Erasmus+

UNPICK YOUR HISTORY, WEAVE YOUR FUTURE

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Preface

"Interwoven Europe" is a two-year project of European Union named "Unpick Your History, Weave Your Future" running from September 2016 to August2018. There are 4 participating schools :
Instituto di Instruzione Superiore Galileo Galilei, Jesi, Italy
SOU, Orde Chopela, Prilep, Macedonia
IES David Bujan, Cambre, Spain
Gymnázium, Česká 64, České Budějovice, Czech Republic
It is a project targetted at the promotion of STEM subjects (science, maths, technologies) as the developing companies call for technically skilled professionals able to think critically and apply science and technologies in practice. Not only computer literacy, analytical skills but even a good language command appears to be crucial in EU but indeed worldwide. This is the reason the communication language in this project is English, which highly motivates students to advance their language skills.
We focussed on textile industry as a result of the fact that Italy, Spain and Macedonia have ever been famous for their textile production and until 1990 the textile industry had played an important role even in previous Czechoslovakia and new revitalising processes have already started using the latest advances.
The project itself as the name implies traces the history, presence and future of textile industry. The students involved studied its different aspects, including their impact on socioeconomy and environment. Last but not least they have acquired awareness about the latest technological advances such as e.g.nanotechnologies are and their applications in textile of the future.
During international mobilities the students visited a scale of textile enterprises, scientific workplaces but even museums and places of interest in each particular country. They took part in plentiful workskops not only in laboratories to study chemical and physical properties of different materials but also creative workshops to experience how to create "smart textile" or recycled material art.
Teamwork was required internationally as well as locally when this book was originating. Pararelly the teams were working on other educative materials which alongside with this book can be used in the proces of teaching.
This book comprises three chapters, "History of Textile Industry" "Pollutants in Textile Industry" and " Workshops", which can become a good guidance how to make STEM or Art lessons intersting and innovative.
The first two chapters were made by students themselves just being conducted by their teachers, chapter 3 compiles workshop manuals including useful worksheets made by particular science and art teachers.
Photographies illustrating the workshops were taken right in the laboratories during each particular mobility.

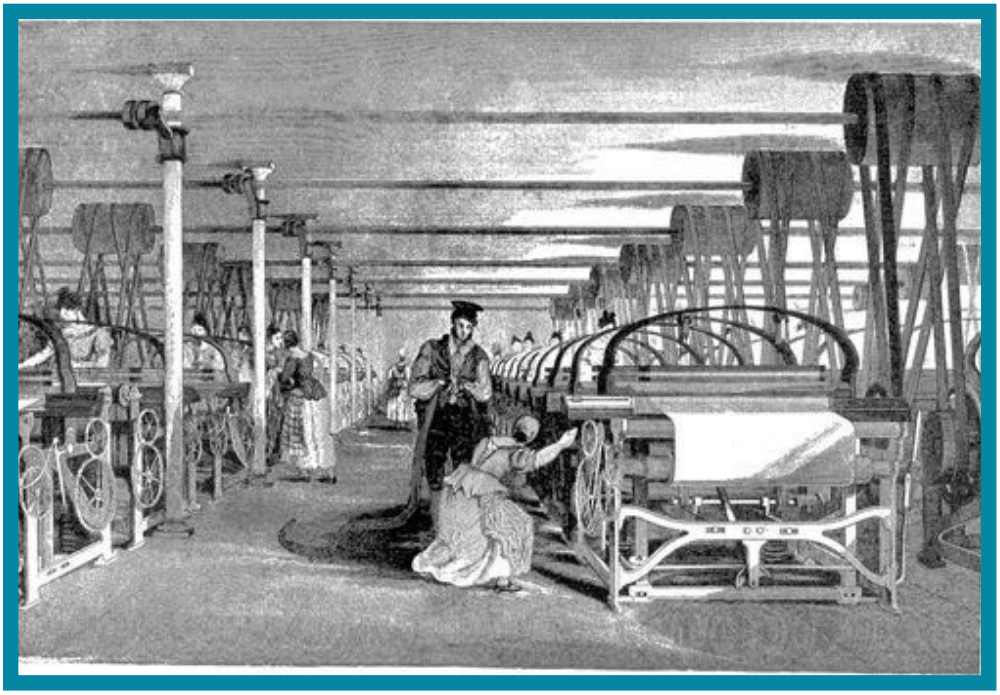
Chapter I

HISTORY OF TEXTILE INDUSTRY

HISTORY OF ITALIAN TEXTILE INDUSTRY

In Italy the first testimonies of textile manufacturers date back to the Norman period in Palermo, where the famous Royal manufactory of the noble workshops produced silk and precious fabrics with gold and gems. In the middle of 12ct the production began thanks to "La confraternita degli umiliati", dedicated to wool procession located in Milan convents and it developed into
a prosperous industry that spread throughout the whole northern Italy. The textile manufactures in Umbria, Perugia, has been inserted in the international textile market since the 13th century. Other important Umbrian textile centres are represented by Città di Castello, Foligno, Gubbio and Todi. With the resumption of trades the wool industry gave wealth to the cities that practiced it (Milan, Vicenza, Bologna, Florence) and power to the guilds that managed the various sectors: Art of Calimala, art of wool, art of dyers, and art of silk. With its dedication to trades in the Renaissance is Florence which is affirmed as the center of import and export of weaving artifacts. In the modern age in the Kingdom of the Two Sicilies, the seteries of San Leucio near Naples represent one of the most important examples of industrial textile manufacturing. The textile industry in Italy developed mainly in the north in Alto Milanese, in Biella, in Bergamo and in Alto Vicentino where still remain as a trace of industrial archaeology the remains of some flourishing textile industrie, for example, the villages Workers of Crespi d'Adda, new Schio, "Olcese" and Leumann Village in Collegno. Comasco industry specialized in the production of silk and in Mantua; in the area of Castel Goffredo, they specialized in the production of women's socks and pantyhoses. In central Italy it developed in the industrial district of Prato, the most important the number of textile companies in Italy.

In recent years Asian countries such as China and India have begun to enhance their industrial production by becoming in a short period formidable competitors for Italian textile industry. China is in fact the only breeder of Silkworm and is getting a monopoly in spinning and weaving this material.



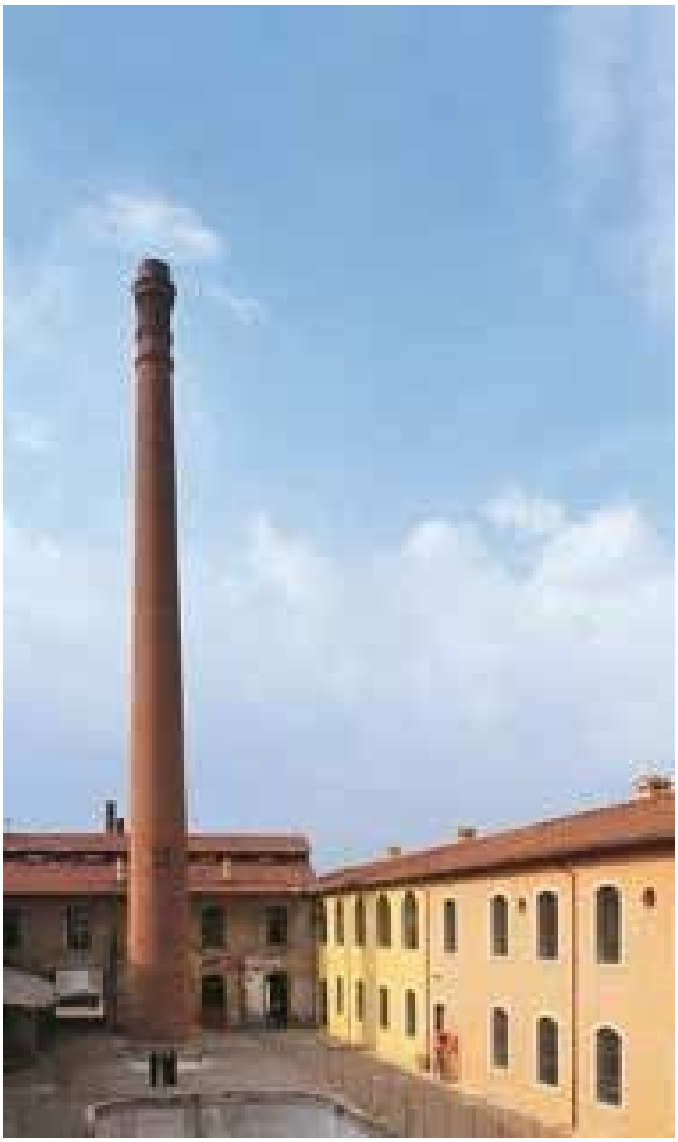
THE DEVELOPMENT OF ITALIAN FASHION

Clothing in Italy has become the most fashionable in Europe since the 11th century and powerful cities of the time, such as Venice, Milan, Florence, Naples, Vicenza and Rome began to produce robes, jewelry, textiles, shoes, fabrics, ornaments and elaborate dresses. Italian fashion reached its peak during the Renaissance. Art, music, education, finance and philosophy flourished in Italy, and alongside"", Italian fashion designs became immensely popular, especially those worn by the Medicis in Florence. The fashion of Queen Catherine de' Medici of France were considered amongst the most fashionable in Europe. Italian fashion in the 15th and 16th centuries was mainly influenced by the art of the time, especially by the masterpieces of Michelangelo, Leonardo da Vinci, Raphael and Botticelli.

Italian designs were well known for their extravagance, and their expensive accessories, such as velvets, brocades, ribbons and jewels. Also, Italian fashion for ladies changed dramatically around 1460, where skirts were gathered or pleated, and would often be split at the front and the sides to show a sleeved under dress. During the Italian Renaissance, men wore closely fitted waistcoats underneath pleated overcoats called "giornea", which had wide, puffy mutton sleeves and were often made from brocade. They wore different kinds of hats, ranging from caps to berets. They also had an overcoat called "cioppa". Its lining was of a different colour than the main fabric, which was a feature of Italian Renaissance. They also wore hose or tights to emphasize their lower bodies. As hair styles, anything from short to shoulder-length hair was common; it was often curled inwards. Women's dress consisted of fitted garments worn underneath a belted dress which was also called "giornea". Unlike the men's version, the women's reached the ground and covered their feet. Women's giorneas, originally evolved from the overcoat, had separate skirts and bodices. The skirts were tight at the waist and the lower part of the dress was often pleated. They were cut at the front, and in later years at the sides, to display the rich undergarments.

Underneath the "giornea" women wore a dress called "gamurra", which was a high-waisted long dress which could have detachable sleeves. The under dress worn underneath was a simple linen dress called camicia. Men and women would wear outer clothes with detachable and often slashed sleeves of varied designs. Rich people would own many different pairs of sleeves to match with their overcoats and dresses. The Renaissance was a turning point for people's attitude regarding clothes and their appearances. People had a desire to wear tighter fitted clothes to emphasize the body shape, particularly in men's clothing. Merchants expanded the market for items of clothing, creating accessories such as hats, hairnets, bags, or gloves.

The spread of mirrors led to people becoming more interested in their self-image, and people were increasingly trying to look good and care about how they appeared to others. Prior 1500, clerical dress was arbitrary, then in 1565 Milan, black became the accepted color in Italy, while white remained as the pope's biretta color, scarlet for the cardinal's, purple for the bishop's and black for other clerics. In the 17th century, Italian fashion fell into decline when the designs of Spanish, English and French courts took the lead. In France, French fashion became the most popular in Europe. Despite this decline,



was regulated by the Wool Merchants' Guild. The political and economic decline experienced in Italy during the 16th and 17th centuries caused a decline the in textile businesses, which resumed in the late 18th century with the production of knitted caps made for Arab markets. A significant contribution to industrial expansion was also due to the lower costs of carded wool processing, caused by the gradually increasing production of recovered wool obtained from shredding old clothes and industrial scraps said "combing".

Between the postwar period and the early 1950s, the outlets towards low-level standard production markets for India, Africa, etc. rapidly disappeared.

The Prato district became more powerful during the 1970s. The emerging of fashion as a mass phenomenon, together with higher salaries and the revolution in customs, marked a historical division in the clothing market and the demand became more fragmented, differentiated, unsteady and seasonal.

These variables disrupted the production and distribution chain forcing the structures to be- come more flexible, responsive and agile.

During that period the Prato district underwent a fundamental transformation, from a product-oriented, wool-processing district to a market-oriented, fashion/textile district. The re-orientation of its competitive identity in terms of "satisfied needs" cleared the way for a considerable increase in the variety of products and production technologies. During the seventies new possibilities were explored and developed, often with a pioneering spirit, in textiles (patterned combed yarns for knitwear, knitted fabrics, furs, coated fabrics, flock fabrics, etc.) and in non-wool fibres, both natural and synthetic.

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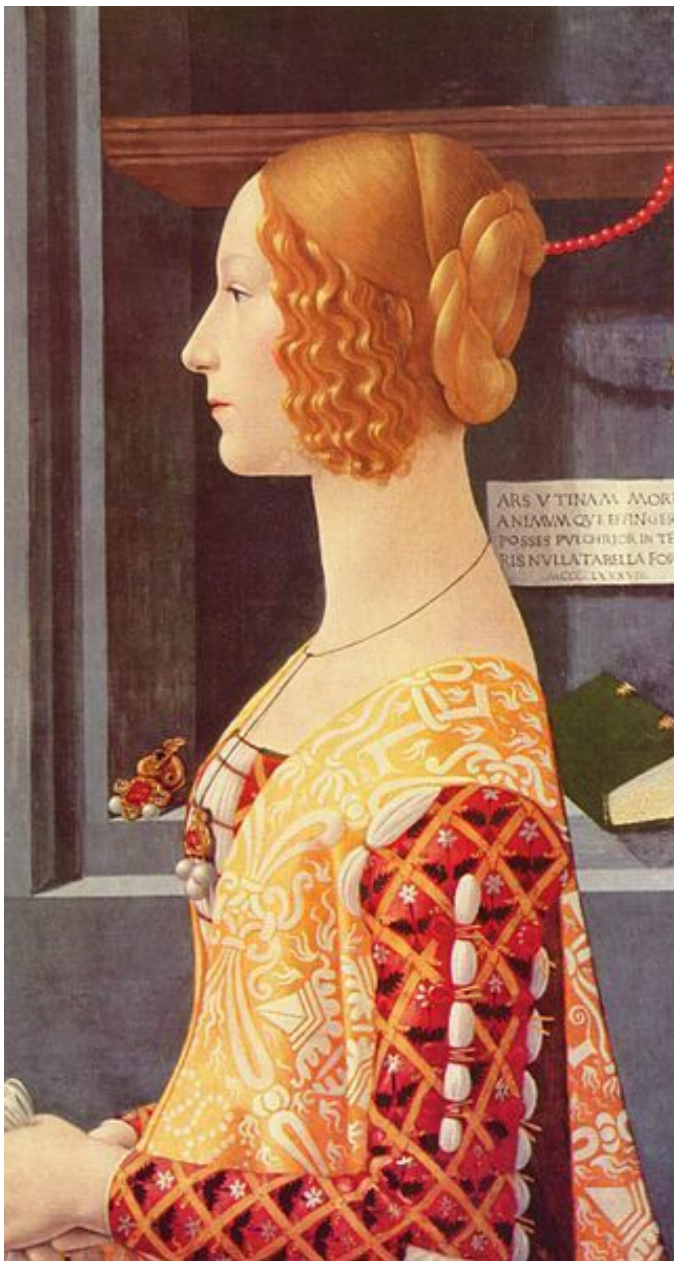

EVOLUTION OF PRATO FASHION AND TEXTILE DISTRICT

Prato is one of the areas in Central and North Italy which shows successfully its modern industrial growth. In 19th and 20th centuries, the industrialization process underwent a rapid acceleration after World War II and had been fully established by the 1970s. Thanks to its development it became the most European important textile and fashion centre - a prototype of a modern industrial district. One of its features is its specialization and distribution of work among small business firms. The development of the textile industry in Prato saw the interlinking and overlapping of several different "models of competition" in terms of organization, products and markets. Prato began to specialize in textiles in the 12th century, when garment manufacturing was

CHANGES IN THE NEW MILLENNIUM AND SOCIAL TRASFORMATIONS: THE CHINESE MIGRATION WAVE OF THE SECOND HALF OF THE 1990s

In the rest of Italy on the economic level, the main element of the change was the fall in demand caused by one of the longest postwar periods of recession, which particularly hit the geographic markets, first of all Germany, but even USA and Italian markets mainly due to the unprofitable change in currency and the new spread of e-commerce.

The demand for labour in Prato and the employment opportunities created by the economic expansion that occurred during the postwar period could not be met by the local population alone.

Up to the 1960s, the main contribution to filling Prato's labour demand was provided by medium-range immigration coming from the countryside and the small towns around Tuscany. That migratory movement was gradually integrated by workers arriving from southern Italy, who became predominant during the 1970s. Small towns from the Italian south moved to Prato almost completely, maintaining their sense of identity for years, chiefly because their settlements were concentrated in certain city districts. It is the reason why Prato has been often compared with Turin, although the former showed a better capacity for integration and social mobility.

During the 1980s, the progressive drying up of southern immigration and the further reduced coverage of the lower segments of the labour market by the local population cleared the way for non-EU immigration, albeit in a context of a slower growing local economy and a diminishing number of manufacturing jobs. The new migratory influx concerned a high number of nationalities; these are currently more than 100, but in the 1990s the prevailing nationality was Chinese.

The advent of "backyard globalization", with its different cultures, religions, customs and languages, introduced an innovating factor among Italian provinces, to which they were definitely unaccustomed.

