-base direction from the front side, in relation to the pressure.

The graphic dependence of the thickness of two layers of fabric in the warp-warp direction from the front side for cotton fabrics is logarithmic, and as the pressure increases, the thickness of the two layers of fabric decreases.

It is found that at pressures of about 25 g to 50 g, the graph is steep, with the beginning of the steep section corresponding to a thickness equal to the algebraic sum of the thicknesses of two tissue layers measured individually at 200 g pressure (from the mass of calliper pressure disc).

All graphs are at high confidence coefficient R2 > 0.99. The values of the confidence coefficient R2, which can be seen below the graphical equations in graphs, characterize the convergence as excellent and ideal quality, with a confidence norm above 0.85.

For fabrics with a 3/1 twill weave, the dependence of the thickness of two layers of the fabric in the warp-warp direction from to the face about pressure can be approximated by the following equation

$y = 0.2 \ln(x) + 2.$

Keywords: *cotton fabrics, the thickness of one and two layers of fabric, pressure*

https://doi.org/10.53230/tgm.1310-912X.2024.1002.22

RELATIVE DENSITY OF QUALITY INDICATORS WITH NORMAL AND POISSON DISTRIBUTIONS IN ASSESSMENT OF WOVEN FABRICS

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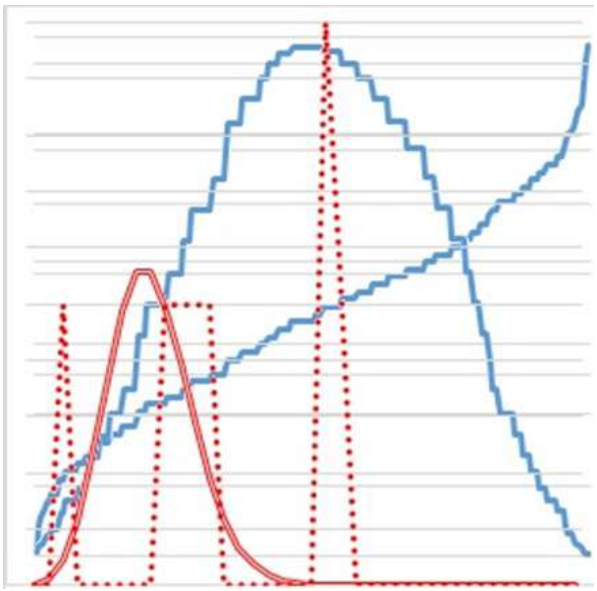
Just as fabrics are manufactured under conditions of deterministic machine settings and sporadic failures, quality indicators are divided into two main groups: results of laboratory measurements with a normal distribution of numerical values and organoleptic observations of rare events with a Poisson distribution. The method of measuring properties through laboratory tests is characterized by objectivity, accuracy and numerical values of the established results. The properties to be measured follow the designed and specified fabric structure. Measurements are single statistical events that are reflected in the numerical value obtained by the laboratory apparatus. The set of numerical data from laboratory measurements of the determined properties has a normal distribution. The probability density of properties with the normal distribution is characterized by a bell-shaped change in the exponential function and by established statistical indicators, of which the mathematical expectation and the confidence interval of the mean value are of particular application.



$$f(x) = \frac{1}{\sigma\sqrt{2\sigma}} \cdot e^{-\frac{1}{\sigma^2}(x-m)^2}$$

While the physical properties remain hidden in the fabric's construction, even the smallest defect on the surface is visible and repels the consumer. These defects are rare but clearly profiled discrepancies such as: dirty spots, color differences, broken weaving threads, knots and the like. Defects are the result of a sudden change in one of the machine modes, due to an accident or other similar event. The emergency origin and their rare occurrence (less than 1/10,000) categorizes them as rare events with the corresponding specificity of statistical processing and analysis. Unlike measurement methods, the organoleptic method is applied to the entire general population of the batch of fabric and in this case, a representative sample is not drawn up. Enumeration of defects of the same type for a single piece of fabric and for the entire batch leads to the compilation of sets of numerical data that reflect rare events and have a Poisson distribution. The essential feature of the statistical processing of numerical data with a Poisson distribution is the single extremum of the relative distribution and the equality between the mathematical expectation and the standard deviation.

$$\bar{x} = n \cdot p = \frac{n \cdot m}{n} = m$$

Subject of this study is the density and distribution of quantitative indicators with normal and Poisson distributions originating from the measuring and organoleptic method for grading woven fabrics.

Keywords: *textile fabrics, quality evaluation, Gauss / Poisson density*

Topic №3,
Apparel Technology

UDC 687
Tailoring (apparel) Industry


НА ЕЛЕМЕНТИ ОТ БЪЛГАРСКИТЕ НАРОДНИ НОСИИ В
ОТО ДАМСКО ОБЛЕКЛО

https://doi.org/10.53230/tgm.1310-912X.2024.1003.23

INTEGRATION OF BULGARIAN FOLKLORE COSTUME ELEMENTS IN CONTEMPORARY FASHION GARMENTS

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This presentation explores the innovative integration of Bulgarian folklore garment elements into contemporary fashion, highlighting the cultural significance and aesthetic potential of traditional motifs. By examining key folkloric garments, such as the "Nosia" and various elements of regional attires, we will show how their intricate patterns, rich colors, embroideries, accessories and unique textile techniques can be combined to different modern clothes to sustainable, modern and unique style.