The Chinese immigration showed peculiar characteristics, both in quantity and quality, and, apparently paradoxically, grew stronger during the years when Prato's textile industry was experiencing economic hardships after 2001. Chinese workers rarely sought employment in Italian-owned companies. Instead, they established a large network of small or very small firms where they manufactured knitwear and high-street fashion garments. The expansion of the Chinese community

firms where they manufactured knitwear and high-street fashion garments. The expansion of the Chinese community and entrepreneurial activities reached impressive levels that rapidly and deeply affected the linguistic, cultural and physical features of large parts of the Prato area. The situation is truly unequalled both in terms of the quality and quantity, and has the potential to produce disruptive effects even in a town like Prato, that is historically and socially accustomed to immigration and integration.

THE SPINNING JENNY

The spinning jenny is a multi-shaft and was one of the key developments in the industrialization of weaving during the early Industrial Revolution. It was invented in 1764 by James Hargreaves in Stanhill, Oswaldtwistle, Lancashire in England. The device reduced the amount of work needed to produce cloth, with a worker able to work eight or more spools at once. This grew to 120 as technology advanced. The yarn produced by the jenny was not very strong until Richard Arkwright invented the water-powered 'Water Frame', which produced yarn harder and stronger than that of the initial spinning jenny. It started the factory system.

The spinning jenny was invented by James Hargreaves. He was born in Oswaldtwistle, near Blackburn, around 1720. Blackburn was a town with a population of about 5,000, known for its production of "Blackburn greys," cloths of linen warp and cotton weft initially imported from India. They were usually sent to London to be printed. At the time, cotton production could not keep up with the demand of textile industry, and Hargreaves spent some time considering how to improve the process. The flying shuttle had increased a yarn demand for weavers by doubling their productivity

and now the spinning jenny could supply that demand by increasing the spinners' productivity even more. The machine produced coarse thread. The idea was developed by Hargreaves as a metal frame with eight wooden spindles at one end. A set of eight rovings was attached to a beam on that frame. The rovings when extended passed through two horizontal bars of wood that could be clasped together. These bars could be drawn along the top of the frame by the spinner's left hand thus extending the thread. The spinner used his right hand to rapidly turn a wheel which caused all the spindles to revolve, and the thread to be spun. When the bars were returned, the thread wound onto the spindle. A pressing wire was used to guide the threads onto the right place on the spindle.

Hargreaves, the inventor, kept the machine secret for some time, but produced a number for its own growing industry. The price of yarn fell, angering the large spinning community in Blackburn. Eventually they broke into his house and smashed his machines, forcing him to flee to Nottingham in 1768. This was a centre for the hosiery industry, and knitted silks, cottons and wool. There he set up a shop producing Jennies in secret for one Mr Shipley, with the assistance of a joiner named Thomas James. He and James set up a textile business in Mill Street. On 12 July 1770, he took out a patent on his invention, the Spinning Jenny, a machine for spinning, drawing and twisting cotton. By this time a number of spinners in Lancashire had been using copies of the machine, and Hargreaves sent notice that he was taking a legal action against them. The manufacturers met and offered Hargreaves £3,000. He at first demanded £7,000, and stood out for £4,000, but the case eventually fell apart when it was learned he had sold several in the past. The spinning jenny succeeded because it held more than one ball of yarn, making more yarn in a shorter time and reducing the overall cost. The spinning jenny would not have been such a success if the flying shuttle had not been invented and installed in textile factories. Its success was limited in that it required the rovings to be prepared on a wheel and this was limited by the need to card

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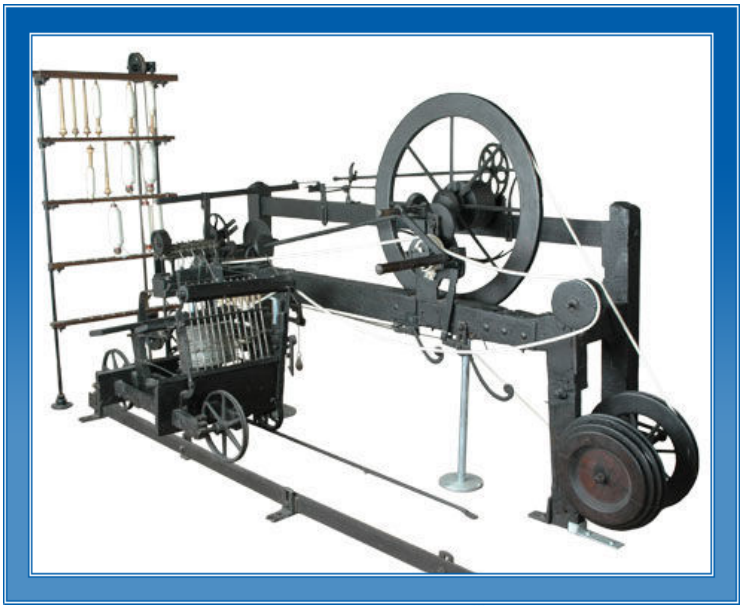


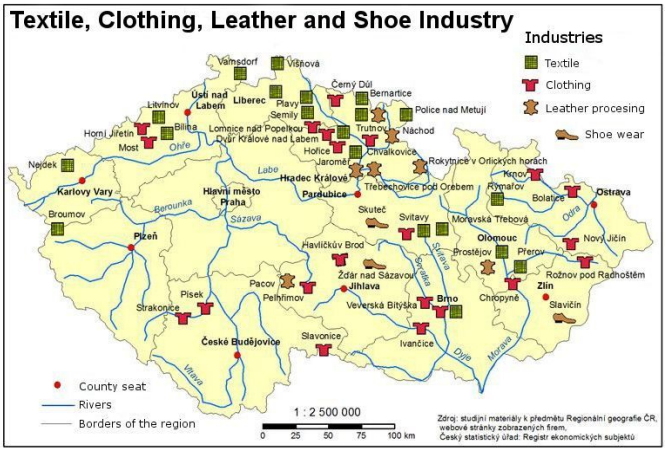
THE FASHION BRAND GENNY BY DONATELLA GIROMBELLI, A GREAT EXAMPLE OF INTERNATIONAL DESIGNER IN ANCONA

Named after their first-born child, Genny was the brainchild of Arnoldo and Donatella Girombelli, who founded the company in 1961. Genny Holding SpA then became one of Italy's foremost fashion companies, designing, manufacturing, and distributing its own ranges including Genny, Genny Due, Complice, Byblos, and others. From relatively humble origins as a small clothing factory based in Ancona, Italy, the company was operating at an industrial scale by 1968. During the 1970s it experienced a rapid growth when its founder made radical changes in the company structure, steering it towards a more fashionable product in terms of garment styling. These changes did not, however, alter the company's original commitment to the production of high quality, predominantly tailored garments. As an early protagonist of the "Made in Italy" label, Genny assumed a leading role during the 1970s when the Italian fashion industry took its first steps toward becoming a serious competitor with French ready-to-wear fashion. Genny is typical of a number of Italian fashion companies manufacturing high fashion lines designed for them by leading names in the industry, however launched under the company's own label.

Fashion writer Colin McDowell has described this very successful, as well as lucrative, format as a form of "moonlighting." Considerable financial reward, coupled with the high quality of the Italian ready-to-wear product, has meant there was no shortage of well-known designers willing to supply their creative talent for such companies. Genny's earliest working relationship with an outside designer was with the young, virtually unknown Gianni Versace who designed his first collection for Genny in 1974. Versace was also responsible for designing the early Byblos collections, a younger range introduced in 1973 to complement the classic Genny image. After the death of Arnoldo Girombelli in 1980, his wife, Donatella, assumed a leading role in the company

Donatella, assumed a leading role in the company and chaired its board of directors. Described by fashion retail entrepreneur Roberto Devorik as "a rare catalyst for design talent," Donatella Girombelli continued her husband's policy of employing top designers to create lines for the Genny labels and have included a who's who of top designers like Stefano Dolce, Domenico Gabbana, Alan Cleaver, and Keith Varty. The position of Genny and its other labels were not quite cutting edge, dramatically avant-garde or barrier-breaking, but rather top quality ready-to-wear clothing with a powerful design element. This style was what led to the company's widespread success in the international market. By the mid-1990s Genny produced over two million items under its different labels, which were distributed worldwide through the company's nearly two dozen freestanding boutiques and in better department stores in the U. S., Middle East, Europe, and Japan. A growing number of carefully controlled licensing agreements encompassed such products as eyewear, fragrances, bridal wear, leather handbags, belts, and shoes sold worldwide. Heading into the later 1990s, Genny had undergone restructuring from top to bottom. New designers were brought in and others let go; the new faces were Americans Rebecca Moses and Richard Tyler, the longtime Byblos design team of Cleaver and Varty had been gone, and Donatella Girombelli focused on a more American feel for Genny's women's wear. Commenting to Women's Wear Daily, Girombelli said she aimed for a "succinct combination of straightforward American sportswear and Italian flair." Next John Bartlett came who signed with the Italian firm in 1997 to produce his existing menswear designs as well as to create a new women's wear line. In the new century, Genny and its varied holdings seemed to have a revolving door with designers. The latest were Martine Sitbon and Sandy Dalal at Byblos, and Girombelli had approached Lawrence Steele to sign on as a consultant to freshen the Genny labels. Yet despite Genny Holding's frequent overhauls and team changes, it continues to be a well- known and widely respected Italian fashion firm.

HISTORY OF CZECH TEXTILE INDUSTRY



Textile industry has got a long-lasting tradition in our lands. The previous homemade production had been replaced with manufactures, which were established in the second half of 18th century. The so called "spread manufacture" was typical for Czech textile industry in the 90's of 18 century (looms were divided into several buildings). This arrangement followed the long-lasting tradition of textile production in the Czech countryside and so Czech labour force was involved. More enterprising textile manufacturers began to build mechanical production plants (mills) in which they processed domestic raw materials - wool and flax. With the progressing industrialization the manufactures changed into factories. The growing industry resulted in an increase of Prague's Czech population as people moved to the city from the countryside.

Since the middle of 19th century, the Czech textile industry had established itself at the core of manufacturing in the Habsburg Austrian Empire. Even up to the late 1920s, the textile and clothing industries incorporated in the strongest and the most export-oriented industrial sectors. There were laid foundations of many textile factories, most of them focused on spinning, weaving and cotton dyeing. (e.g. Liebig spinning Mil, Josefa Crha Mechanic Weaving Mill, Knittning Mill Vobořil & Bayer, Spinning Mill Melich and son, Hybler and Son Textile Mill)

In Czech Lands, textile production was always traditionally more important than clothing production. Since the 1930s, both industries had suffered a loss of importance, a situation which the period of central planning (1948-1989) did not change. In fact, these industries were discriminated against other industries as to investments and labour, while a preference was being given to the development of heavy industries. The Czechoslovak Republic was considered to be an industrial country with machinery and car industry and the world's 16-17th car maker. However, even during the last 40 years of communist rule, when textile and clothing were challenged by many adverse decisions, these industries were considered substantial exporters and resources of foreign exchange.

THE SIXTIES AND THE SEVENTIES OF THE 20TH CENTURY

In the 1960s, there were many revolutionary changes in the world of fashion. Traditional dress code of individual social classes had gone. Various avant-garde styles of the young generation emerged, miniskirts appeared on catwalks. Designs of the 60s were much simpler, made in expressive, bright and eye-catching colours. The outfits were not decorated by so many ornaments; they were based on fresh and young look. Hats of various colours and shapes became very popular accessories. They were considered to make shapes of ladies´ necks longer and slenderer.

In the 60s favourite materials such as tweed, corduroy and silk were replaced by new artificial ones, such as tesil. They soon became very favoured because of their practicality and ease to be

In the 60s favourite materials such as tweed, corduroy and silk were replaced by new artificial ones, such as tesil. They soon became very favoured because of their practicality and ease to be maintained. As a result of the enchantment of new materials Wellington boots made of PVC appeared on the market. What's more, even shoes that people could wear at home such as ordinary slippers and flip-flops became very popular.

Coats were usually double-breasted with metal buttons, simple pockets and sometimes with military fringing. Handbags were mostly of a square shape, made of different artificial materials, however, crocheted handbags or beaded handbags were also very popular. Nylon stockings were replaced by tights, whose producers started to work more with geometric shapes and white colour, especially the white and black contrast was popular.

Elegant fashion designs were revived, however the young generation, in particular those who did not want to recognize the ruling communist regime, were expressing their disagreement and nonconformity through avant-garde fashion. Tight jeans, coloured pullovers, black turtlenecks, short-length jackets and white shirts were completed with shoes with a skipped toe. Another dominating style in late 60s and early 70s was hippie style with its typical floral pattern, loose trousers, flat shoes and floral headbands to call for personal freedom.

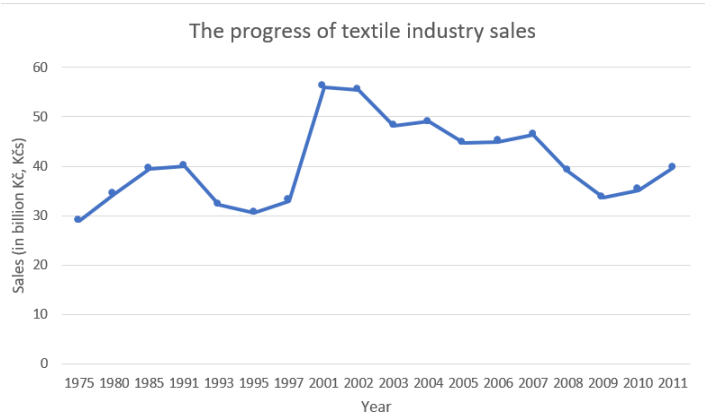
This period was marked by a sexual revolution, drug experimentation, and promotion of women's rights. Due to these social changes women started to favour wearing trousers.

Popular shoes were high-heeled platform shoes, bell-bottomed trousers and polyester shirts, often decorated with ruffels.

Whereas the era of the hippie brought finer, less shimmering colours and natural materials such as wool, cotton and silk, in the70s everything that wasn't ordinary was cool. Shiny metallic artificial materials, vivid colours, massive patterns and crazy combinations became popular soon. Lycra textiles, t-shirts printed with exotic patterns and short skirt wrappers rushed into fashion. The glam look was promoted by the films Grease and Saturday Night Fever.

However, the common outfit of a "successful woman " on a daily wear was usually a ladies' suit or possibly a skirt with a blouse made of light artifical material, body stocking, low-heeled shoes, and unobtrusive gold jewelery. Men liked the combination of jeans and comfortable blasers. The strengthening call for gender equality reflected in popularisation of unisex clothes which reached its top in early 80s.

Actually, Czechoslovak fashion was inspired by foreign fashion trends that unfortunately always arrived in Communist Czechoslovakia with a two-year delay.



THE CHANGES AFTER NOVEMBER 1989

In 1989, the year of the profound change for the whole Czechoslovak economy triggered a decline in the textile industry. The Velvet Revolution, despite the name, ironically seemed to upset the whole textile sector.

With the start- up of the economic transformation in 1990, the textile and clothing industrial structures became one of the most afflicted ones among all Czech manufacturing industries. The output in the knitting and clothing industry has been dramatically falling since 1990. At the end of 1993 the decline was - 58% in textile, -54% in knitwear, -66% in clothing industries. The reasons standing behind the decline were the lack of technologies, expensive labour, production of low quality products, low unit export prices on the hard currency markets and last but not least a flooded textile market with cheap goods coming from Asia. Despite the falling production in the whole industrial sector and its shrinking share on GDP after 1989, textile and clothing still play an important role in Czech economy.

Thanks to the effort of textile producers in the last decade, steps have been taken to sustain the international competition and to bring the previous fame of textile industry back. New producers have been trying to change the poor image of their products by hiring reputable designers, using high quality materials, advanced colouring and design technologies, controlling the precision of handwork, as well as improving on marketing techniques and servicing the customer.

The growth of the textile industry in the Czech Republic depends not only on export competitiveness, but also on creativity. Only those who specialize in high quality products survive.

The turnover of the textile and clothing sector grew in 2014 by 8.4%, to a total of 51 billion crowns, but since 2000 a reduction by two-thirds in the production, and the loss of 37,000 jobs has been reported. What unites the textile enterprises is the dependence on export. The main purchaser is Germany, in addition to being the leading supplier of raw materials, followed by Turkey, the US and Russia. Yet foreign trade has had a deficit since 2004. The deficit in 2014 reached a record level of 15.5 billion crowns, as noted by the Czech Office of Statistics. The direct cause is an increasingly large import of cheap goods, mostly from China and Bangladesh.

What remains of the great factories of the twentieth century are dozens of buildings in ruins, ready to be converted into offices and residential complexes.

In 1989, a year of change for the whole Czech economy, the decline of the textile industry started. The City of Brno lost its leading position taken over by a number of manufacturing facilities seated in Liberec, which from the nineteenth century had been the second biggest textile centre of the country and boasts a reputable textile college

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The most intensive changes were influenced by the loss of foreign trade demand which already started in the mid of 1990 and caused a loss of output in manufacturing. The fall in production continued in 1992 and 1993, though at the end of that year there was a visible stabilization in some segments of the textile industry and clothing sector due to the successful privatisations of former Czech textile plants. Some of the enterprises were taken over by foreign investors, e.g. in 1994 Marzotto, an Italian company, merged Mosilana, nowadays Nova Mosilana, the only one to continue the weaving tradition.

Since then the interest of foreign investors in the country has grown, they often just invested in new machinery and the reconstruction of buildings. In 2012 Marzotto also relaunched Sametex, dedicated to velvet production

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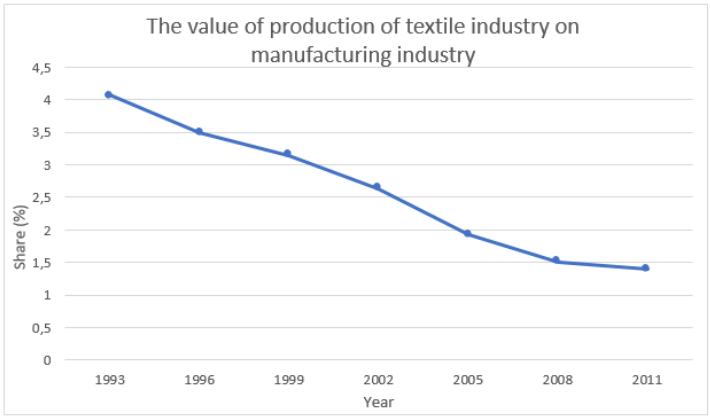
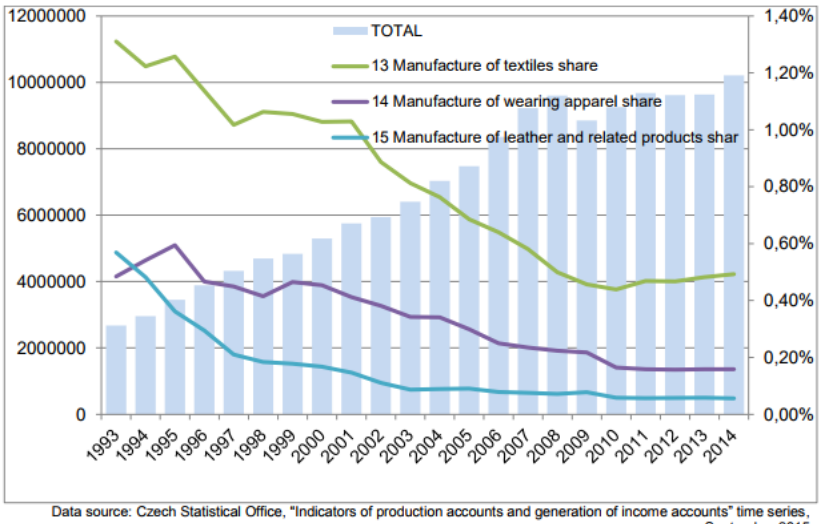
Skilled labour, lower taxes, a good geographical position and competitive cost of energy led other Italian industrialists to relocate their production to our country. Despite this the foreign trade has had a deficit since 2004. The deficit in 2014 reached a record level of 15.5 billion crowns, as noted by the Czech Office of Statistics. The direct cause is an increasingly large import of cheap goods, mostly from China and Bangladesh.



What remains of the former great textile factories of the twentieth century are just dozens of buildings in ruins, ready to make room for offices and residential complexes.



Data source: Czech Statistical Office, "Indicators of production accounts and generation of income accounts" time series, September 2015

Total Czech Trade in Textile and Clothing (in mil US $)

Trade	1988	1989	1990	1991	1992	1993	1993/1989
Imports of textiles	447.89	424.24	415.07	283.87	266.22	412.4	0.97
Imports of clothing	137.45	123.96	161.06	102.48	114.56	195.2	1.57
Exports of textiles	493.61	466.00	484.80	464.85	575.39	691.3	1.48
Exports of clothing	235.94	208.26	175.19	168.31	222.19	304.2	1.46

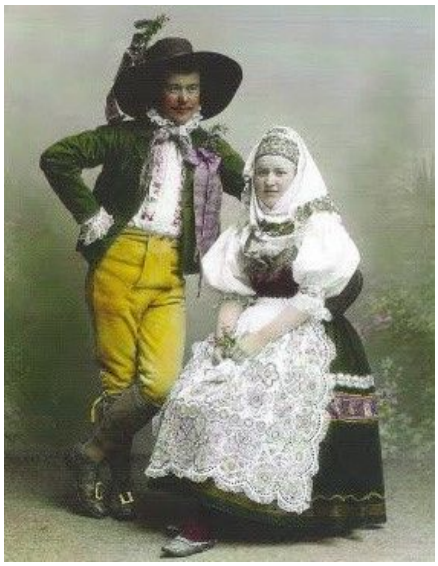
CZECH TRADITIONAL COSTUMES

Czech culture and customs projected in the pace of time in Czech traditional garments.
A folk costume expresses the identity which is usually associated with a regional area or a period of time in history. It can also indicate social, marital or religious status.

Czech folk costumes may be divided into two groups: Western style in Bohemia and mid-Moravia, and Eastern style in the rest of Moravia and Silesia.

Specific aspects such as colours, embroidery, motifs and fragments of traditional costumes varied according to social, geographical and symbolical factors as well as according to the purpose of their use. Costumes worn on special occasions were usually richly decorated, colourful and accompanied with a wide range of accessories (scarves, ribbons, headdresses, hats, belts, etc.) while everyday clothes tended to be rather simple and practical. Every region had a set of amusing particularities. For example, women in Plzen region used to wear up to 24 underskirts, which were restricting their movements, nevertheless they wanted to feel stylish.

At present, folk costumes in the Czech Republic are no longer commonly worn, but people still wear them during popular traditional folk celebrations. This tradition is the strongest in Moravia, the eastern part of the country. Folk costumes are still worn by members of folklore ensembles during various traditional celebrations or festivals. In some families, costumes are handed down from generation to generation as they wish to preserve the tradition. Likewise, many stay protected in museums and private collections.



TRADITIONAL COSTUMES IN OUR REGION

The Blata folk costume is worn in the region of České Budějovice, Tábor, Jindřichův Hradec and Vodňany. Previously it extended as far as Moravia and into some villages in Austria. Even if we can recognise common features, there are some differences stemming from various regions, primarily in embroidery patterns.

A Bohemian costume, especially the women's costume, is decorated with embroidery using sequins, which is typical for south-bohemian region (comes from the tradition of keeping carps in ponds). Chemises used to be richly embroidered in the first half of the 19th century and in the second half of the 19th century the embroideries were enriched by beads. There was an embroidered collar round the neck above the embroidered shirtfront. Women's shirt was richly embroidered and decorated with beads.

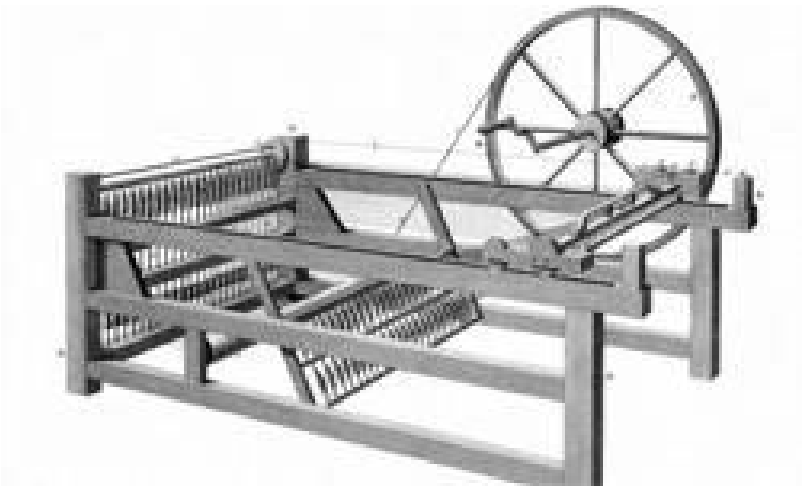
The variety of worn colours was wide – most often it was red, but also green (for weddings), dark pink or violet (for funerals and Lent). Aprons were made of silk, usually striped or with floral patterns.

HISTORY OF SPANISH TEXTILE INDUSTRY

Flax

Galicia (Spain) is one of the places where flax has been cultivated for more than 500 years.
Flax is a plant which has to undergo a very complex manufacturing process. When the plants are collected in June, they have to be plucked off together with their roots so as not to damage their fibers. Then, the flax is retted and then allowed to dry. Finally, the stems are rolled into balls to be processed in mills. Pre-prepared flex stems are to be peeled, hackled, spinned and finally linen fabrics woven. For centuries, both linen and wool from sheep were the fundaments of a home-based economy in most of the country.

In the 19th century, Spain decided to focus on cotton industry in Catalonia and imposed taxes on linen industry. Galicia couldn't pay those high taxes so linen production stopped. Nowadays, some Galician associations are trying to recover flax growth and some popular techniques to produce linen.



Industrial Revolution

The industrial revolution which started at the end of the eighteenth century was based on cotton which came from Asia. Catalonia was one of the few European regions to be involved in this process from the very beginning. The mechanization of spinning in Catalonia advanced thanks to the invention of the spinning machine.
The full development of Catalonian textile industry hadn´t been made until French War (1792-1802). The Catalonian industry had to face the poverty of its subsoil, to depend on foreign energy resources, especially coal from the UK and to deal with the poor demand of the Spanish domestic market (made up of farmers and ranchers).

ZARA

PULL&BEAR

Bershka

stradivarius

Inditex is a Spanish clothing company and it's one of the world's largest fashion companies, with 8 distinct brands.

In the early 1960s, Amancio Ortega established in clothing industry as a teen while working for a local shirt maker in A Coruña, Spain, and began developing his own designs. After 12 years making textiles, Ortega and his wife opened their first store in A Coruña. It was called Zara. In 1976, Zara's business model reduced the gap between fashion creation and consumers, bringing customers closer than ever to the products they wanted, all for an affordable price. Nowadays, the company has brand stores in some of the most prestigious shopping districts in cities all over the world and it has become a fashion icon.

Inditex was officially founded in 1985. It was incorporated to bring all its companies together under one brand. In 1988 Zara went international. Between 1991 and 2009 new brands appeared within the company, such as Pull & Bear, Massimo Dutti, Bershka, Stradivarius, Oysho, Zara Home and Uterqüe.

Since the beginning, Inditex has been expanding all over the world and continues to do so today.

Store	Year of Creation	No. of shops nowadays
Zara	1975	2,266
Pull & Bear	1991	986
Massimo Dutti	781	1991
Bershka	1998	1,102
Stradivarius	1999	1,024
Oysho	2001	672
Zara Home	2003	587
Uterque	2009	86
TOTAL		7,054

Textile nanotechnology

Creating, modifying and improving textiles at molecular levels and increasing their performance is possible nowadays thanks to nanotechnologies. Their use provides developing textile industry with new features such as antibacterial or hydro-repellent properties, and many others.

Currently in Spain, there is the AITEX (Textile Research Institute) which has been inventing and researching new textile properties that can make our lives easier. Clearly, this science may be very important in the future. However, more and more companies like Nike or Ralph Lauren have been making use of these special properties implementing these new technologies in their production.

HISTORY OF MACEDONIAN TEXTILE INDUSTRY

Considering that the textile industry is one of the oldest industries on the territory of Macedonia, the normal track of things is to go through the development and growth through various historical and economic phases.

If we look back, Macedonia was a developed centre primarily for the production of wool, then cotton, and for a short period silk. Because of the social conditions and wars, the development of this sector underwent various transformations, which at times resulted in a great progress, but sometimes it suffered seriously.

If we start from the end of the 19th century, Macedonia was a territory with numerous small towns with developed trade, especially craft.

The introduction and further development of the textile industry in Macedonia was mainly caused by the needs of the Ottoman army for various types of clothing and uniforms. Another reason for the emergence of the textile sector was meeting the needs of citizens from urban areas.

The first textile enterprises were established in the 1880s in the villages in the Bitola region, and their main activity was the production of wool products. A small number of cotton products were made in craft workshops. Since Bitola, at that time known as the Manastir, was a significant economic and cultural centre in the European part of the Ottoman empire, the development of textiles in this region was logical.

Although at that time owners and directors of the textile industry had the capital that they invested in this branch, which proved to be very profitable, however numerous Balkan Wars and the First World War affected the industry in the region very badly.

One of the first textile companies on the territory of the Republic of Macedonia was the textile and knitting factory in the village of Dihovo. The factory was built in 1883 and was one of the largest textile industries in the European part of the Ottoman Empire. It was focused mainly on woolen products, applying modern production processes and it was the use of homemade wool which made it highly competitive. However, to produce high-quality products, they also imported wool from England.

Market of clothing and materials in Bitola in the Ottoman period

The final products were sold in most of the major cities in the region - Bitola, Thessaloniki, Skopje, Istanbul, Izmir, Durres. The factory was equipped with a large number of machines - 461, out of which 10 automatic machines for stationery, 200 machines old pressing system, 200 machines (clocks) for knitting broom, four combs for grooming wool , two steam presses etc. The factory was closed in 1915, as the Bulgarian army took the mechanization in Sliven and Gabrovo in Bulgaria.

At the end of the 19th century and the beginning of the 20th century there were ten more textile workshops. Unfortunately, all were closed and destroyed during the First World War. In addition to wool products, cotton was also produced. However, this sector could not have been developed during this period due to the high competition from European cotton producers.

The second negative factor for the development of cotton production was the poor purchasing standard of the Macedonian population. However, between 1933 and 1949, the cotton production industry grew.

But except for cotton and wool, silk was produced on the territory of Macedonia. Modern silk production began in the late 19th century. The main centers for silk worm were the regions of Gevgelija, Dojran, Strumica and Radovish. The first silk processing plant was founded in 1894 in Gevgelija and was owned by Sultan Hamid. The mechanization was made in Italy and set up by Italian experts. At that time the workers worked for 12 to 14 hours a day, for a total of 180 workers, all from Gevgelija. Among them there were women. The factory was closed at the end of the Balkan Wars in 1912 and destroyed during the First World War.

Overall, this war remains a major and serious reason for the catastrophic effect on the silk industry in Macedonia.

In the period from 1918 to 1949 there were 16 companies producing textiles on the territory of the Republic of Macedonia. At the beginning of the Second World War only 12 companies worked.

The companies in the Macedonian textile sector were engaged in silkwashing, weaving fabrics of cotton, wool and artificial silk, knitwear, etc. The most important industrial objects were the cotton fabrics for cotton products, and the only company that owned a spinning mill for wool and cotton processing was located in Strumica.

The late appearance of the textile industry in the interwar period was due to the lack of capital, industrial energy, skilled workers. In this period, the textile industry took the fourth place in terms of investments, after food, distribution of electricity and tobacco industry. In 1939, the Macedonian textile sector was employing 434 people, which was 5% of the employees in the industry.

Macedonian industry had gone through a period of a steady increase in the interwar period. The production increased in the second half of this period.

The period after the Second World War is said to be a flourishing period of Macedonian textile industry. Thus, the development of this branch in this period until 1990 can be divided into three parts:

1. The government of the SFRY decided to change Macedonian economy from craft to industrial with the program of five-year plans. According to this plan, about 16.7% of the investments were in the textile industry (period from 1947 to 1953). It was the first positive impulse when in 1950 a silk factory, "Noncha Kamishova" in Veles, was built and put into regular production. This is a period when two large capacities are created in Macedonia - the factory for processing wool, sheets and goods - Todor Vipovski Merzhan (ie Teteks) in Tetovo in 1951, and in 1951/1952 the factory for processing cotton started, spinning yarn and weaving of cotton fabrics "Makedonka" in Stip. In fact, in this postwar period, Stip stands out as the center of the textile industry.

2. The second positive impulse lasted from 1958 to 1966 when 22 textile factories were built in all parts of the country. During this period, in 1962, "Astibo" started working. This factory was the first branch of "Makedonka" and its production line was located precisely in "Makedonka " premisses.

Makedonka Factory

3. The third impulse is from 1970 to 1985, when 14 factories were built and put into operation.

But despite this generally positive impetus, the problems for "Makedonka" started within the 1970s. The factory increasingly depended on imports of cotton, since its production in Macedonia dropped significantly. In 1970, the idea of joining forces with other textile and clothing factories was realized, so "Makedonka" became a part of the "Inteks" conglomerate.

But it was not only "Makedonka" which faced serious problems. After 1985 the problems started in the whole Macedonian textile industry.

At the beginning of 1990, a sharp decline in this industry began. The decline was low in the manufacture of apparel but more significant in the textile sector. The decline in the apparel production sector lasted until 1996, stabilizing in the next years until 2000. At the same time, the decline in the production of textiles and canvases continued.

With the break-up of Yugoslavia all factories were closed because there was no market. However, since the1990s smaller textile factories, where the owners are the people who previously worked in the big ones, have been emerging. These people had the opportunity to send their children to get educated outside (in Italy, Bulgaria), who saw the situation outside and after their return to Macedonia they entered the business. Yet, there are not being created enough job opportunities for the others. The small textile factories where are up to 300 employees operate the LON system.

Macedonian designers organize a fashion week on regular basis. They come out with new designs, yet, it is more than uncertain whether they are able to sell them. There must be something to do so to cover their basic expenses. "Fashion is expensive. It is a luxury. We are trying to enter the EU, and they seem to find the workers and pay them less, and we belong to them" - as the Macedonian fashion designers state.

But we are not the only ones that are turning to the ready-made or serial production. The big fashion houses, realizing that they cannot survive the High Fashion, have been turning to this production too.

In the 1980s, pret-a-porter look appeared as a new generation of consumers emerged. These are people who have had the opportunity to get educated, have a new way of living, have the opportunity to buy, see, own their taste and know what they want. There was hunger on the market for new products which would be aimed at young generations. Since the fashion houses could not survive only High Fashion. They had 70 workers to be paid, and because the labour was expensive, they started to spread.

"In China I was in 1989 and all the big French houses had their own factories that produced pret-a-porter models sold in boutiques. And we are part of that, the cheap labour is in our hands and in some way we are doing exploitation. But it's not just textile. So it is almost in all industries in our country. In France they will pay 1000 euros, with us 200 euros", says Zorica Mladenovic - a famous Macedonian fashion designer, costume designer and professor. With all this in mind, it is not optimistic about the development of the textile industry, but even more so for the staff that is educated in this branch.

"There are several examples of fashion designers from Macedonia who were outside, some of them managed, but it is very difficult. Lidija Georgieva went to school in Paris, Marian Peyovsky stayed in London and now she has a boutique in Paris, Alek Bimbiloski works through Paris, sells to America, Japan, France. However, I'm sorry for the young fashion designers, because here, they cannot do what they dreamed and hoped for. That is, the majority of them" - says Mladenovic.