Through a series of design experiments and collaborations with contemporary fashion influencers and pop-folk artist, we investigate how these historical elements can be reinterpreted to create modern ensembles that resonate with today's fashion sensibilities while preserving the essence of Bulgarian heritage. Traditional folk elements of the Bulgarian women's national costume from the 19th century including embroidered shirts, tunics/ soukman, aprons, bruchnic/ draped skirt, saya/dress or overcoat and various accessories interwoven in interesting and unusual combinations with voluminous tulle skirts, classic trousers, elegant dresses. The presentation will showcase a collection of designs that marry the old with the new, aiming to revive cultural appreciation and promote sustainable fashion practices.

Integrating Bulgarian folk costume elements into contemporary fashion not only revives traditional craftsmanship, but also offers a unique perspective in today's fashion landscape by bridging the gap between tradition and modernity, this initiative not only revitalizes folklore but also encourages a dialogue about identity, cultural representation, and innovation in the fashion industry.

Keywords: *sustainable fashion, Bulgarian folklore costume, modern traditional clothing*

Referenses:

Traditional Bulgarian Costumes and folk arts
- National Ethnographic Museum by Bulgarian Academy of Science
- Photo credit: Nina Nikolina

https://doi.org/10.53230/tgm.1310-912X.2024.1003.24

MAKING A WOMEN'S BLOUSE ACCORDING TO A PATTERN

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Blouses are clothing

That covers the upper part of the body - from the shoulders to the waist and to the hip line.

Now, they are worn by women.

They are looser than shirts and there are more diverse of models.

We focus on the women's blouse

In a classic style, fitted with pleats on the chest line and waist pleats on the front and back.

We button up it with buttons. The collar and cuffs are pasted under. The extra decorative detail, which gives an elegant look to the product, is a seesaw line, which is mounted on the sleeve curve.

The blouse is suitable both for everyday life and for formal occasions.

The present survey has a descriptive and practical-applied character. It is accented on a women's blouse, according to fashion trends.

The subject of this article is to present the model, the description, the materials used, the sewing machines and devices, as well as to describe the technological sequence of the given product.

The purpose of the elaboration is to make a comparison between the productions of women's blouses according to a model in the production and at school in the practical lessons.

https://doi.org/10.53230/tgm.1310-912X.2024.1003.25

DRESIGNING A MODERN WOMEN`S DRESS WITH ELEMENTS OF THE BULGARIAN FOLK COSTUME-A DOUBLE APRON COSTUME

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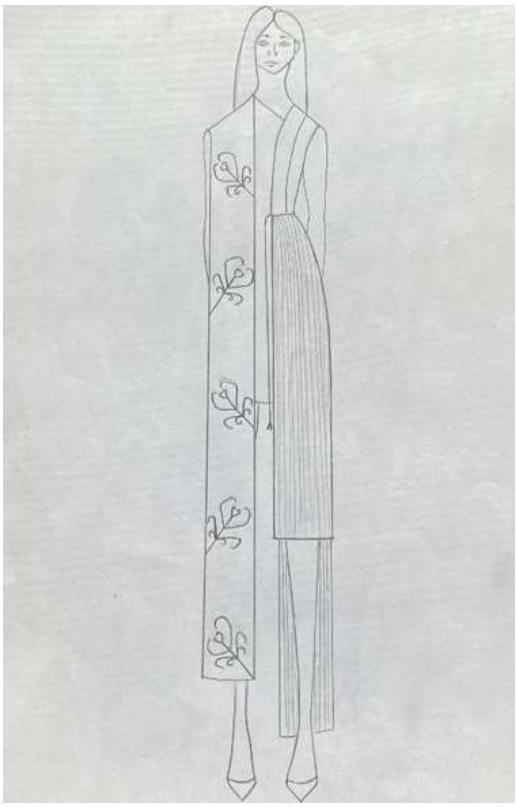

The Bulgarian folk costume is a living testimony to the wealth and diversity of Bulgarian culture and reflect the various ethnic groups, regions and historical periods that unite the Bulgarian people.
Bulgarian traditional costume is the clothing of the Bulgarian from the Renaissance to the mid-20th century, including until the present day. It reflects the specifics, traditional culture and life of the Bulgarian people. The costume is the oldest women's clothing that has been preserved until the beginning of the 20th century. After the Liberation in 1878, significant changes occurred under the influence of urban clothing. Women's costumes are classified into three groups-a designed, suckman and sait costume.

What we will look at is how a Bulgarian two -rowed costume from the area of Northern Bulgaria can be turned into contemporary women's clothing.

Our design jewelry brings the spirit of Bulgarian history. The model is asymmetrical in the front and back, with the perfect accent worn on another outfit in the form of a vest or outer dress. The long front can be over as a scarf or descending calmly, conveying elegance to any vision. The main focus is in this element, which is contrasting red with gold ornaments and stands out in front of the white color of the garment. Ornaments are part of a seamstress that are hand -painted with an idea and Contribution to the development of fashion design and to something really beautiful and contemporary. The project itself looks at the characteristics of the Bulgarian costume, Including materials, symbols and colors used. The result is an official model that combines the elegance and history of our Homeland with modern attractiveness and practicality. With this outfit I want to inspire the necessary return to the Bulgarian root in Fashion overpowered in a contemporary look. Sewing is the ancient energy and treatment that is needed in the modern world!

Keywords: *Tradition, Bulgarian two -ahead costume, hand ornaments*

https://doi.org/10.53230/tgm.1310-912X.2024.1003.26

WOMEN'S 70'S STYLE DRESS

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Nowadays, fashion is an abstract concept. People are experimenting with different looks, combining and wearing clothes in unusual ways to be different and show their identity. Inspiration comes from many aspects of our surroundings and the influence of social media. The same can be said about the vision of the 70s of the 20th century. People's mindset, way of dressing and lifestyle were heavily influenced by wars, civil rights movements, music and the hippie movement of the late 1960s.