According to Lidija Georgieva, it is undoubtedly that we should ask ourselves why tradition does not guarantee us to develop further. She thinks that several factors influence this. Of course, one can not ignore the dissolution of a country, and therefore of one system. Furthermore, the giants were divided into units, the continuity of working in a professional manner was interrupted in the industry, and continued to sew after the LON system, and this is not the same. The new owners naively thought that a modeler could perform the function of a creator, or simply did not differentiate those two totally different positions. As long as the owners of the plants do not understand that they cannot exclude the creative mind, we will not have much progress, regardless of the fact that we have a young educated staff. Today the market is extremely competitive and precise positioning for success is needed. We have great quality and advantages. But what might be a mistake is that we built the experience only with the perfect production of products, but not in the creation of brands - considers Lydia.

How are textile associations satisfied on the other? According to the latest information published by the Economic Chamber of Macedonia, and connected with this branch, things are not good.

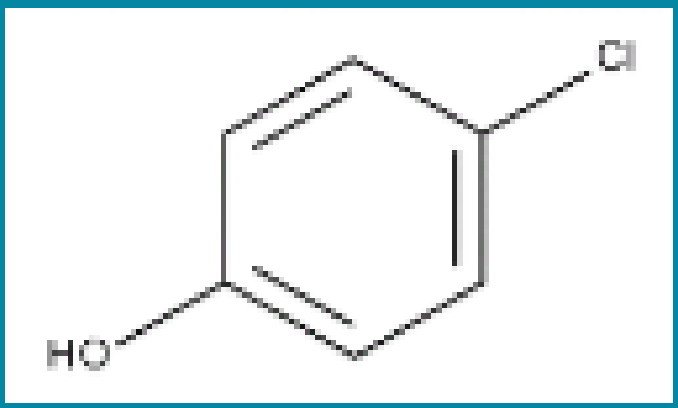
The textile association points out that the textile industry is facing a break down. According to the Association of Textile Industry and Apparel in the Economic Chamber of Macedonia in 2005, the export and the number of employees are reduced. „Considering the textile industry is one of the main economic branches, anti-crisis measures should be taken in terms of certain incentives in the function of maintaining the industry, otherwise the textile industry will be dead", said the president of the Association. Among the other requirements, the Association asked for support to make a conversion from "LON" -production into classical production, ie the creation of own brands that will be intended for export. In the end, the breakdown of a single system, transition, lack of staff or favourable working conditions are contributing to the poor state of TI. And whether the current alarming situation described above contributes to a new and better time and development, remains to be seen. In fact it will be the next historical period that will have to be noticed.

Chapter II

POLLUTANTS IN TEXTILE INDUSTRY

POLLUTANTS IN TEXTILE INDUSTRY

Textile Industry is chemically harmful since massive quantities of chemical products are used in all its processes such as fabric dyeing, printing or finishing touch. The waste in the water used in these is frequently toxic and may contaminate important rivers. This dangerous pollution may affect human health, wildlife and the environment. This is the reason why it is extremely important for the authorities to keep these potential pollutants under control. In this article we will try to show the most common ones, their effects and the law that regulates them.

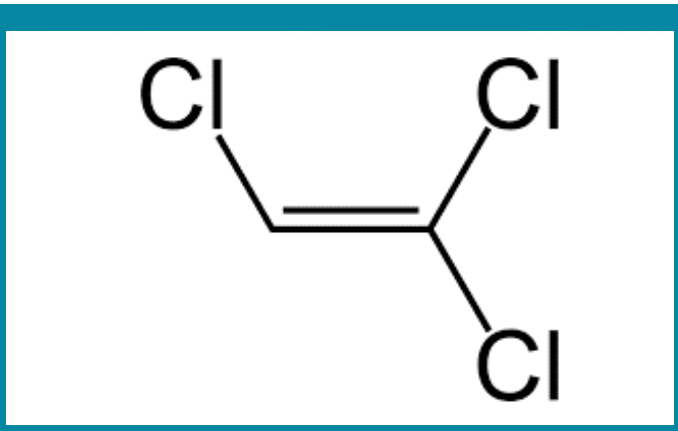


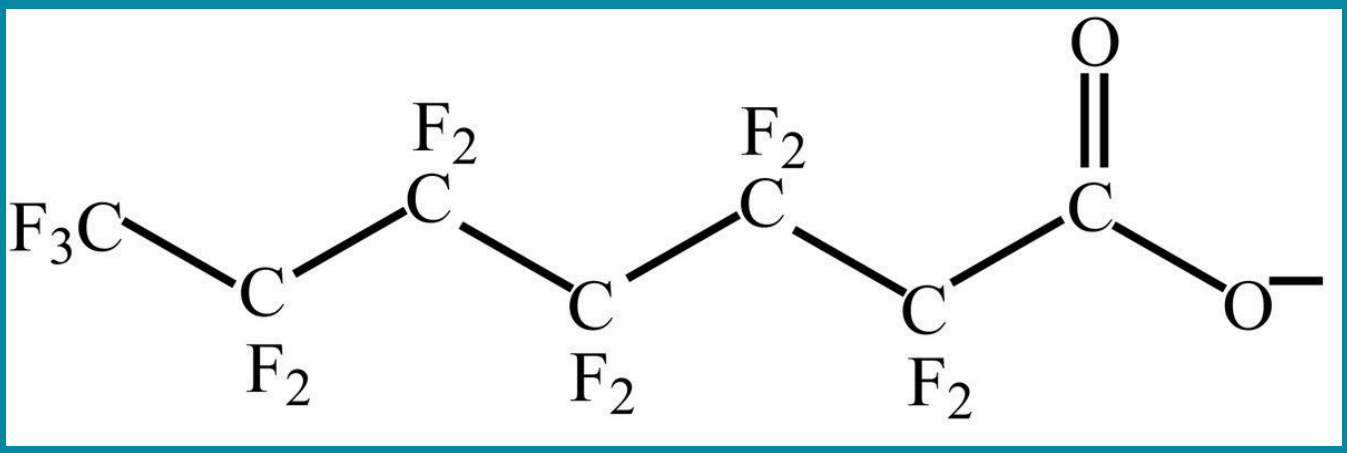
Chlorophenol PCP

It is a substance used in the textile so that insects like cloth moths or other similar bugs won't eat the fabric. Thanks to this substance there are no holes caused by insects in our clothes nowadays. Some of its effects are toxic for the sea life. It is forbidden in EU.

Chlorinated solvents (TCE)

Compounds used as substance solvent and in fabric making and cleaning. It is important to highlight its negative side effect on our neurological system and liver.

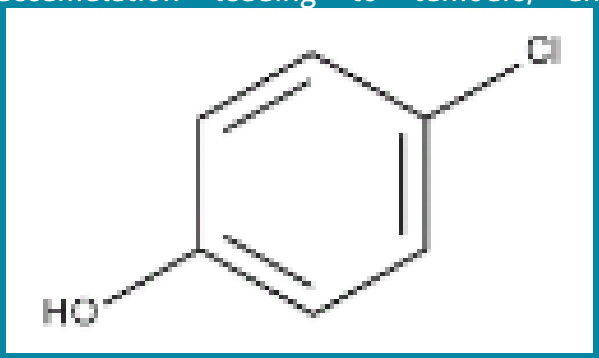




Perfluorinated compounds

The perfluorinated compounds are products used to get water-repellent and stain-resistant cloth. This substance is harmful for humans and some of its consequences are: provoking tissue accumulation leading to tumours, and changing certain hormone levels such as the growth and reproduction ones.

The Stockholm Convention has dealt with the possibility to ban these products off the market.



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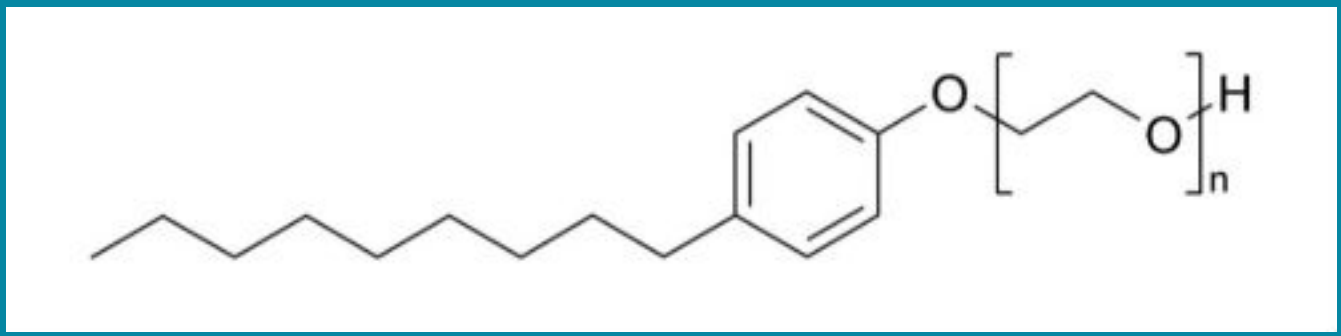
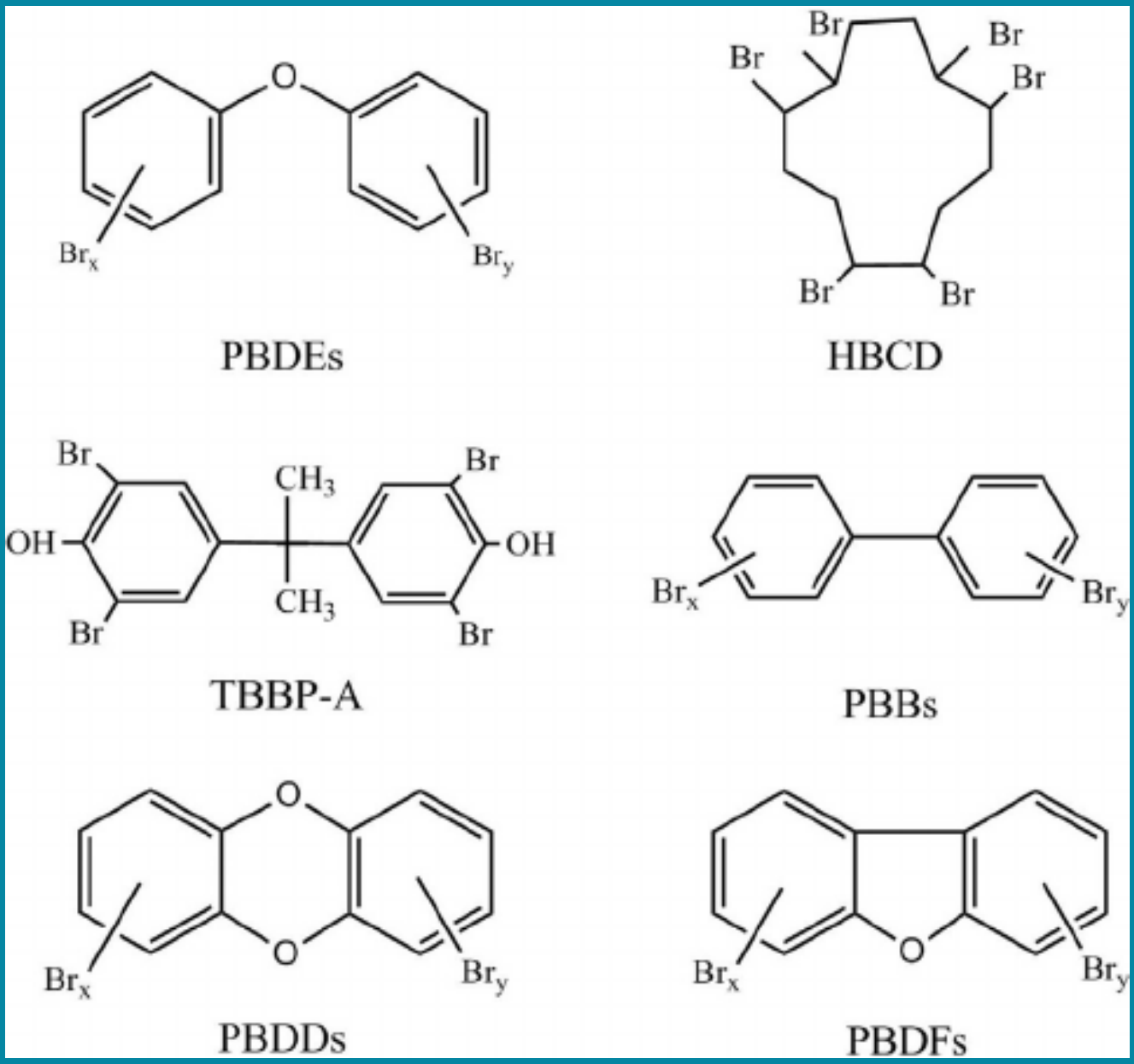


Nonylphenol Ethoxylates (NPE's)

They are chemical substances used primarily in the manufacture of cleaning products (such as detergents) and also in the production of natural and synthetic textiles. This substance causes hormonal interruptions in humans (with the risk of impairing fertility). In the fauna it affects mainly the fish causing changes through which the males become females.

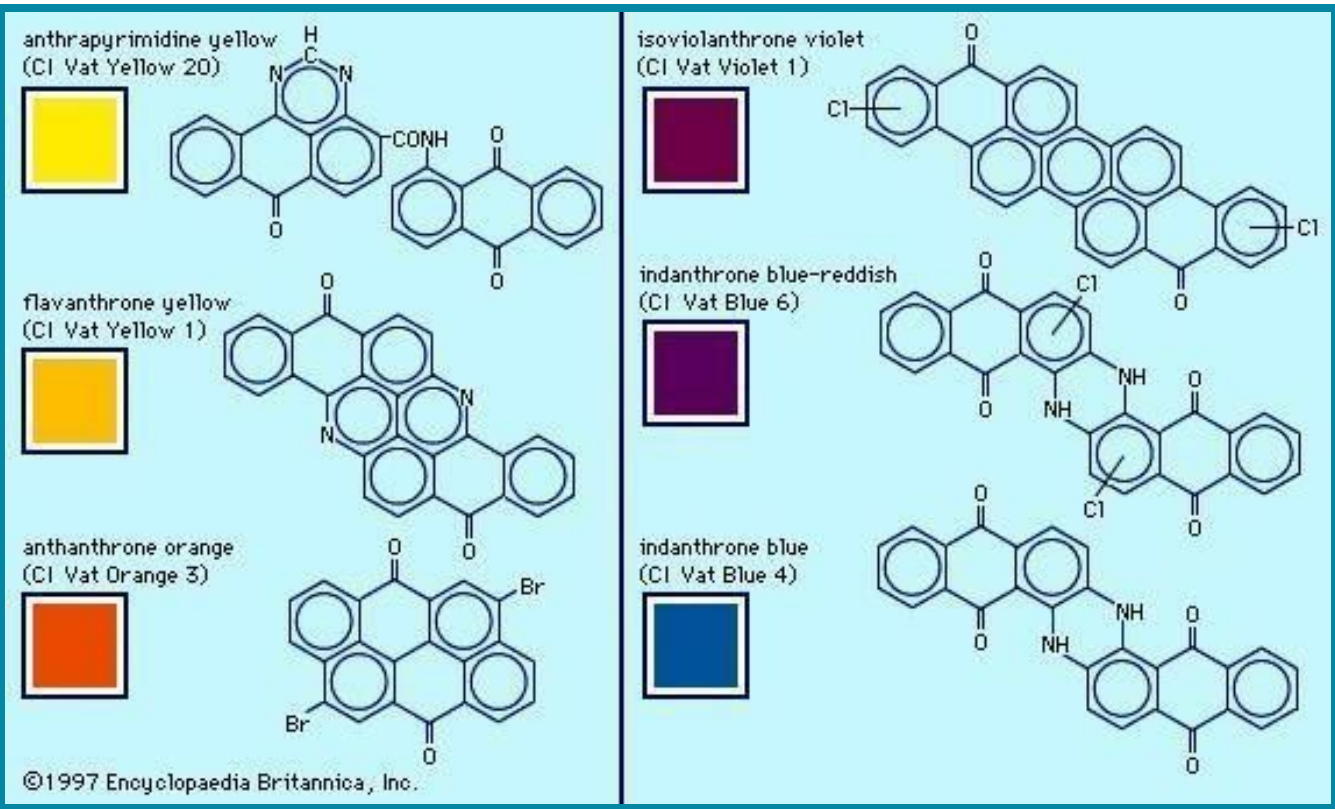
Currently this substance is regulated by the European Union.



BFR's

Brominated flame retardants are organobromine compounds that have an inhibitory effect on the combustion of organic materials. They are used mainly in textiles, since they decrease the flammability of the product.

One of the side effects of this type of compounds is that they interfere in the hormonal systems related to the growth and sexual development.



Azo Dyes

Chemical substances used to dye clothes. These substances can break down releasing aromatic amines, and thus decreasing the probability of getting cancer through contact between textile fibers and the human skin.

Phthalates

Phthalates or esters of phthalaic acid are a group of chemical compounds used as plasticizers, substances added to plastics to increase their flexibility.

One of their most common uses is the conversion of polyvinyl chloride, PVC, from a hard to a more flexible plastic. They are also used as solvents in perfumes, nail polish, adhesives, putties and children toys.

Regarding their effects, they can be harmful for the kidneys, among many others, especially if an allergy is detected. They are also known to have caused liver cancer in mice.

It is not easy to determine the extent of the textile industry affecting our country's environment, since for decades major brands have shifted production to emerging economies where looser safety and environmental rules – and low labour costs – have allowed them to sell clothing at often rock-bottom prices. Most fashion apparel and fabrics are produced in Asia, so we should focus on the pollution levels in those countries too.