The 70s are a great inspiration for both world designers and this collection. The model of the dress is casual, summery, suitable for young girls with a taste for the past. It is made of a light material, such as is used in the summer months, which holds the colors well. The idea for the pattern of the main fabric, the colors and the cut of the sleeves comes from the style of the early hippies, also called "flower children", the Charleston and the earth colors. The dress combines a bohemian style with a corset, typical of the earlier years of the last century. Accessories include a belt with colorful motifs and boots or platform shoes in tune with the spring-summer 2024 year trends.

The cut uses a basic women's dress construction in a semi-fitted silhouette, the sleeves are flared from the elbow down. The corset uses the same basic construction as the dress. Two shoulder seams are made on the front and back. Front seams are stitched as an accent of the product. The material for making it is polyester imitating suede with a lining from the main fabric of the dress. The interesting thing about the corset is that it is double-faced and can be worn in two ways.

Fashion both past and present inspires us to create interesting and extravagant garments that express our identity. The 70s were years of expression, freedom and a desire for justice. That's why I created this dress with a touch of freedom and extravagance.

Key word: *women's dress, 70s, hippie*

https://doi.org/10.53230/tgm.1310-912X.2024.1003.27

A MODERN INTERPRETATION OF A WOMEN'S SKIRT AND A WOMEN'S TANK TOP

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Being fashionable is always relevant. The variety of colors and shapes, flowers and laces, fabrics and clothing decorate our everyday life every day. This variety can be alone or in various combinations. A lot of floral motifs started to be used to enrich the clothing. They have always been relevant over the years since ancient times. They add mood, warmth, inspiration to every outfit and color to everyday life. Various ornaments with floral shapes are well received in both women's clothing and men's products. Floral designs appear in textile fabrics and products. The fabrics are varied with multi-colored repeating motifs of flowers and shapes. Flowers are a universally recognized and eternal symbol of feminine beauty and tenderness everywhere in the world. There is no lady who is not subject to their charm. Elegant and mysterious models bring style and beauty to everyday life. All shades of the green range add lightness and romance and are preferred for summer skirts and tank top. The creation of model version of a women's skirt and tank top is included in the fashion collection „In love with youth" giving calmness, elegance and enchantment to the spring-summer season.

A model development of a women's skirt and a women's tank top was considered and made, and technological options for making new models were transformed and archieved.

The results achieved are:

- Development of women's asymmetric skirt with own dimensions;
- Development of a women's tank top from a basic cut of a women's tank top with own dimentions;
- İmplementation in production;
- For use in future projects in the textile and garment industry.

Keywords: *women's skirt, women's tank top, floral motifs, fashion, textile and sewing production*

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https://doi.org/10.53230/tgm.1310-912X.2024.1003.28

ANALYSIS AND COMPARISON OF POPULAR PATTERNMAKING SYSTEMS: sMÜLLER AND ESMOD

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Making a garment cut according to a given design usually requires using ready-made basic blocks as a starting point. It is naive to consider that only the design idea is essential to its success among consumers. Many factors determine whether a garment will be liked, but the most important thing for the customer is comfort and how it fits on the body. Achieving a good final result in less time largely depends on the perfectly constructed basic block. Using bad basic blocks brings problems in later stages, and solving them leads to wasted time and increased product development costs (Gehlar, 2008, p. 58). Therefore, choosing the right patternmaking system is very important and must meet the individual needs of the brand.

My experience as a fashion designer and pattern maker for my own brand challenged me to create the best basic blocks by choosing which pattern-making system to use. This is why I started an in-depth study of the different patternmaking systems.

This study provides a detailed analysis and comparison of two of the most popular systems - M. Müller & Sohn (Müller for short) and ESMOD. The choice is based on how both systems consider body proportions and shapes in detail, designs are complex, and although more complicated to draft than most methods, they are more accurate, and a better basis for developing new patterns.

The purpose of this study is to identify the advantages and disadvantages of the two methods, to give suggestions for adjustments, and to propose a revised, easier-developing drafting method. Specifically, the research is based on the development of a woman's basic bodice block.

The experimental part of this research includes the following stages: Analyzing the drafting principles of both methods; Drafting the basic blocks by both methods in size 36 according to the European standard; Measuring the obtained dimensions of the constructive lines of the blocks (bust, waist, hip, etc.) and comparing; Determining the development difficulty level; Sewing the prototypes and examining them over a professional dress form size 36 according to the European standard, corresponding to the measurements used to develop the blocks; Analyzing the results and proposing corrections for both foundations.