There are two areas where the textile industry can be harmful: water consumption (both for growing natural fibers and industrial activity) as well as water and air chemical pollution. Chemicals generation is massively intensive in this industry: fibres dyes, printing and finishing are extremely harmful. The waste waters from these processes are toxic and pollute important rivers like Ebro, in the north-east of Spain. The textile industry is responsible for the 25% of waters pollution in our country, and the figures are increasing more and more due to the "fast fashion" phenomenon. These dangerous poisonous discharges affect human health, wild life and the environment.

Map of the distribution by autonomous communities of perfluorooctane sulfonate (PFOS) concentrations, one of the alkyl perfluorinated substances found in a multitude of products and industrial processes and that may pose a risk to health. Credit: José Antonio Peñas / SINC.

POLLUTION MADE BY TEXTILE INDUSTRY IN THE CZECH REPUBLIC

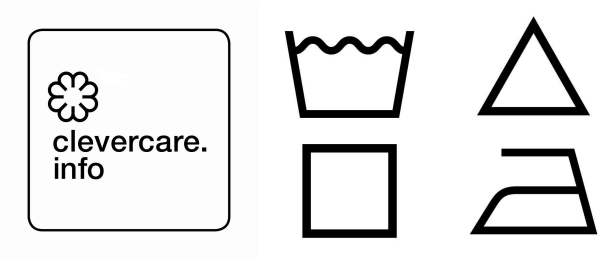
Textile industry has been condemned to be one of the world's worst environment polluters. It requires large amounts of chemicals and water at every step of the textile manufacturing and finishing processes.

Primary textile crop production

Pesticides that farmers use to protect textile crops when being grown can harm wildlife, contaminate other crops and get into the food chain.The main problem is the evaporation of pesticides into the air and their leakage into underground waters which followingly results in contamination of soil and posing threat to vegetation and all live beings.
In our country flax has been grown ever since as the primary textile crop. It is not as water, fertilization and pesticides demanding as for example cotton, which appears to be a painful isssue for example in China, India, USA, Pakistan and others.

Harmful chemicals

Chemicals that are used to bleach and colour textiles can damage not only the environment but also our health. Not only in the process of their production but even when being used.
Although the situation is getting better, the level of textile pollution is still pretty high. The question is if we could help the environment even more. The Czech Republic has its way. We have been involved in the GINETEX group, an international association taking care of the proper usage of textile and clothing which consists of many European countries such as Italy, Spain or Germany. Experts supporting the movement have developed symbols which help consumers to better textiles treatment. They have come up with a new project called Clever Care which teaches us how to deal effectively with textiles to prevent environmental pollution. On the Clever Care website you can find advice on how to treat our garments more environmentally-friendly. The given advice applies to washing, bleaching or dying. For example washing powders contain phosphates (used to soften the laundry) as well as formaldehyde (a potential cancer-causing substance), which can hardly be cleaned even in sewerage plants. That is why phosphorus gets in the sewage and causes the outbreak of algae and cyanobacteria in standing waters. Bathing in such waters can cause serious skin allergies such as various eczemas or even eye disorders. If you want to make the use sustainable, look at Clever care's site which offers several tips on how to save both money and the environment.



Disposal of textile

From 191,228 tons of textile waste in 2002 in the Czech Republic the amount of textile waste rapidly increased and in 2009 it reached almost 800,000 tons. Fortunately, the figures had not risen and had stayed more or less constant until 2017. Corporate waste from textile factories amounted to 66,844 tones in 2006. The share of hazardous waste was 4,374 tones. Luckily,in the following years the situation had been improving and the amount of corporate waste fell to 37,840 tones, 2,362 tones of which fell on hazardous waste in 2013.
One human produces about 7 kilograms of textile waste on average.

According to official statistics, about 8% of municipal waste is textile waste. In the Czech Republic a citizen produces 250 kg of waste per year. Which means more than 20 kg of textile waste is thrown into landfill sites and thus unreasonably burdens the environment.
Every year we consume an average of 15 kg of textiles each year, in Germany it is even about 20 kg.
A significant reason why this is happening have been most of all rapidly changing fashion trends resulting in the increasng worldwide need of clothing production.

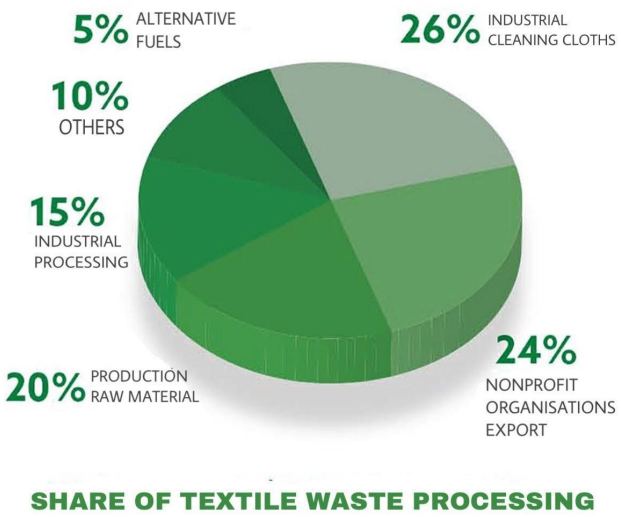
To make it more sustainable the DIMATEX Company in the Czech Republic has come up with an idea of placing two kinds of textile containers in residential areas. White containers are designed for textiles which can be reused again for example as a substitute to raw materials or as alternative fuels. Whereas in red containers people can throw away clothes they no longer want to wear, and then these pieces of clothes are donated to charity.

95% of the collected textile waste are recycled in our country. Whereas textile factories are seated in the north and in the east of our country, the major textile waste recycling factory, Klatex, is in the west near Klatovy. The above mentioned Dimatex company is one of its biggest suppliers in terms of collected waste. The collected textile enters a process of cutting, shreading or tearing on separated fibers. Further, the mass originated is finalised in the form of stitched nonwoven textile. This is used for many purposes, for example as car insulations, in agriculture and since 2008 it has been used for protective clothing production.

Other recycled textile is used as various forms of upholstery or to finalize car interiors (coating the seats, making car rugs, etc.)

Remarks:

- industrial cleaning cloths are made of special absorptive material, mainly used in automotive and engineering industry
- nonprofit organizations such as International Federation of Red Cross and Red Crescent are societies which help people in need and dispense the collected second-hand clothes
- raw material is the basic material used to produce new textile items.
- industrial processing is one of the possibilities how to recycle and reuse materials
- alternative fuels are fuels other than petrol or diesel for powering motor vehicles.



SHARE OF TEXTILE WASTE PROCESSING

Exploitation

Exploitation of animals often goes hand in hand with intensive farming practices that damage the environment as a whole.

Every year 90 million animals are killed because of their fur, 75 million of which come from fur farms with terrible conditions where certain animals are raised and bred. The most raised animal for fur is the rabbit. The CAFT (Coalition to Abolish the Fur Trade) organization has made a research on how many rabbits are killed for their fur. The result is surprisingly almost 50 million every year. The other animals are for example foxes, minks or chinchillas which live in cramped wire cages, where they do not have enough space. They are often fed with expired and smelling food such as eggs or cheese.

Fortunately, fur farming is banned in the Czech Republic as well as in Germany or in the UK, however, there is a black market which handles fur.

Animals are also used to provide leather and wool and which is alarming, 30-40% raw materials produced by leather and wool-processing industry turn into waste!

Air pollution

Textile made in developing countries travels vast distances, thus causes serious pollution to the atmosphere. In the hope of cutting down on costs of labour some Czech companies have moved their production abroad, especially to Asia. In 2015 clothing imports totalled 25,112 billion CZK, which on the other hand represents a huge load of atmosphere pollution because of the transport. For example just a pair of casual jeans has to travel about 19,000 km to the Czech market. It is the transport which stands behind the release of nitrogen oxides (NOx), which rank to major air pollutants. Annual emissions transcend repeatedly unbelievable 50 million tons and this amount is still increasing.These gases contribute to smog formations, followingly to acid rains. The most frequent nitrogen is nitrogen dioxide (NO2) which causes as well as sulphur dioxide (SO2) respiratory diseases.
Other harmful substances are carbon monoxide (C and carbon dioxide (CO2). CO may cau insufficiency of oxygen transport to tissues and has been proved that it slows down reflexes. CC is safe for human body, yet it contribut significantly to global warming.

Water pollution

Water is needed to convey chemicals into the fabr and to wash it at the beginning and end of every step. It absorbs all chemical additives and then is expelled as wastewater, which in turn pollutes rivers and also soil in the form of residual waters.
"BOD", which is biochemical oxygen demand or biological oxygen demand, is a measure of organic pollution in a wastewater sample.
Emissions of organic water pollutants are measured by biochemical oxygen demand, which refers to the amount of oxygen that a population of bacteria in water consumes when breaking down the waste. This is a standard water-treatment test on the presence of organic pollutants.
Since the early 1990s, the Czech Republic has experienced a significant improvement in surface water quality, which has resulted mainly from the reduction of the amount of pollution discharged into surface water. The significant reduction in pollution discharged into surface water is not solely the result of the industrial

restructuralisation from early 1990s. It equally importantly owes to the construction and modernisation of sewer systems and waste water treatment plants, which is subsidised both from the state budget and from European Union funds. Even though the surface water quality has improved significantly in the Czech Republic, a needed attention is to be paid to pollution with nutrients and locally with some hazardous substances. Since 1990, the number of waste water treatment plants in the Czech Republic has more than trippled (from 626 in 1990 to 2065 in 2007) and the trend has been continueing. The Czech Republic also has got a long tradition of cooperation with neighbouring countries on border waters, which is sheltered by bilateral commissions for border waters.

A comparison of the changed states of pollution

Class I	Unpolluted water
	indicators do not exceed values consistent with normal natural background in surface streams
Class II	Slightly polluted water
	the existence of a rich, balanced and sustainable ecosystem is possible
Class III	Polluted water
	conditions may not be in place for the existence of a rich, balanced and sustainable ecosystem
Class IV	Heavily polluted water
	the conditions only permit the existence of an unbalanced ecosystem
Class V	Very heavily polluted water
	the conditions only permit the existence of a very unbalanced ecosystem

Water pollution, chemical industry (% of total BOD emissions)
10.89 %

Water pollution, metal industry (% of total BOD emissions)
5.4 %

Water pollution, wood industry (% of total BOD emissions)
4.38 %

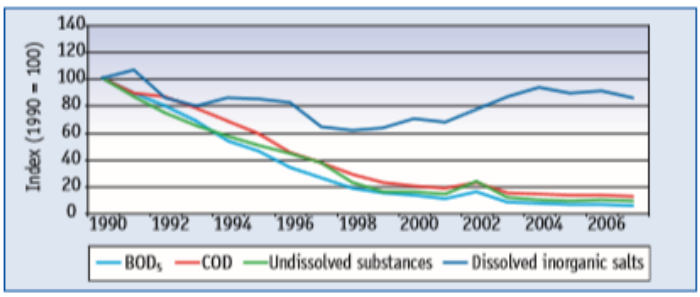
Water pollution, food industry (% of total BOD emissions)
10.93 %

Water pollution, textile industry (% of total BOD emissions)
7.4 %

Water pollution, clay and glass industry (% of total BOD emissions)
6.36 %

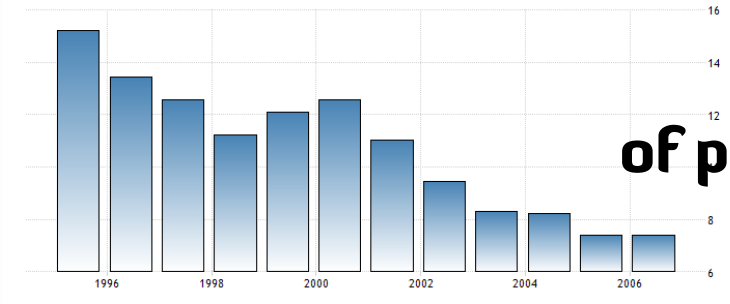
Water pollution, paper and pulp industry (% of total BOD emissions)
4.84 %

In addition to the industrial restructuralisation that took place mainly during the first half of the 1990s, the termination or reduction of some production activities, technological changes associated with reduced water consumption and wastewater discharge and the above mentioned improvement of sewer systems and waste water treatment plants in compliance with the application of the "polluter pays" principle overseen by the Czech Environmental Inspectorate play major roles in reducing the water pollution. Between 1990 and 2007 the amount of pollution discharged decreased by 94.7 % for biochemical oxygen demand, by 88 % for chemical oxygen demand, by 90 % for undissolved substances and by 14.6 % for dissolved anorganic salts.



Besides agriculture, textile industry is the second biggest polluter of water. Moreover, there are 72 toxic chemicals released during textile dyeing which can intoxicate waters. These chemicals do not just harm the quality of water, but the ecosystem as a whole, make us prone to chemical exposure and its health hazards. Even if cotton production is not an issue in our country, as our climatic conditions are not appropriate, globally 2.6 % of annual global water usage fall on it. In addition it burdens the soil and potentially pollutes water with pesticides, herbicides, and fertilizers. Moreover, 25 % of the worldwide insecticide use and 10% of global pesticide consumption is used for growing cotton. Luckily, in the Czech Republic water pollution by textile industry due to all the measures and regulations afore mentioned ranges between 7-8 percent of total water pollution which is not alarming and this trend is to be continued as 2015 statistic says.

The changes in the rate of pollution caused by TI



Soil pollution

Pollutants released by global textile industry are continuously doing unimaginable harm to the environment. They pollute land and make it useless and barren in the long run.
Surveys show that it is the cotton which consumes the highest amount of harmful pesticides and fertilizers. These fertilizers as well as used pesticides pollute and deplete soil. There comes another aspect of growing cotton. Despite mechanized harvesting, the cotton industry is still largely dependent on cheap labour where childrenś labour plays a major role. Even the following procedures in cotton processing, such as dyeing and softening, contribute to soil pollution.These are the general facts which have been afore mentioned.
A study was conducted to test the amount of metals present in soil and groundwater located near textile and tannery plants in Haridwar, India. Results indicated all the metals like Chromium (Cr), Iron (Fe), Manganese (Mn), Copper (Cu), Lead (Pb), and Cadmium (Cd) were present in amounts larger than those prescribed as safe by World Health Organization (WHO). Majority of them dump in the ground. Similarily, textile manufacturing units release hazardous waste into the nearby land.
On the overall scale in the world, the pollution in the Czech Republic caused by textile industry is on really a low level. Even if the situation is not so bad, in the run of the last decade heavy metal toxicity has attracted the attention of many scientists. The increase in environmental pollution is mainly due to human activity. Although currently textile industry does not play a major role, metals such as Cr,Mn,Cu, Pb, etc. tend to accumulate in soils. Mercury, currently used for the production of artificial silk, used to be contained in textile dyes. Even if it has been replaced, residual waste waters coming especially from the dyeing process still significantly contribute to pollution and a complimentary treatment process is needed to remove the colour and if possible the residual impurities.

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To sum up,the values of cadmium, mercury and lead released by textile enterprises meet Czech norms and the highest concentrations do not appear in areas where textile factories are located

Noise pollution of pollution caused by TI

Most of the textile industries cause noise and sound. There are a few types of machines in textile industry even in the 21th century such as annular spinning machines, rotor spinning machines, yarn forming machines, cordless weaving machines and knitting machines which still contribute to noise pollution.

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Issues of post-production of pollution caused by TI

Another environmental issue appears after closing the factories down. For example, the former biggest wool-processing factory in our country since the times of Maria Theresa reign, Vitka Brněnec, has become only a crumbling complex of buildings after its close-down. Additionally, in the plant there was found a great deal of chemicals, poisons and harmful substances which used to be needed during textile production. In 2013 thirty litres of life threatening sulfuric acid leaked into the soil in the close neighbourhood of the Svitava River.
Another abandoned textile plant caught fire in early 2018 and put at risk the citizens of Krnov.

In terms of soil pollution the abandoned and deteriorating textile plants pose a great risk because of the residual chemicals in the land nearby and it is the Czech state which has to solve its detoxification at the state costs.

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Greenpeace and the Czech Republic

Czech Greenpeace in the Czech Republic stands behind many campaigns connected with textile industry to protect the environment in the Czech Republic.
For example the Detox campaign whose mission is to stop poisoning waterways around the world with harmful chemicals. It has exposed links between textile manufacturing facilities causing toxic water pollution and many of the world's top clothing brands. Nike, Adidas, Puma or H&M have committed to Detox, in response to the growing international campaign. The listed chemicals are for example alkynphenols, phthalates, azo dyes, chlorobenzenes and heavy metals. Other top clothing companies still need to get a move on to detox their brands and help detox our future.

Czech republic has become a member of this project too. Czech volunteers and members of Czech Greenpeace office have been fighting for toxic-free fashion.

POLLUTION MADE BY TEXTILE INDUSTRY IN MACEDONIA

The development of textile industries in R. Macedonia industries in R. Macedonia and the need for education in sustainable technologies

General classification of solid waste from textile industry

In Macedonia 82% of buyers would decide to choose a textile product that is labeled as less polluting the environment.

Sustainable Waste Management
- Reduced waste generation
- Reduced consumption of natural resources
- Circular motion of matter and energy in nature

The total amount of generated waste in the Republic of Macedonia.

Macedonia's textile waste can be estimated at around 26 million tonnes a year, of which 2.2 million tonnes per year belong to solid waste.Pollution from the textile industry in Macedonia

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Classification number	Type of waste	Estimated quantity (t / year)
01	Waste from research, mining, quarries, physical and chemical treatment of minerals (Hazardous + non-hazardous)	17.246.000
02	Waste from agriculture, horticulture, aquaculture, forestry, hunting and fishing, preparation and processing of food • Animal by-products • Plant by-products	 5.060.000 550.000
03	Waste from wood processing and production of panels and furniture, pulp, paper and cardboard	300
04	Waste from leather, fur and textile industry • Non-hazardous waste • Hazardous waste	 795 155
05	Waste from oil refining, natural gas purification and pyrolytic coal treatment (hazardous)	391
06	Waste from inorganic chemical processes • Non-hazardous waste • Hazardous waste	 101.611 227
07	Waste from organic chemical processes	467
08	Waste from production, manufacture, supply and use of liners (paints, varnishes and glazed enamels), adhesives, and inks for printing (hazardous)	12
09	Waste from the photographic industry	3

	(hazardous)	
10	Waste from thermal processes • Non-hazardous waste • Hazardous waste	 2.015.379 75.347
11	Waste from chemical surface treatment and coating of metals other materials; coloured hydro-metallurgy • Non-hazardous waste • Hazardous waste	 596 240
12	Waste from shaping and physical and mechanical surface treatment of metals and plastics (hazardous)	48
13	Oil and waste from liquid fuels (hazardous) Used oils PCB / PCT content oils	777 8000 121
15	Packaging waste, absorbents, wiping materials, fabric materials, filters and protective cloth not otherwise specified (hazardous)	52
16	Waste not listed on the list • Old vehicles • Used tires • Used accumulators • Other unladen waste (coatings and refractory materials from metallurgical processes) (non-hazardous)	 17.500 6500 1500 1550
17	Construction waste and rubble (including excavated soil from contaminated locations)	500.000
18	Waste from surveys for health and veterinary protection and / or related research (except kitchen waste and restaurants that do not stems from immediate health care • Non-hazardous waste • Hazardous waste	 5.670 1.000
19	Waste from waste management facilities, wastewater treatment plants waste water outside of the circle of capacity and preparation of water intended for use by humans and for industrial use • Non-hazardous waste (sludge, waste recycling metals, ...) • Hazardous waste	 54000 16
20	Communal waste • Household waste • Commercial waste (ingredients similar to	 420.000 150.000

	those of waste from households) Including: - paper / cardboard (160001 for recycling) -PET - glass	 86.500 10.700 14.000
Total		26.200.000

Source of data: Waste Management Strategy (2009-2015) of the Republic of Macedonia.

Textile production is one of the oldest industries in the world. Textile and clothing industries have basic inherent characteristics and contain a large and diverse range of activities. The overall process of production of textile products can be presented in three stages:

Raw materials
- fiber preparation

Textile
- processing of raw materials
- manufacture of knitted and woven textile materials
- preparation of dyeing textiles
- production of: carpets, home textiles, technical and industrial textiles

Clothing
- transformation of textile materials into products

The textile industry in Macedonia is one of the most important industries:
By 1990
- developed basic textile industry
Today
- developed apparel industry (95%)

Export of textile products to the developed countries' markets can only be achieved if certain definitions are met:

1. Qualitative requirements from an environmental point of view

2. Minimal consumption of all types of resources
3. Reducing the negative impact on the user, the environment and the society,
4. Fulfillment of international quality norms – ISO.

Within the textile industry, the waste in solid aggregate state consists of: fiber, pelts, yarns and remnants of textile materials.
According to Article 25, paragraph 2 of the Law on Waste Management ("Official Gazette of the Republic of Macedonia" No. 68/2004 and 71/2004), solid waste from the textile and apparel industry, in the list of types of waste is classified into two groups:
04 - Waste from leather, fur and textile industry
04 02 waste from the textile industry
04 02 09 waste from composite materials (impregnated textile, elastomer, plastomer)
04 02 21 wastes from unprocessed textile fibers
04 02 22 wastes from processed waste fibers
04 02 99 other waste
20 - Municipal waste (household waste and similar waste from commercial, administrative and industrial activities) including fractions selected waste
20 01 separately collected fractions
20 01 10 clothes
20 01 11 textiles

In the Republic of Macedonia, the largest number of ready-made clothes enterprises throw out solid wastes after the cutting process and together with other communal waste is dumped at city

Number for classification	Type of waste	Estimated amount (t / yr)	(%)
20 01/20 02	Biodegradable (organic) waste	148,819	26.0
20 01 38	Wood	15,454	2.7
20 01 01	Paper and paperboard	68.113	11,9
20 01 39	Plastics	54,949	9.6
20 01 02	Glass	20,033	3,5
20 01 11	Textiles	16,599	2.9
20 01 40	Metals	14,882	2.6
15 01 05	Mixed packaging	12,592	2.2
	Another waste (complex products, inert material, other categories)	42.929	7,5
20 01	Hazardous household waste	1,145	0.2
20 01/02/03	Cabbage waste- fine mixed particles (<10 mm)	176,866	30.9
	Total communal solid waste	572.000	100,0

Environmental aspects in the textile industry

Waste in the textile industry consists of waste in solid, liquid and gas aggregate state. Waste in solid aggregate state occurs during the formation of textile or used product. Waste from the process of forming the textile consists of fibers, pellets, yarns or scraps of fabrics. This waste, in firms with complete production process, from yarns, knitted fabrics, etc. usually returns to production again by various means of recycling procedures. For this purpose, it should be sorted by raw composition and colour, and to recycle by way of chopping, dislodging and how to fib back to back process spinning, and later knitting or weaving.

For recycling, and depending on the nature of the residues, apply dry and wet procedure. Namely, over-riding residues such as fibers, pellets, yarns, knitted and woven fabrics with small densities can be recycled after dry, while fabrics with large densities, especially of synthetic fibers or wools obtained by rolling after wet procedure. In "Teteks" Tetovo, a recycling plant was put in dry procedure, where recycled products are sorted by colour and raw material composition and most often from them or in a mixture of new fibers cheap commodities are produced, such as blankets and rugs.

If the material is not sorted by raw material, and especially not by colour, it can to be recycled in pellets and applied in construction as insulating material or for reinforcement of concrete, in the automotive industry (composite materials, non-woven textile for interior coating), furniture industry, (duks, upholstered furniture), pelts for one-time absorption of impurities soluble in water (usually white cotton) or impurities soluble in oil (usually white synthetic), energy sources, etc.

The survey indicated that most companies are dumping waste after tailoring, and a small number that sort it in terms of composition and colour and sell it in country or abroad. By introducing modern computer methods for fitting on tailored images the rest of the cuts ranges from 3 to 5%, and only in certain cases can reaches up to 20%.

A worse problem is the used textiles. In the countries of Europe and US textile consumption reaches 20-25kg / person per year. In our country Macedonia, because of the low one living standard this quantity of waste is very small (500 tons of daily waste at the landfill Drizla contains only 15 kg of textile and leather waste. With the approach to the EU, increasing the standard of living is expected to increase the consumption of textiles as well which will impose finding appropriate solutions for its removal or conversion.

Waste in liquid aggregate state are wastewater from refinishing plants which they consume large quantities of water, energy and chemicals, whose degree of pollution depends of the technological phases of finishing and is the largest in the washing and wool washing phase, decomposition, cotton wool, washing after printing, followed by colouring, mercerization of cotton, carbonization and wool painting. According to the results of a survey only 5 firms out of 26 responded have wastewater treatment stations while the rest, waste water directly drained into the city sewer or in the watercourses.

Wastewaters are categorized into five classes: the first one includes the pits, in the second water can be cleansed and become chaste, in the third unclean, in the fourth very unclean in the fifth dead. The waters in the Republic of Macedonia can most often be classified into the first three classes, and the fourth occurs depending on the season and the month in year.

Environmental problems and their resolution

Export of textile products to the markets of developed countries can be only if certain conditions are met from an environmental point of view. Today, a quality textile product is considered only if it contributes in the entire cycle protection of the health and safety of people during the production, use, maintenance and postponement after use, i. e. realization of production with minimal consumption of all types of resources, without adverse impact on the user, environment and society, and which are defined by international quality norms and standards of ecology ISO.

Textile ecology is divided into three areas: ecology of production, humane ecology and ecology of waste disposal. The ecology of production includes the procedures for obtaining fibers, textiles and clothing and finishing the products, which are environmentally friendly.

In the past, the Former Yugoslav Republic of Macedonia had developed a basic textile industry and was a major producer of synthetic (polyester, polyacrylonitrile and polypropylene) and natural fibers (cotton, wool and silk). Today, small volumes of wool are produced with very limited application in the textile industry. In addition, the production of textile products for the most part (95%) consists of production of various types of clothing. Therefore, all types of fibers, yarns are ready-made and will be imported in the coming period as well as 100% of fabrics or knitted fabrics made with one or two or more fibers. This requires, when importing raw materials, to strictly apply the ecological criteria which for textile are divided into three groups A, B, C.

The largest group is A, and it is divided into:

1. A1, which defines the limitations of the presence of toxic chemicals deposited during the production of natural, artificial and synthetic fibers.
2. A2, which defines the limitations of the use of certain chemical compounds in the preparation to the finished product.

These are substances that if they come in contact with the human organism during their use are very harmful. On import, manufacturers of these fibers will have to strictly adhere to the environmental regulations required by the EU countries, the United States and other developed countries.

Today in the Republic of Macedonia there are machines that process products of cotton, wool, synthetic fibers and their mixtures, as well as machines to finish end products for clothing, with almost all the production being exported. This requires that the refinements comply with the requirements defined by the EU's ecological criteria, which refer to the means for cracking, softening, aggravating, bleaching, burning, collecting, finishing, biocides, detergents, complexes, impurities in colours and pigments, metal complexes with Cu, Cr, Ni, carcinogens and colourants that cause mutation, allergies, printing pastes, formaldehyde releases, laminates, membranes and the like. In addition, mandatory labeling of certain actions has been introduced (to cause cancer, inherited genetic damage, infertility, damage to the fetus, risks during pregnancy, inhalation cancer, highly resistant to aquatic organisms, long-acting undesirable effects, etc.).

Considering that the Republic of Macedonia is a producer of very limited number of chemicals for the textile finishing, it is very easy, only by applying the regulations, that the requirements of the exporting countries of textile products will be fulfilled.

Since the shortcomings of the raw materials cannot be seen in the procurement process of raw materials or during the warranty period (the harmful components are difficult to notice); it will be necessary to require all the raw materials to be processed before purchasing. Just an eco-sign guarantees to the buyer that the product is environmentally sound. Eco-sign means that the product does not contain harmful substances and that it is not made of fibers made with procedures that are harmful to man and the environment. In Europe, since the beginning of 1960, the adoption of regulations and directives that regulate or prohibit the application of harmful chemicals to the environment are applied. For this purpose, the products bearing the eco-labels should be determined and this can be achieved through: identification of the buyer's requirements for products with a label;

selection of eco-products with which they can break into the markets of the EU countries, the United States and other developed countries; identification of production lines and introduction of eco-label that will bring the greatest profit; products derived from the same raw material by applying similar procedures can at the same time carry an eco-label; getting an eco-label certificate.

In order to export to the EU and to become a member, it will be necessary to strictly respect the requirements of this community, to respect the rules of the game, to import raw materials that meet the standards of the importing country on the final product, as well as to apply procedures, finishing agents and colours that comply with EU regulations. This is not a complex obligation, and considering that the Republic of Macedonia is not a producer of such assets. Also, if already made yarns or fabrics are already finished, they have to be finished in accordance with the standards of the country of delivery for which they should have certified documentation.

The observations indicate that with the global warming, it is expected that in a decade the total quantity of water in the world and in our country will be reduced. As a result of the growing consumption and the more restrictive sources of clean water, prices are increasing and there is a need for saving, recycling and reusing. This can be achieved by selecting automated equipment with possibilities for a computer running the process. Also a critical review of colouring, printing, washing, recycling purposes should be made in order to reduce or replace toxic and dangerous chemical agents with biodegradable ones as well as a selection of methods for purification of wastewater in accordance with the legal provisions.

Waste water can be collected in collectors and purified by physical, chemical, biological and combined methods. When selecting the method, the economic justification should be strictly observed, and for these reasons the most commonly used in textile industry are: coagulation, flocculation, membrane filtration, etc. During the purification, new toxic compounds should not be created.

Origin and characteristics of wastewater from the textile industry

In the textile industry, a lot of water is consumed, and at the same time it is a large water pollutant. There are many processes in the textile industry and most of them are composed of a number of stages each of which is characterized by its pollutants. These waters are usually heavily alkaline, with high BOD values and the content of the suspended solids, and are characterized by high temperatures. The most polluting dirt that is extracted from the fibers and chemicals used in the production processes, as well as waste from the fibers themselves. In the industry, mainly three types of materials are used: cotton, wool and synthetic fibers. Cotton processing involves multiple operations. The raw cotton is combing, purring, wrapping, sticking up and weaving or knitting before sending it to final finish. The above operations, apart from the starch, are mechanical, so that there is no waste water. Following these processes, the starch is removed, followed by wet processes that involve removing the natural impurities from the cotton. Namely, it is welded, white, mercerized, printed and painted. Then there are some finishing processes, which help to increase the resistance to wrinkling, achieve dimensional stability, a certain opacity, hydrophobic ties, etc.

Namely, it is welded, white, mercerized, printed and painted. Then there are some finishing processes, which help to increase the resistance to wrinkling, achieve dimensional stability, a certain opacity, hydrophobic ties, etc. Thus, to make cotton waterproof it is processed with aluminum acetate or formate mixed with dispersed wax. In order to protect it from burning, it is treated with titanium or zirconium salts. The largest amount of waste (65%) is separated during the washing, boiling, dyeing and finishing processes.

When processing wool, waste originates from the processes: cleaning, dyeing, frosting, filling, carbonizing and washing. In fact, all natural impurities are removed by immersing the wool into a hot alkaline detergent. Wools containing large amounts of impurities are cleaned with an organic solvent by extraction, and then the solvent is regenerated by distillation. Colouring is done with a warm colour solution, circulating through the wool, and the lubrication is done by spraying the wool with oil mixed with water. Its quantity is from 1% to 11% relative to the mass of the wool, and the task is to increase cohesion between the fibers and facilitate the spinning. In the final processes of processing the wool, the entire oil is removed. For carbonization, a hot solution of concentrated acid is used in order to transfer the plant material into the wool into free carbonated particles, which are then mechanically removed from the fabric by processing it on special machines. Following these processes, staining,

whitening and stirring are followed in order to achieve certain properties.

When cleaning the wool, as well as the finishing operations, a brown coloured, coloured effluent with a pH value of 9 to 10.5 is obtained, which is characterized by high values of BPK5 (900 mg / L), high content of total waste (3000 mg / L) and contains chromium (4 mg / L). The main source for the increased values of BPK5 are wool grease, which are released during cleaning and soap used for washing. For 1t wool it takes 600t water. The largest amount of BPK5 (75%) comes from washing and filling the hairs, then from the bleaching process (25%), and the smallest amount (1%) is from the neutralization process after carbonization of the wool.

The synthetic fibers from which the fabric is made are composed of pure chemical compounds and do not contain natural impurities like wool and cotton. Therefore, they require slight cleaning and bleaching before their staining. The most commonly used synthetic fibers are: viscose, nylon, cellulose, travare, dacron, orlon, perlon etc. Viscose is obtained from cellulose. The nylon and the perlon are polyamide fibers, and the weed is a polyester fiber which in Macedonia was produced in "Hem " under the name Maklen. The eagle is a polyacrylonitrile fiber, and "Ohis" produces it under the name Malon. The semantics of the treatment of these fibers are mainly derived from the chemicals used in the process of dyeing and cleaning.

HOW TO FACE THE PROBLEM OF TEXTILE INDUSTRY POLLUTION

In 2011 Greenpeace published two reports, one investigating the discharge of hazardous substances from textiles manufacturing in China linked to major clothing and sportswear companies (Dirty Laundry), and another detailing the presence of NPEs, nonylphenol ethoxylates, in clothing and footwear of 15 leading brands (Dirty Laundry 2: Hung Out to Dry). With the publication of these reports Greenpeace challenged global brands to eliminate all releases of hazardous chemicals from their supply chains and products by 2020. The Detox Campaign, as it is now known, targets especially at Chinese manufacturers, nearly 50,000 textile factories. It has been prompting the government to face up to the problem. "China is moving towards legislation where each company is responsible for its wastewater," said Ulrike Kallee. "Awareness is now very high." The man-made chemical by-products of textile industry are shown to have long-term effects on the environment and potentially devastating impacts on human and animal lives. Furthermore, when testing clothing from 15 corporate brands, Greenpeace found out that chemicals used in textile production process continue to be released when contaminated clothing is washed by consumers across the world. These tests demonstrate the truly global danger posed by these toxic chemicals as they are released into rivers and water sources from the point of production to the consumer.

Greenpeace's Detox Campaign helps create a greener economy by challenging major global brands to eliminate hazardous chemicals from their textile production processes. Detox Campaign has already successfully demonstrated the power of grassroots activism and social media in pressuring corporations to clean up their production practices. Only months into the Detox Campaign, major retailers H&M, Puma, Adidas and Nike had committed to eliminate discharges of hazardous chemicals across their supply chains by 2020; most recently, Marks & Spencer has joined the group. In addition to putting corporations under pressure to adopt greener production practices, Greenpeace has been pursueing legislative changes within textile industries in several Asian countries and the European Union in order to protect rivers, communities and ecosystems they support.

POLLUTION MADE BY TEXTILE INDUSTRY IN ITALY

WATER POLLUTION

The globally growing demand for textile has resulted in a growing production of textile mills. Therefore, the pollution has been affecting the globe as never before. Textile industry is one of the major areas that have an importance throughout the world.

Water pollution is the main issue when it comes to textile industry. Textile industry is a voracious consumer of water. Water is used for various processes like sizing, bleaching, dyeing, printing and other finishing processes. As a result the waste water is full of various reminiscent dyes and chemical additives used in the process of dyeing and receiving final qualities.

Chemicals that are used in textile industry cause environmental and health problems. Among the many chemicals that can be found in textile wastewater dyes are considered to be the worst pollutants appearing in the textile procession. Since it drastically decreases oxygen concentration due to the presence of hydrosulphides and blocks the passage of light through the water body it is detrimental to the water ecosystem.