Keywords: *patternmaking, basic block, fashion design, Müller, ESMOD*

Topic №4,
Textile art and Fashion Design

UDC 745/749
Applied Art. Art Crafts. Interior. Design

UDC 658.512.23
Artistic design (industrial design)

https://doi.org/10.53230/tgm.1310-912X.2024.1004.29

CHILDREN'S CLOTHING IN THE BULGARIAN MONARCHIES

Rosica Rangelova

The development of the Bulgarian children's monarchical clothing follows the changes of the monarchical clothes throughout the historical stages in Bulgaria. There is almost no information from the Medieval Ages for the Children's Monarchic Costume. The main information is obtained from the London Gospel, depicting Tsar Ivan-Alexander with his wife Sarah-Theodora and their two sons. The period of the Third Bulgarian Kingdom gives the most detailed information about the development of children's monarchical clothing. It is characterized by going to keep up with the fashion for children in other European monarchical families. Information about this is taken from the many photographs and portraits of the royal heirs. Their clothing is simpler to such loaded with many decorative elements. Also, they are not excluded from the Bulgarian national costume, which in some cases are even leading.

https://doi.org/10.53230/tgm.1310-912X.2024.1004.30

FASHION FORECASTS IN THE CONTEXT OF NEOCONCEPTUALISM IN FASHION

Milka Aleksandrova

In the era of digital reality, fashion is rapidly evolving under the influence of new technologies. Virtual and augmented reality (VR and AR), artificial intelligence (AI), and digital models play a key role in shaping the future of the fashion industry. In this sense, neoconceptualism represents a new reality for fashion, where technology and art shape the new fashion landscape. Neoconceptualism is a new movement in fashion that combines traditional conceptualism with the new possibilities offered by technology. It explores new forms of expression and communication in fashion and is characterized by several key principles:

Artificial Intelligence in Design and Production: AI is used to generate new ideas, automate processes, and improve production, leading to innovative and avant-garde fashion designs. Digital expression and aesthetics are achieved through the use of VR, AR, and 3D modeling, creating garments that offer new visual and tactile experiences. Virtual and augmented realities are becoming the new settings where fashion brands increasingly present and market themselves, utilizing VR and AR to create virtual showrooms, fashion shows, and apps for virtual try-ons. This provides unique user experiences and simplifies the shopping process.

Interactivity: Neoconceptualism actively involves viewers as participants in fashion experiences by using digital installations and virtual fashion shows. Interactive and personalized experiences are achieved with the help of AI and interactive technologies, allowing users to receive personalized recommendations and interact with products in new ways, such as through interactive shop windows and digital tags.

Deconstruction of Traditional Models: By using unconventional materials and innovative forms, neoconceptualism challenges established norms of luxury and aesthetics.

Fusion of Fashion, Art, and Technology: Technologies like AI and AR create garments that can adapt and change in real-time. Virtual models and influencers, created through AI and CGI, are gaining popularity. Virtual fashion collections, designed for digital wear in social networks and the metaverse, are also becoming increasingly relevant. Artificial intelligence in design and production is used to generate new ideas, automate processes, and enhance production, leading to innovative and avant-garde fashion designs.

Sustainability and Ethics: The use of digital technologies to reduce waste and carbon footprint is an important aspect of the new era and neoconceptualism. Ethics and sustainability should be the watchwords of our time—digital fashion and technology support sustainability, reduce waste, and facilitate supply chain traceability. Circular fashion and models for renting and resale also contribute to environmental responsibility. Neoconceptualism is changing consumer habits, encouraging new business models, and integrating fashion into other disciplines such as technology and social sciences. This new movement redefines the boundaries between the physical and virtual, between tradition and innovation, and plays an important role in the contemporary cultural landscape. In the age of AI and the metaverse, fashion is becoming a new form of culture that requires in-depth analysis and new conceptual frameworks to understand the interaction between art, technology, and fashion products.

Keywords. *Neoconceptualism, fashion, digitalization, technology, AI, CGI, AI, AR, 3D modeling, VR, sustainability, ethics, design, art, metaverse.*

https://doi.org/10.53230/tgm.1310-912X.2024.1004.31

APPLICATION OF TEXTILES IN EXHIBITION DESIGN

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Textiles are a material with diverse applications, inspiring and enabling designers, artists, scenographers, architects and various visual artists, to develop and realize their creative ideas. The wealth of materials with different technological and constructive qualities, their strength and flexibility when processed, the variety of visual imprints on the textiles are the basis of impressive projects of different scales.

In the report, textiles are presented as the main material in the layout of the exhibition "Vasil Stoilov - Architectural motifs" in the UniArt gallery, at the New Bulgarian University. The study reveals the creative concept and the process of its execution as well as the final result of the exhibition and shows that it could not have been achieved and would not have reached the sought-after impact without the application of fabrics of different structures.

The concept aimed at the creation of an atmosphere that, based on pencil drawings made by Vasil Stoilov, recreates a sense of presence in a setting from the Netherlands in the 17th century. A serious challenge was to achieve a harmonious relationship between the modern architectural setup of the UniArt gallery, executed with modern materials and approaches to form creation and with an emphasized horizontal layout, with the idea of the "lowlands" from four centuries ago. The use of a total of over 200 m² of four types of synthetic fabrics - chiffon, gabardine, organza and lining material, with the same width of 140 cm, but with different lengths and making prints on them with the sublimation technique, allows bold design solutions in terms of scale and visual impact.

With the help of the selected materials, it becomes possible to collect the elements of the exposition compactly, to store and transport them in order to realize the concept later, and to show the exhibition as a new exposition in another, completely different in size, form and space aesthetics.

Keywords: *textile installations, exhibition design*

https://doi.org/10.53230/tgm.1310-912X.2024.1004.32

REFLECTIONS AND REFERENCES TO BULGARIAN FOLKLORE IN FASHION ILLUSTRATION IN BULGARIA

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The report explores the influence of traditional Bulgarian folklore on fashion illustration within the country. It highlights the historical and cultural richness of Bulgaria, tracing its roots through centuries and the unique inspiration derived from its folk motifs, which have influenced artists across various creative fields, including fashion.

The report provides a chronological review of key examples in fashion illustration, beginning from the early 20th century. It discusses the integration of folk elements such as embroidery, traditional costumes, and motifs in contemporary fashion. These elements are not only seen in clothing but also in various artistic interpretations like ceramics, wood carving, and metalworking, influencing both local and international designers.

Bulgarian designers like Pelagia Vidinska and Teri Karaivanova, among others, have incorporated traditional motifs into their fashion collections, creating unique pieces that merge folk heritage with modern trends. This influence is also reflected in women's 39 periodicals from the early 20th century, where illustrations of modern clothing often incorporated folk motifs such as traditional embroidery.

Moreover, the report discusses the role of educational institutions, notably the National Academy of Arts, in preserving and promoting the use of Bulgarian folklore in fashion design. Courses on fashion illustration and traditional costume design ensure that future designers continue to draw inspiration from Bulgaria's 39 cultural heritage. The work of contemporary educators, such as Dr. Rafaela Rafaelova, emphasizes the use of modern technology to reinterpret folk motifs in fashion illustrations.

Overall, the report underscores the enduring relevance of Bulgarian folklore in shaping fashion design and illustration, both in the past and present, while highlighting its potential to inspire future trends.

Keywords: *fashion illustration, Bulgarian tradition, fashion magazines in Bulgaria, Fashion design department NNA.*

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https://doi.org/10.53230/tgm.1310-912X.2024.1004.33

THE JOURNEY OF COLOURS: FROM NATURE TO SCIENCE

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This text explores the evolution of dyes from their natural origins to modern scientific innovations, examining how chemistry has transformed the art and science of colour. It begins by detailing the use of natural pigments by ancient civilizations, including minerals and plant-based dyes, and follows their progression through history.

The Industrial Revolution marks a significant turning point as synthetic dyes emerge, revolutionizing industries such as textiles with new colours and production methods. The discussion extends to the environmental and health issues associated with synthetic dyes, leading to a growing interest in sustainable alternatives. Natural dyes are highlighted for their eco-friendliness, safety, and support for local economies, despite challenges like cost and variability.

The text also delves into contemporary advancements inspired by nature, including sustainable pigments and structural colours, which create vibrant, long-lasting, and environmentally friendly solutions. The study underscores the importance of integrating historical knowledge with modern scientific developments to address industrial and ecological challenges effectively.

Keywords: natural dyes, synthetic dyes, history of dyes, art, ecology, sustainability, textile installations, exhibition design.

Topic №5, Textile Machinery and Equipment

UDC 677
Textile Industry. Technology of textile materials

https://doi.org/10.53230/tgm.1310-912X.2024.1005.34

STUDY AND DESIGN OF AXIAL CAM OF 8-NEEDLE HEAD FOR KNITTED CORD

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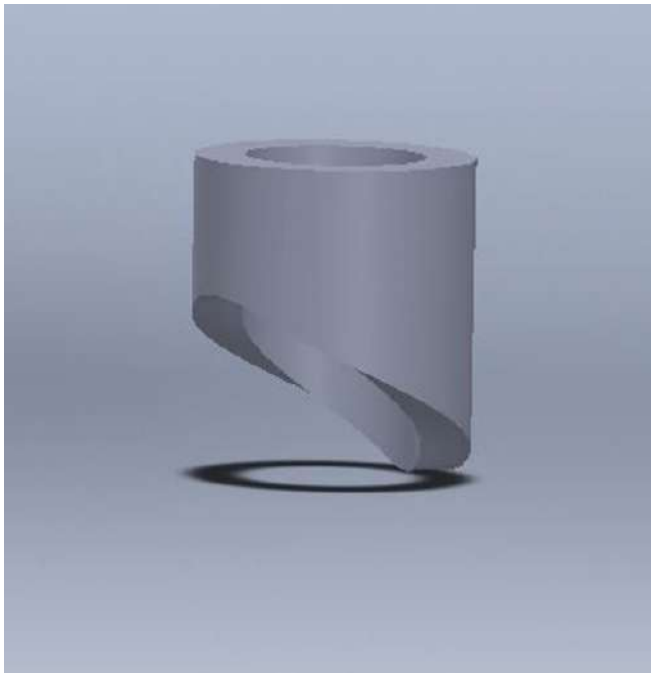

The knitting head for cords is a miniature version of a circular knitting machine. The consistent and regulated axial movement of the knitting needles is due to the profile of the axial cams and their smooth surface.

The seemingly simple sinusoidal trajectory of the axial cam for driving the knitting needles turns out to be a complex spatial surface. The drive and control of the needles is carried out by direct contact between the guide of each needle and the opposing surfaces of the cams.

During the rotation of the cams, the knitting needle guides experience two types of forces that can only be considered as mechanical action from the cam mechanism.

On the one hand, there is the tight contact between the needle guide and the cam guide surface. As a result of the contact, the rotary movement of the cam causes the linear axial movement of the needle. The bearing between the cam and the needle guide is carried out by friction. Insufficient smoothness of the two surfaces will cause additional friction forces. A reduced contact surface will cause abrasion of the two surfaces, more on the less resistant one.

On the other hand, the second type of effort is due to the distance between the two cam surfaces. This is the width of the channel in which the needle guide moves. The width of the channel must exclude pressure and friction between the guiding surfaces of the cams and the needle guides. Conversely, clearances in the cam groove can cause oscillations and vibrations in the axial movement of the needles.

The conditions considered thus impose the following requirements on the axial cams: solid material, smooth surface, and perpendicularity of the leading surface to the axis of rotation.