If the pollutants present in textile wastewaters are disposed without proper treatment, they may cause depletion of dissolved oxygen in receiving bodies causing septic conditions and this affects the survival of aquatic life. High TDS, total dissolved solids, present in the wastewater increase the salinity and the high alkalinity increases the pH of receiving water bodies. Colours from dyes are aesthetically objectionable, particularly in recreational waters. In addition to this, certain carrier chemicals used in dyeing, such as phenol may add taste and odours.

Textile industry in general uses millions of gallons of water every day. The problem does not just rest in the high usage; what is more the waste is not treated to remove pollutants from it before it is disposed to water bodies. The waste water usually contains PBDEs, phthalates, organochlorines, lead, and many other chemicals that cause severe health problems and diseases in human beings.

The liquid effluents released by textile industry are the most disturbing area of concern. This is because the toxic material released through liquid waste is vast in quantity. It consists of chemicals such as formaldehyde (HCHO), chlorine, and heavy metals. Besides, it is disposed into water bodies that reach far away areas and is consumed by a high number of people for drinking or for daily activities. It is inevitable to treat the waste waters to reduce their toxic content before being released into water bodies.

SOME SOLUTIONS

The use of organic raw material can help in fighting the emission of pollutants by the textile units. Organic cotton is especially beneficial as the standard production of cotton require maximum amounts of pesticides and fertilizers. Besides, the waste generated from textile manufacturing plants should be processed in a manner that it is free from toxic chemicals before it is disposed. Environment-friendly methods of cultivation and manufacture should be resorted to. The textile waste should be strictly recycled.
However, all these actions should be taken urgently.

ENVIRONMENTAL EFFECTS OF SPECIFIC MATERIALS

Growing cotton: when growing it uses 22.5 percent of all the insecticides used globally. Growing enough cotton for one t-shirt requires 257 gallons of water. It also entails vast amounts of chemical fertilizers and pesticides that pollute and deplete the soil. Despite mechanized harvesting, the cotton industry is still
On top of that, bleaching and then dyeing the resulting fabric creates toxins that are released into the ecosystem.
Wool pollution: both agricultural and craft workers suffer from the exposure to organophosphate sheep dip problem. Getting wool material from fibre to cloth, (bleaching, dyeing, and finishing) uses yet more energy and water, and causes yet more pollution.

Nylon and polyester: artificial fibres made of petrochemicals are non-biodegradable, and so they are inherently unsustainable on two counts. Nylon manufacture creates nitrous oxide, a greenhouse gas 310 times more potent than carbon dioxide. Making polyester uses large amounts of water for cooling, alongside with lubricants which can become a source of contamination. Both processes are also extremely energy-demanding.

Rayon (viscose): artificial fibre, made of wood pulp, which on the face of it seems more sustainable. However, old-growth forests are often cleared to make way for pulpwood plantations. Often the tree planted is eucalyptus, which draws up phenomenal amounts of water potentially causing problems in sensitive regions. To make rayon the wood pulp is treated with hazardous chemicals such as caustic soda and sulphuric acid. The use of rayon for clothing contributes to the rapid depletion of the world's forests.

Chapter III

WORKSHOPS

SCIENCE AND TECHNOLOGY (WORKSHOPS)

MACEDONIA (SOU "ORDE CHOPELA" – PRILEP)

Manufacturing clothes from recycled materials

Students were divided into 6 mixed groups (students from different countries), and they were given instructions. The students were instructed by teachers on how to create posters. On the posters, students were to explain briefly their product, explain which materials and techniques they used, to indicate whether their product is environmentally-friendly and whether it is practical and useful. Furthermore, to give reasons why they should win.

The first group

The name of the model: DARKNESS

Names of the students who created the model: Adela Cerna, Hari Dimeski, Mila Blagoeska, Dimitar Stojcheski, Elisa Bozzi and Lucia Gonzales.

Materials: plastic cups, feathers, plastic foil, tape, gold and black spray, silicon glue, tie, newspapers, and cardboard.

Techniques: hot gluing, spraying, cutting and cello taping.

Description of the product: evening dress suitable for special occasions, "haute couture" look, glamorous and astounding.

Environmentally friendly: (+) reuse of plastic cups and newspapers (reused); (-) too much spraying;

Creative and innovative: combination of using recyclable materials and breath-taking elegance.

Practical and useful: easy to create at home.

Why we should be the winner? Because our dress is the best!

The name of the model: PEACOCK DRESS

Names of the students who created the model: Kristina Petrikova, Ana Marija Mitreska, Angela Jakimoska, Antonio Naumoski, Iria Ventoso and Aurora Farinelli.

Materials: newspapers, trash bag, tape, stapler, feathers, card board and spray.

Techniques: sticking, spraying and stapling.
Description of the product: evening dress.
Environmentally friendly: because it's from recyclable and reusable materials.

Creative and innovative: because it's made of paper, feathers and trash bags. These are interesting materials.

Practical and useful: Yes, because everyone can wear it.

Why we should be the winner? Three reasons why we should be the winners are: the dress is beautiful, everyone can wear it and it's comfortable.

The third group

The name of the model: JT-CASUAL

Names of the students who created the model: Tijana Kasoska, Filip Capl, Naum Apostoloski, Marta Paz, Ljubica Dimkoska, Vanessa Remine.

Materials: a pair of jeans, a lot of old ties, glue, staples, an old CD, tape, a glue gun, scissors and a newspaper.

Techniques: to staple, to cut, to glue, to cello tape, to spray.

Description of the product: casual dress made up of old ties stapled together and ripped jeans glued with the stapled ties.

Environmentally friendly: because it's entirely made of recycled materials that would not be going to be used anymore.

Creative and innovative: because it has never been done before, it's made only of 2 materials: jeans and ties.

Practical and useful: because our product is comfortable to wear. It a kind of casual wear.

Why we should be the winner? Three reasons why we should be the winner are: easy to make, easy to wear, original and unique.

The fourth group

The name of the model: SPACE DRESS

Names of the students who created the model: Angela Petroska, Alessia Paesani, Alejandro Fernandez, Vaclav Novak and David Damjanoski.

Materials: newspapers, baking paper, ties, soft cardboard, tape, plastic wrap, bubble wrap, spray paint and glue.

Techniques: cutting, spray painting, taping, crumbling paper, stapling, folding paper and glueing.

Description of the product: 2 in 1, day and night and special events.

Environmentally friendly: because it's made t of recycled materials.

Creative and innovative: the bubble wrap part of the dress is removable.

Practical and useful: emphasizes the body curves

Why should we be the winners? Because our final poster is different from the others and we used combinations of many different techniques that the other groups didn't use.

The fifth group

The name of the model: TRASH FASHION

Names of the students who created the model: Nicoleta Tatiana Stan, Mihaela Gjurchinoska, Hristijan Durljanov, Hugo Cortes and Josef Urban.

Materials: ties, rubbish plastic bags, silver spray, stick paper, tape and hot glue.

Techniques: cutting, spray colouring, taping, stapling and glueing.

Description of the product: upper part (hoodie made of plastic black bags and so are the shorts), ties re-used for details...

Environmentally friendly: because this material wouldn't be used and so we recycled them...

Creative and innovative: it's cheap and easy to make.

Practical and useful: it's comfortable, it's waterproof.

Why should we be the winners? We are the only group presenting a male outfit, we look good and even with the language barrier we finished our project.

The sixth group

The name of the model: EVENING DRESS

Names of the students who created the model: Valentin Ilioski, Arianna Dambrosio, Johana Bartonova, Eva Tumanovska and Uxia García.
Materials: newspaper, bubble foil, spray, cooking foil, tie, tape, peacock feathers, glue, transparent foil, cardboard and stapler.

Techniques and description of the product: we wrapped the mannequin with the cooking foil and a layer of newspapers, fixed the layers with tape, painted the cooking foil with spray. After that we arranged the outer skirt layers and fixed them with the stapler. The tie bound round the waist, fixed by staplers is to cover the seams. Finally, we finalised the whole outfit with fixing peacock feathers to the bottom of the dress.

Environmentally friendly: we were very creative because we used a lot of recyclable materials.

Creative and innovative: It's an evening dress, you can wear it on special occasions and everyone will look at you because you will look amazing!

Practical and useful: the dress is cheap and original.

Why should we be the winners? It's original, we used a lot of recyclable materials and we used peacock feathers.


IMEC
PRILEP

Dying Fabrics with Natural and Syntetic Dyes Workshop

Workshop "Dying textile "
02/11/2017
Dividing the students into groups
(18 students are divided into 3 groups)
Making an initial survey

Workshop
Making the final survey
Each participant stamps oneś own " characteristic mark" on the to-be-originated textile poster.

Group I

(1)Pour 3 litres of tap water into a pot, a teaspoon of red synthetic colour, half a teaspoon of salt (NaCl)and heat the ingredients to the temperature of 40 oC. Then put the textile in the pot (cotton shirt, woolen thread, polyamide socks), and continue to heat with constant stirring for 5 more minutes until it boils. Add 10 ml of vinegar (CH3COOH 5%) and continue to heat it for 5 more minutes. Then wash the fabrics with a detergent and dry them using a hairdryer.

soak the fabrics inside (cotton, woolen thread, and polyamide socks) for 5minutes. Replace the fabrics into a 500 ml beaker where peels of onions have already been soaked. Heat it for 10 minutes until it boils with a constant stir. Then wash the fabrics with a detergent and dry them using a hairdryer.

(3)Cut a lemon into halves, cover the cuts with an acrylic colour and make several prints of it on the cotton shirt. (Put foil on the front and the back side of the shirt)

(4)Cut a potato into halves. Using a knife carve a shape of your choice, cover it with an acrylic colour and make several prints of it on the cotton shirt.

(5)Make a paper pattern, lay it over polyamide fabric and spray the fabric.

Group II

(1)Pour 3 litres of tap water into a pot, add a teaspoon of yellow synthetic colour, half a teaspoon of salt (NaCl) and heat all the ingredients to the temperature of 40 0C. Then put the textile in the pot (cotton shirt, woolen thread, polyamide socks), and continue to heat with constant stirring for 5 more minutes until it boils. Add 10 ml of vinegar (CH3COOH = 5%) and continue to heat it for extra 5 minutes. Then wash the fabrics with a detergent and dry them using a hairdryer.

(2)Pour 20 ml of vinegar (5%) In a beaker and soak the fabrics inside (cotton, woolen thread, and polyamide socks) for 5 minutes. Replace the fabrics into a 500 ml beaker where walnut leaves have already been soaked. Heat it for 10 minutes until it boils with a constant stir. Then wash the fabrics with a detergent and dry them using a hairdryer.

(3)Cut a lemon into halves, colour it with an acrylic colour and make several prints of it on the cotton shirt. (Put foil on the front and the back side of the shirt)

(4)Cut a potato into halves. Use a knife to carve a shape of your choice, colour it with an acrylic colour and make several prints of it on the cotton shirt.

(5)Make a paper pattern, lay it over a polyamide fabric and spray the fabric.

Group III

(1)Pour 3 litres of tap water into a pot, add a teaspoon of blue synthetic colour, half a teaspoon of salt (NaCl) and heat the ingredients to the temperature of 40 0C. Then put the textile in the pot (cotton shirt, woolen thread, polyamide socks), and continue to heat with constant stirring for 5 more minutes until it boils. Add 10 ml of vinegar (CH3COOH = 5%) and continue to heat it for 5 more minutes. Then wash the fabrics with a detergent and dry them using a hairdryer.

(2)Pour 20 ml of vinegar (5%) in a beaker and soak the fabrics inside (cotton, woolen thread, and polyamide socks) for 5 minutes. Replace the fabrics into a 500 ml beaker and add a teaspoon of curcuma powder. Heat it for 10 minutes with a constant stir until it boils. Then wash the fabrics with a detergent and dry them using a hairdryer.

(3)Cut a lemon into halves, cover it with an acrylic colour and make several prints of it on the cotton shirt. (Put foil on the front and the back side of the shirt)

(4)Cut a potato into halves. Use a knife to carve a shape of your choice, colour it with an acrylic colour and make several prints of it on the cotton shirt.

(5)Make a paper pattern, lay it over a polyamide fabric and spray the fabric.

SPAIN (CHAMBRÉ, DAVID BUJAN SCHOOL)

Sewn Circuits Workshop

Phases

1. Dividing the students into groups
2. Activity Introduction
3. Group Work
4. Product Presentation

Materials

- Conductive tape
- Conductive thread

TIP: This is just like an ordinary thread but it has a metal wound-in conductive thread which acts like a wire. Electricity will go anywhere where two pieces touch.

- Needle nose pliers
- Round nose pliers
- Sew on battery holder
- Coin cell batteries
- LEDs

TIP: Unlike an incandescent bulb, LEDs have coin cell batteries. They have a positive and negative orientation. When you attach them to the battery the positive leg needs to touch the positive side of the battery, and vice versa.

General Materials

- Fabric glue (optional)
- Stuffing
- Needles
- Thread
- Pincushion
- Scissors
- Buttons
- Felt
- Sharpies and pens

Procedure

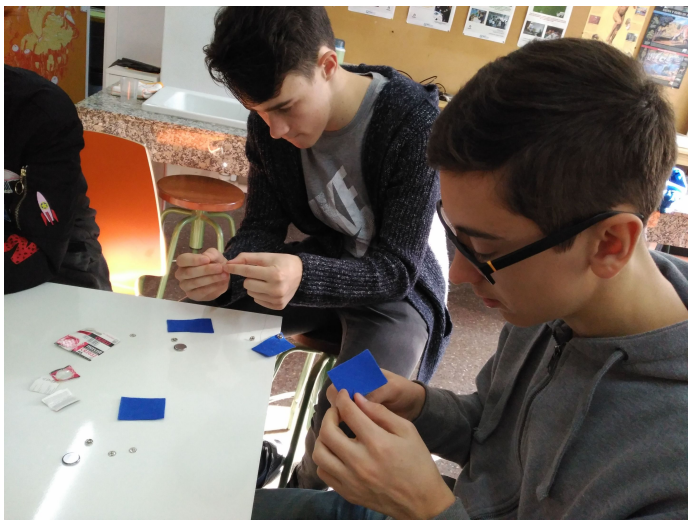
1. Layout the circuit on your piece of fabric. Think about where you want to place your battery holder and your LED.
2. Prep your LED to make it a sewable component. Test your LED by placing one leg on either side of the coin cell battery. You might notice that the LED works when oriented one way on the battery but not the other one. When lit, mark the leg that is touching the positive (smooth) side of the battery with a sharpie.
3. You can make the LED sewable by using jewelry pliers to curl it into a circle. Pinch the end of the LED leg in the pliers. Turn the pliers away from you to begin curling the leg. Before you loop around both tips of the pliers, pause, open the pliers and rotate them back, then repeat the first two steps. Continue turning until you reach the LED. Now, set aside your LED and grab your needle and conductive thread.
4. Sew one side of the battery holder onto the fabric. Make sure your needle is small enough to fit through the hole in the battery holder. Once one side is in place, sew away from the battery pack towards the place where you want to connect one leg of your LED.
5. When you've stitched to the place where your LED will go, grab your prepped LED to sew it on. If you started by sewing on the negative side of the battery pack, you'll want to sew on the negative leg of the LED (and vice versa). Loop the thread around the LED leg several times to secure it (just like you did with the battery pack). Tie a knot and snip off the excess thread. Set aside your LED for now and grab your needle and conductive thread.

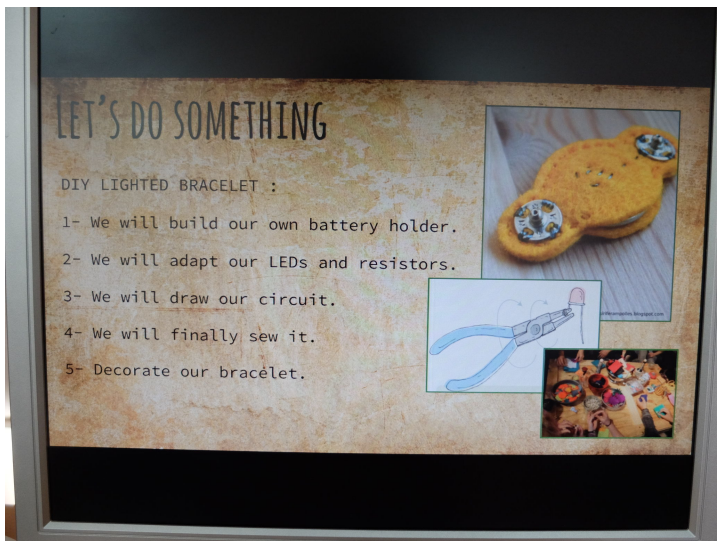
Now that you have half your circuit complete, it's a good opportunity to test it out before you sew the rest. Use another piece of thread to connect the opposite leg of LED to the other side of the battery pack. If it works you're good to go! If not, here are a couple things to check:

• Is your LED oriented the right way?

• Is there a short circuit somewhere? It's easier for the electricity to go through the thread than the LED. If a piece of thread is accidentally crossing both lines of thread the light will not light. Sometimes this happens on the back of the piece and you can't see it on the front.