The subject of this article is a design of axial cams for circular knitting of cords with 8 or 12 needles. Purpose of the development consists in determining the numerical values of the guide profile with the additional condition that the movement of the knitting needles is carried out by the guide profiles of paired mirror axial cams.

https://doi.org/10.53230/tgm.1310-912X.2024.1005.35

METROLOGICAL SELECTION OF WOOD FOR MAKING A HAND WEAVING LOOM WITH A SUSTAINABLE STRUCTURE

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Several requirements intersect in the design of a handloom: ergonomics, capabilities, and price. Above all, the loom must be comfortable for weaving.

The role of the weaver differs significantly from human intervention in industrial weaving.

In hand weaving, the operator selects the crossings of each weft, drives the working elements, and ties up the broken threads. The hand weaver must have easy access to the working parts and put minimal effort into the drive.

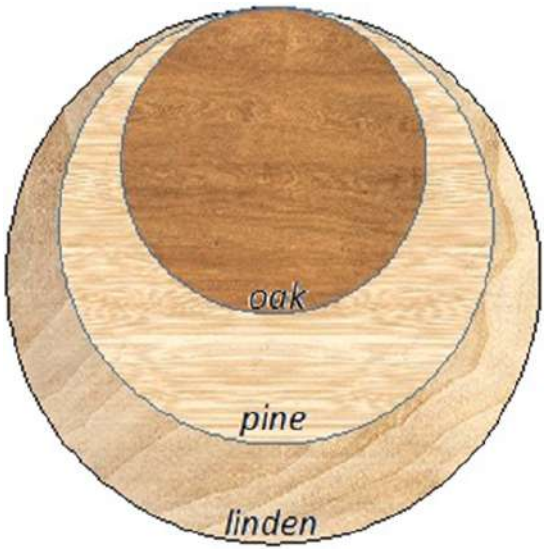
Finally, the handloom should have an aesthetic design that conveys stability in the workplace.

The construction of the handloom consists of three groups of working elements.

The supporting frame is most often in the shape of a parallelepiped.

It carries the working elements, supports the tensioned weaving threads and stably dampens the vibrations and inertial forces generated.

The wood of the loom frame must be very dense and of great strength.



The working parts of the loom that experience direct contact with the weaving threads are the cross and the shuttle.

They are cylindrical in shape, on whose surface the weaving threads are pressed and rubbed.

The majority of the supporting working elements are movable and rotate at a low angular velocity.

The wood for the supporting working elements can be of medium density and strength, but with the possibility of a hard contact surface.

During the weaving cycle, three working bodies are in contact with the human feet and hands.

The weaver uses his feet and pedals to control the selection of the main threads, and uses his hands to drive the shuttle and the shuttle.

The shuttle carries the weft thread with minimal kinetic energy from the hands and tolerates little friction from the warp threads. The wood for the shuttle must have a minimum density, low strength and acceptable surface resistance.

Materials science in woodworking provides the following three woods with suitable properties and specific gravity from 3.50 to 8.3 kN/m³.

№	Wood	Volumetric weight, kN/m^3	Compressive strength, MPa	Janka hardness, MPa
1	oak	6.90	12.00	47.00
2	pine	5.70	8.50	19.00
3	linden	4.10	3.80	18.00

Keywords: *weaving, hand looms, carpentry metrology*

Topic №6, Textile Management, Marketing and Sustainability

UDC 33
Economics. Economic sciences

UDC 677
Textile Industry. Technology of textile materials

UDC 678
Industry of High Molecular Substances. Rubber industry. Plastic industry

https://doi.org/10.53230/tgm.1310-912X.2024.1006.36

METHODS FOR EXTRACTING NATURAL DYES: TRADITIONAL AND MODERN APPROACHES

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This text aims to examine and compare various methods for extracting natural dyes, both traditional and modern. Natural dyes are becoming increasingly popular due to their eco-friendliness and safety, and the methods for extracting them vary in complexity and efficiency. Water extraction, for example, is one of the oldest and simplest methods, suitable for small-scale and individual projects. Fermentation is another traditional process, used for centuries to extract dyes, often resulting in richer colors.

Modern approaches include acid and alkaline extraction, which allow precise control over the chemical composition of the dyes, as well as solvent extraction, which is more effective for hard-to-reach sources. Technologies like enzymatic extraction, ultrasound, and microwave extraction offer faster and more energy-efficient processes. Supercritical fluid extraction, using carbon dioxide, is one of the most innovative techniques, enabling the extraction of dyes in an environmentally friendly way without the use of toxic chemicals.

In addition to the theoretical review, the author conducts an independent study on extracting dyes from madder roots. The goal is to compare the results of different extraction methods performed in uncontrolled laboratory conditions and to analyze the effects of using hard and soft water in the process. This practical study enhances the understanding of how various conditions impact dye yield and quality, providing valuable insights for applying these methods outside of controlled laboratory settings.

Keywords: *natural dyes, extraction, methods, ecology, sustainability*

https://doi.org/10.53230/tgm.1310-912X.2024.1006.37

RECYCLING OF HIGH-PERFORMANCE BALLISTIC FIBERS AS PART OF SUSTAINABLE MANAGEMENT CAPABILITY FOR MILITARY PERSONAL PROTECTIVE EQUIPMENT

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Introduction: Ultra-high molecular weight polyethylene (UHMWPE) fibers (Fig.1) are high-performance ballistic materials that have attracted significant interest due to their wide-ranging applications in the Armed Forces, law enforcement and personal security [1].

Recycling of high-performance ballistic fibers is part of sustainable management capability for military personal protective equipment in the compliance from the Armed Forces with the environmental requirements imposed on them by The EU' climate change and defence roadmap, which is an integral part of the EU's overall efforts to tackle climate change under the European Green Deal.

Reusing and recycling products reduces the need to extract natural resources and limits the associated damage to ecosystems that threaten biodiversity.

The circular economy also contributes to the reduction of greenhouse gas emissions.

Moving to reliable products that can be reused, improved and repaired lead to less waste.

Recycling raw materials reduces the risks associated with their procurement –the EU becomes less dependent on global crises, price changes and geopolitical pressures [2].

Experimental part: The method for recycling products containing polyethylene fibers with an ultra-high molecular weight, retain the advantageous characteristics of the fibers [8].

Results: Products made up of the recycle UHMWPE are characterized by great functional, mechanical and esthetic advantages [8].

Discussion: Practice shows that recycled UHMWPE fibers can be successfully used as raw materials for the production of new non-ballistic products, thus respecting the principles of sustainability.

Conclusion: From the recycled UHMWPE fibers can be produced: clothing, gloves, protectors, flooring, elements for making renewable energy sources and others.

Keywords: *High-performance ballistic materials, Ultra-high molecular weight polyethylene (UHMWPE) fibers, Military personal protective equipment, Sustainable management, Armed Forces, the EU' climate change and defence roadmap*

https://doi.org/10.53230/tgm.1310-912X.2024.1006.38

APPLICATION OF RECYCLED WOOL RAW MATERIALS IN TEXTILE CRAFTS

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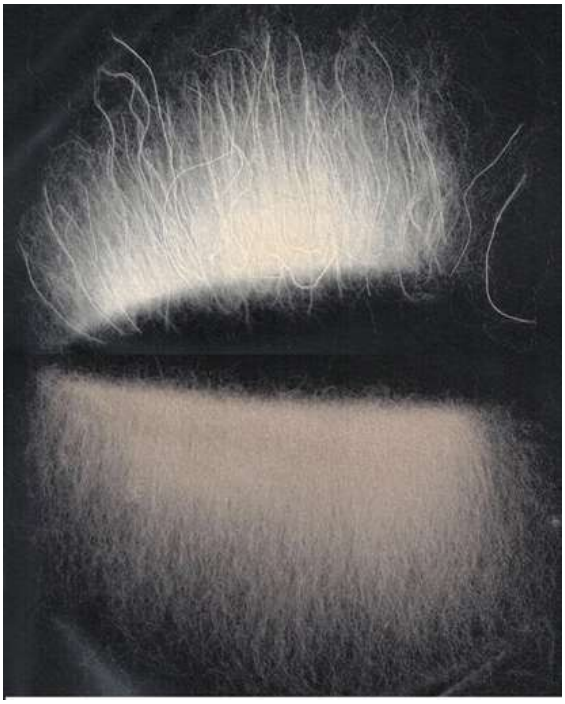

Certified recycling of textile materials complies only with the requirements and technical conditions of the basic Textile Exchange Global Recycled Standard 4.0 and the accompanying regulatory documents. As a result of the application of standardized conditions, recycled fibrous raw materials create the basis for the production of sustainable textile products. The technological requirements of the regulatory processes represent frameworks in which: recyclable materials, garneting and carding treatment, and possible products are considered.

Recyclable textile materials originate from “hard” technological waste, which starts from spun yarns and through fabric scraps are ending with sewing products. The distinction between hard and regular textile waste is of particular importance. All separated fibrous materials from the sliver to the drawn roving in the aspiration of the spinning machine are subject to recovery by reprocessing on the same technological equipment. Hard textile waste requires a recycling process that changes the characteristics of the fibres. Wool fibres are distinguished by their high value and ability to be repeatedly processed. This is the reason why, since the end of the 19th century, an organized system of collecting and recycling wool waste through mechanical processing was established. After the mechanical processing of reverse splitting and carding the wool fibres, a reduction in their initial staple length is observed.

The significant change in the recycled mass consists in the presence of residual parts of twisted yarns. More intensive carding of the waste will lead to additional breakage of the fibres. This will drastically reduce their spinning ability. The optimal technological regime of mechanical recycling allows for unprocessed residues, which are dissimulating or give artisanal authenticity to the yarns. Recycled wool raw materials can be used to make woollen yarns for industrial coarse goods or handicrafts.

The subject of this article is the application of certified yarn made from recycled wool fibres in sustainable hand-woven products. The goal of the development is to compile an exemplary assortment of recycled woollen yarns and possible hand-woven fabrics for household purposes.

Keywords: *wool, recycling, hand weaving, artistic products.*

https://doi.org/10.53230/tgm.1310-912X.2024.1006.39

WORKING PROCEDURES FOR BUILDING A SUSTAINABLE FASHION COLLECTION

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In modern times, there is increasing talk about sustainable fashion and the need to look at the inevitable environmental problem. The planet is screaming under the weight of our greedy need to have. Consumers are becoming increasingly interested in the ecological model, but in fact the information is well manipulated. Most of the products on the market declared as environmentally friendly are far from the real and dreamed green truth. The measures taken are partial and insufficient and light is needed on what is truly compliant with the requirements for sustainability in clothing. Public awareness and specific guidelines are needed on what is certified as sustainable on the market.

This article will explore the necessary path to creating a truly sustainable collection. It will trace the working procedures that each material required for the design of each garment goes through. In order for a collection to be called sustainable, it must possess certain qualities that are strictly standardized by a certified organization. The materials for this collection must fall within the scope of the standard.

The purpose of this article is to inform the consumer about when and how sustainable a garment is. Sustainability standards specify a set of rules and guidelines that help manufacturers and consumers assess the sustainability of textile materials or already created fashion items. These standards help the consumer make an informed choice and support sustainable fashion. This choice is not a whim, but a necessity for a better green future. It is not just a look at an environmental problem, but to educate self-awareness towards protecting the planet and its resources, humane treatment of animals, social responsibility and ….

Keywords: *sustainable collection, work procedure, quality standard*

Topic №7,
Innovations in Textile Education

UDC 377
Special Education. Vocational education. Vocational schools

UDC 378
Higher Education / Higher Education Institutions

https://doi.org/10.53230/tgm.1310-912X.2024.1007.40

AUXILIARY DEVICES IN HAND WEAVING

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Unlike industrial weaving, where technological operations are carried out in separate workshop premises, artisanal weaving concentrates almost all activities in one room. Each of the operations in weaving technique constitutes a part of the process, which is carried out independently and with equal interaction between the textile materials and the working devices. For this reason, the devices for all preparatory and accompanying operations in the weaving workshop must be available to the weaver.

The preparation of the weaving base requires four main devices: a rack for the bobbins with the warp threads, a reed for distributing the threads, a warping frame, and a warp crossbeam. Secondary tools are dividing rods for the warp, hooks, combs, brushes, scissors, etc. The preparation of the wefts is relatively shorter and is mainly limited to winding the yarn bodies for the shuttle. Mandatory tools include different types of cones for the shuttles, as well as different shuttles according to the type of weaving threads.

The common device for all processes, without which the preparation of weaving threads is impossible, is the winding or bobbin apparatus. It is used to prepare spools for shuttles, bobbins for the warp rack, or for rewinding in general.

Directly connected to weaving, two devices are an integral part of the loom. These are the reed and the slats to maintain the width of the rafter. Their peculiarity lies in the need for the presence of reeds and width holders with different technical parameters. For fabrics of different densities and widths, different reeds and differently adjusted width holders are required.

The main requirement for assistive devices and tools is to maintain their ergonomic and manually accessible nature. The initial step towards fully equipping the hand weaving workshop is to compile a list of the necessary auxiliary equipment. The following activities relate to the compilation of technical documentation for each tool: purpose, construction, method of operation.

The subject of this article is the auxiliary tools in the hand weaving workshop. The goal is to compile a project for complete weaving equipment for a hand weaving workshop.

Keywords: *textile equipment, hand weaving, auxiliary tools*

https://doi.org/10.53230/tgm.1310-912X.2024.1007.41

ERASMUS+ PROGRAM APPLICATION IN PROJECTS FOR THE QUALIFICATION DEVELOPMENT OF TEXTILE TEACHERS

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Machine production of mass fabrics has sufficient capacity to over satisfy the world market.

The small and insignificant weakness of the factory organization consists in the maximum uniformity of the fabrics and the reduction of efficiency with the diversification of the assortment.

In recent years, textile training has had difficulty-recruiting applicants, and this applies equally to all educational levels.

The essential problem lies in the alienation of young people and society from this industrial profession, associated with an interest in textile technology and a personal attitude to teamwork.

The core of the problem is basing on the reason that modern spinning and weaving machines are fast moving, and the protective covers and covers are dissimulating working parts and processes.

Machine operators have almost no organoleptic access to the technological process and lack clarity about the essence of the processing. The known forms of practical classes in weaving technology are conducting on industrial machines and the training is not effective, due to the inability to show and follow the complexity of the phases in the weaving cycle.

Effective training in weaving techniques requires a small workshop with handlooms, where learners can slowly, consistently, and safely acquire knowledge, acquire skills, and express their artistic and aesthetic sense on their own woven fabric.

At the beginning of 2025, a group of teachers from secondary and higher education in the field of textiles, clothing and design carried out mobility with their main subject - hand weaving.

The completed curriculum includes three main areas: the design and operation of a hand loom, fabric design, and the creation of an original project for woven fabric.

The aim of the training is focused on the principles of fabric formation and the factors influencing the texture of the fabric.

The project's perspective envisages the design of a training workshop for primary textile techniques and the refinement of raw artisanal fabrics.

The subject of this article is the curriculum and activities for training teachers in practice in the field of weaving technology.

Keywords: *textile technics, hand weaving, vocational education*

Acknowledgments: Financial support from the NA HRDC Erasmus+ (Grant 2024-1-BG01-KA122-ADU-000232194) is kindly acknowledged.

Списание Текстил и облекло
БРОЙ 10/2024

РЕДАКЦИОННА КОЛЕГИЯ

ЧУЖДЕСТРАНЕН НАУЧЕН КОМИТЕТ

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Настоящият сборник с резюмета от 26-та Национална текстилна конференция е издаден с подкрепата на Фонд Научни Изследвания в България по проект КП-06-МНФ/24 от 12.08.2024.

Адрес на редакцията:
1000 София, ул. "Г. С. Раковски" 108, стая 407, тел. 02 980 30 45
e-mail: textilejournal.editor@fnts.bg
www.bgtextilepublisher.org

ISSN 1310-912X (Print)
ISSN 2603-302X (Online)
https://doi.org/10.53230/tgm.1310-912X.2024.1000

Банкова сметка:
НАУЧНО-ТЕХНИЧЕСКИ СЪЮЗ ПО ТЕКСТИЛ, ОБЛЕКЛО И КОЖИ
ИН по ДДС: BG 121111930
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ФОНД
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ИЗСЛЕДВАНИЯ
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