6. Complete your circuit by sewing the opposite side of the battery pack to the other leg of the LED.





Nanotechnology Workshop

Materials

- **Neodymium magnets**
- **White glue**
- **Sodium tetraborate decahydrate**
- **Coloring agent**
- **Silly putty**
- **Iron powder**
- **Staples**
- **Clips**

Procedure

1. Phagocytosis protocol

a) Knead the silly putty to make a ball and place it on a flat surface like a table

b) Carefully place the neodymium magnet in contact with the putty and wait 5 minutes

c) Observe how the silly putty slowly phagocytes the magnet

2. Magnetization protocol

a) Spread a few clips and staples on the table

b) Place the silly putty close to them. Nothing happens. The silly putty is not magnetic

c) Place the magnet in contact with one side of the silly putty for a short period of time to avoid phagocytosis

d) Pull the magnet apart and bring the clips and staples close to the magnetized area of the silly putty

3. Bouncing protocol

a) We are going to compare the properties of regular plasticine and silly putty

b) Make two balls the same size. One of plasticine and another of silly putty

c) Drop both balls and observe their different behavior. The one made of silly putty bounces while other does not

HOW TO REVEAL SUBATOMIC PARTICLES AT HOME

Materials

- A jar
- A sponge
- Rubbing alcohol
- A flashlight
- A black marker
- Some dry ice
- A subatomic particle (There are plenty of them shooting all around us and through us)

Procedure

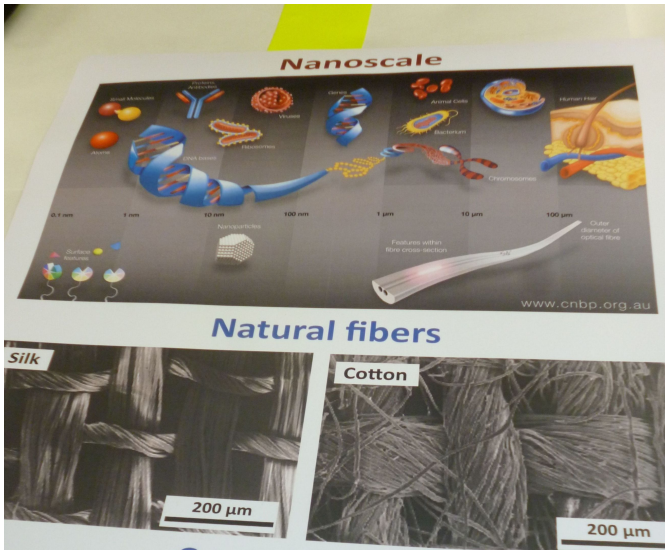
1. Stuff the sponge in the bottom of the jar
2. Pour some rubbing alcohol on the sponge
3. Color the inside of the lid black using the marker
4. Place the lid on the jar
5. Pour out a pile of dry ice
6. Place the jar upside-down on the dry ice
7. Wait several minutes for the lid to cool down
8. Shine the flashlight over the lid
9. Turn off all other lights and look closely for a line of small droplets to appear

These lines consist of a cloud of droplets formed when muons or electrons from the cosmic shower shoot through the supersaturated vapor of alcohol, disturbing it enough to cause the vapor to condense into a cloud of liquid droplets. Every line you see in the jar comes from a different subatomic particle.

THERMOCHROMIC BABY UNDERWEAR

Thermochromic materials change color due to a change in temperature. Baby underwear is one of the multiple applications of this property in the textile industry.

1. Get a thermochromic product https://rapife.com/en/5_termocromico
2. The drawings are silkscreened using thermochromic pigments
3. When the baby's temperature is below 38°C, the drawings are visible
4. If the baby increases its temperature above 38°C the drawings disappear warning that the child has a fever



ITALY (JESI – IIS "GALILEI")

Microscopic Analysis of Textile Fibres - workshop I

Phases

1. Dividing students into groups
2. Activity introduction
3. Group work
4. Product presentation

Objective:
Identify different textile fibres based on their appearance in an optical microscope

Test duration:
2-4 hrs

Materials:

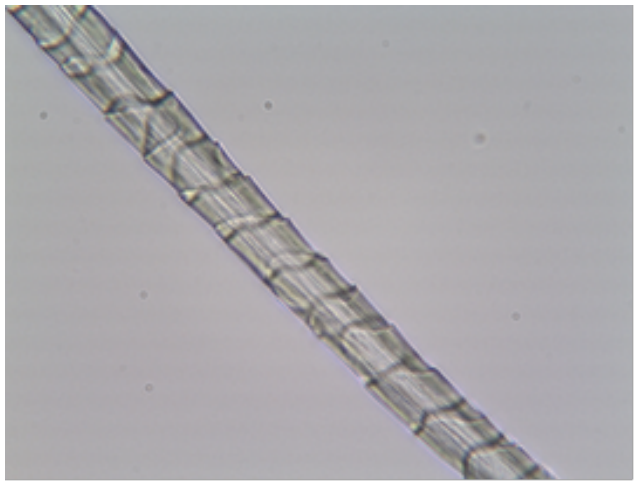
- squeeze bottle
- water
- storage slides
- coverslip covers
- optical microscope
- tweezers
- fibers of wool, silk, cotton, nylon, jute, linen

Procedures:

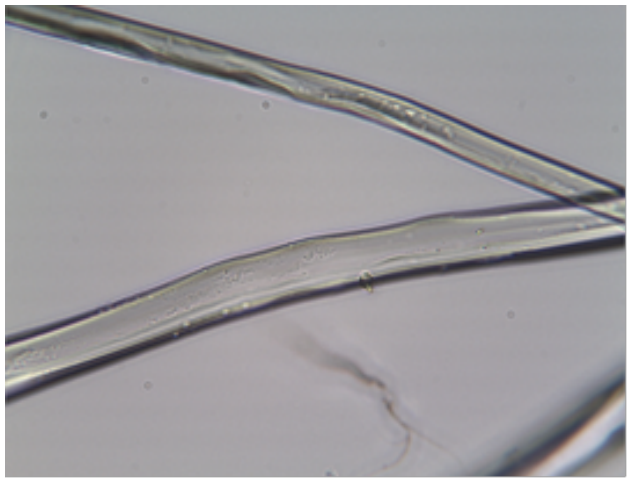
- shred a fabric sample with scalpels and tweezers in order to obtain a few isolated fibres.
- a thread from the particular fabric is placed on the glove compartment
- it gets wet with water
- it is covered with a coverslip
- the slide is placed under the microscope
- focused on 10x
- the first observation is zoomed 25 times
- the second is zoomed 40 times; the observation is carried out to pick up details

NYLON: thin fibres with regular contours and dense dots

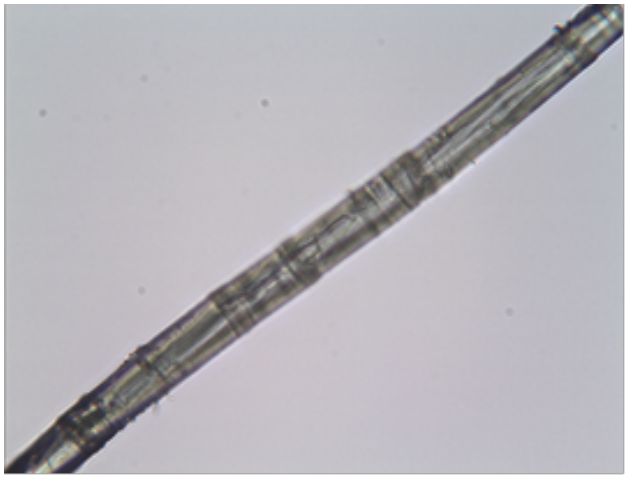
DATA COLLECTION



WOOL: fibres with the presence of superficial flakes

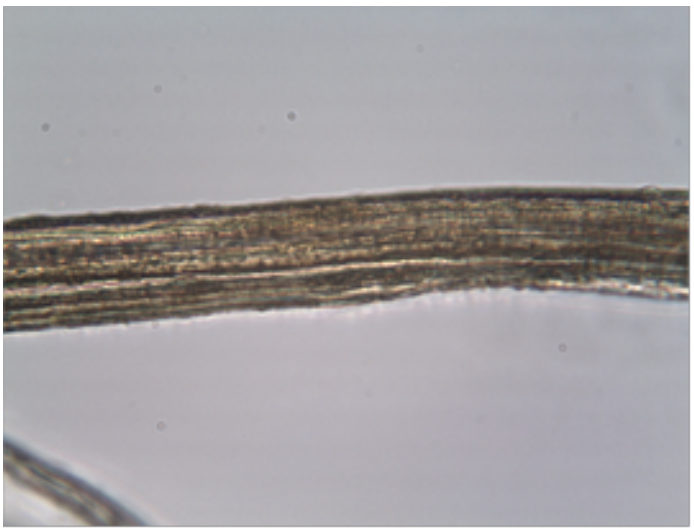


SILK: very thin fibres with regular contours



LINEN: fibres with regular contours and marked transversal striations

COTTON: fibres with smooth contours, with frequent



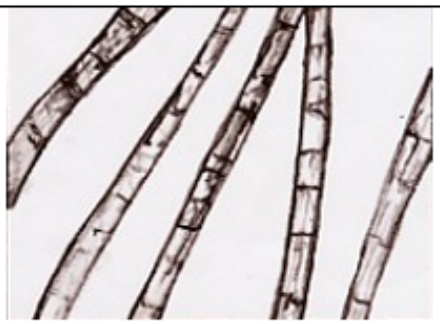
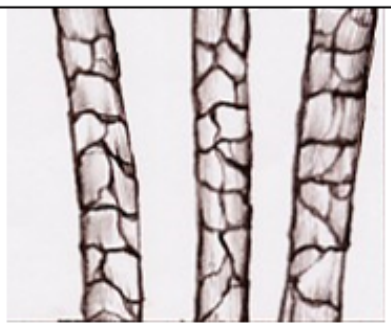
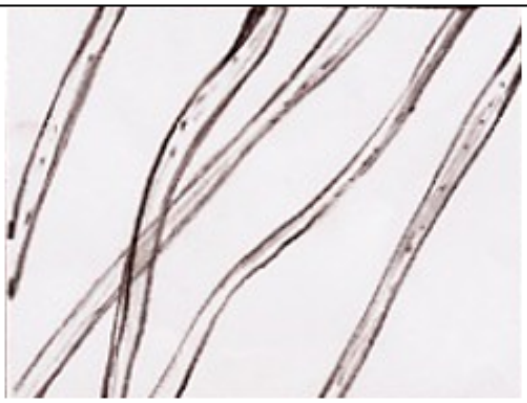
JUTA: fibres with little regular contours and some transversal striations

CONCLUSIONS

Each fibre is characterized by a particular aspect that allows it to be distinguished from the others by microscopic analysis. Wool is the most easily recognizable fibre due to the presence of flakes which are flat and partially overlapped and all oriented towards the tip of the fibre. Nylon synthetic fibre of polyamide nature differs from silk, natural protein fibres due to its thickness and the presence of spots.
The natural vegetable fiber cotton is distinguished from the others by the frequent windings and by the not always visible presence of the lumen (central channel that occupies the space of the cell nucleus). Finally, jute and linen very similar fibers differ mainly due to the quantity of transversal striations that correspond to the point of contact between a tubular cell and the other of the phloem.

MORPHOLOGY OF FIBRES

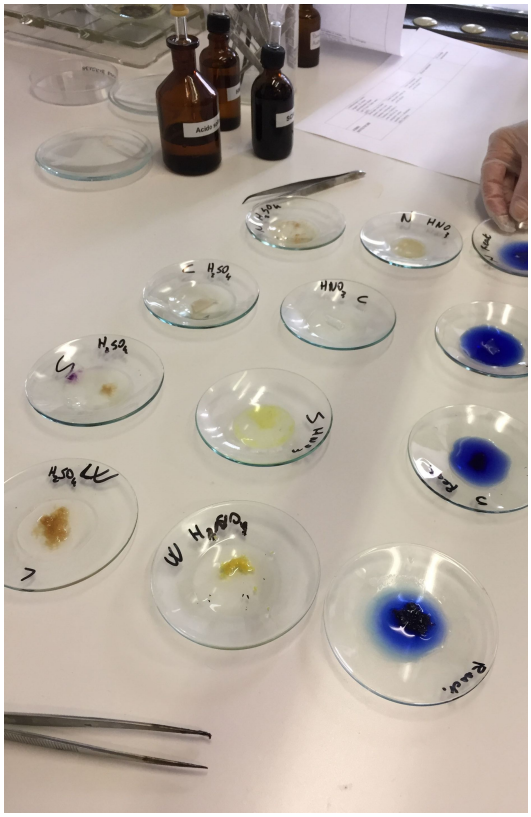
Here below there is The following fibre descriptions of the main features, the chemistry formula of their structure and graphic representation of their longitudinal and cross section, so as they appear through the microscope help to specify the type; during the combustion all the organic compounds produce H2O and CO2 (water and carbon dioxide). Use formula is that one of the component plus NCO2 + Y/2 H2O

Description of the features	Longitudinal section	Cross section
COTTON Fibre made in cellulose from the cotton plant seed with a lumen (cavity inside a cell). Formula: unit of glucose **-(C_6 H_{10} O_5) π** 2 units of glucose make a cellobiose monomer.		
LINEN Fibre made in cellulose from the stem of the linen plant Formula: unit of glucose **-(C_6 H_{10} O_5) π** 2 units of glucose make a cellobiose monomer.		
WOOL Fibre made in keratin from the shearing of goats, sheep and camels. Formula: **-(C_{42} H_{157} O_{15} N_5 S) π**		
SILK Fibre made in fibroin from silkworm **-(C_{24} H_{36} O_8 N_8) π**		

Microscopic Analysis of Textile Fibres - workshop II

Phases

1. **Dividing the students into groups**
2. **Activity introduction**
3. **Group work**
4. **Product presentation**



Objective:

Identify different textile fibres based on their chemical reaction

Test duration:
4 h

Materials:

- **squeeze bottle**
- **water**
- **H2SO4**
- **Different fibres: wool, silk, cotton, synthetics**
- **Schweitzer's reagent**
- **HNO3**
- **NaOH 10%**
- **Bunsen**

CONCLUSIONS:

It is possible to identify different kinds of fibres based on their reactions with heat, acids and other substances. Each reaction is based on the fibre chemical composition.

	FLAME'S BEHAVIOUR	H2SO4	HNO3	NaOH 10% (let it boil for approx. 30 ')	SCHWEITZER's reagent
Wool	It burns slowly with a slight crackle. The combustion ceases as soon as you move away from the flame. It doesn't emit fumes but gives off the smell of burnt hair. The residue is voluminous, porous, carbonaceous, fragile and it easily shatters dirtying the fingers (very fine black powder)	It doesn't melt	It affects the fiber even if it is cold, coloring it first in yellow	It melts when it's hot and if you add some drops of blue lead acetate to the boiling beaker	It doesn't melt but it gets colored
Silk	It burns slowly with a distinguishing smell of burnt flesh (less intense than the wool)	H2SO4 conc. melts. Medium concentration ripples (all animal fibers, except wool, dissolve in 1-2 hours)	It melts completely in a few minutes and it turns yellow and slowly melts forming a yellow solution	It melts when it's hot and if you add a few drops of lead acetate to the boiling beaker	It melts
Cotton	Approached to the flame it burns easily. The flame is sustained and there is no emission of fumes. The smell is similar to paper because it burns cellulose. The residue at the end of the combustion is scarce, light, of generally light color (for the linen the fumes are yellow)	It carbonates completely and faster than animal fibers	It doesn't melt, and it doesn't get colored	It's more resistant to the attack	
Synthetic fibers	It burns with thick and acrid smoke and with greenish flame. They tend to melt, and they are hard to turn off even when you move away from the flame	They are easily attacked even by diluted acids	They are easily attacked even by diluted acids	It remains unaffected	It melts quickly

CZECH REPUBLIC
(GYMNÁZIUM, ČESKÁ 64 –ČESKÉ BUDĚJOVICE)

Physical Materials Properties – workshop I

Phases
1. Dividing the students into groups
2. Activity introduction
3. Group work
4. Product presentation

Objective:
Identify different textile fibres based on their chemical reaction
Test duration:
4 h

Materials:
- squeeze bottle
- water
- H_2SO_4
- Different fibres: wool, silk, cotton, synthetics
- Schweitzer's reagent
- HNO3
- NaOH 10%
- Bunsen

CONCLUSIONS

It is possible to identify different kinds of fibres based on their reactions with heat, acids and other substances. Each reaction is based on the fibre chemical composition.

Physical Materials Properties – workshop I
• Dividing the students into 3 groups (15 mins)
•Survey - (15 mins)
•Workshop-(60 mins)
•Survey - (15 mins)
Tasks – group A
1)Worksheet A1-material gentleness

Study the gentleness and smoothness of 3 various materials by measuring their area weights.
Measure the sizes of particular samples by the mean of a ruler and then state their weight by the mean of digital scales. Calculate the area weight as the weight per 1cm2.

2)Worksheet A2-artificial fibres
Decide which of the artificial materials is the most suitable for the production of artificial fibres. Heat particular samples in small aluminium foil bowls and then try to create the longest fibre by the mean of a wooden pick. Record your observations in a table and deduct which material is the most suitable one.

Tasks– group B
1)Worksheet B1-hydrophobic properties
Study hydrophobic properties of different materials and write down the purposes the particular materials are used for. Drop three different liquids on the particular samples and after 30sec describe the size and the shape of the drop (make a sketch). According to the size decide the absorption quality of every single material (good, poor, no).
2)Worksheet B2-hair thickness
Measure the thickness of your hair by the mean of laser.

Based on the light defraction on small obstacles you can measure the width of the obstacle, which in this case is your hair. Spot the hair with laser and observe the light track on the shade.

Measure the distance of the interferrence maxima and calculate the thickness of your hair. Compare the thickness os the hair and different material fibres.

Tasks– group C
1)Worksheet C1-absorbing power
Measure absorbing power of given materials. First measure the weight of the material before the measurement. Then, soak the sample in water and leave it soaked for 1 min.
After that take it out and leave it drop off for 2minutes and measure the weight again not having squeezed it. Use the gained data to state the percentage of absorbing power of the materials proven

2)Worksheet C2-nanospider technology
Make a fibre thinner than a hair by he means of a special method „nanospider", which was patented in the Czech Republic. The technology was invented by prof.Jirsak at the Textile University of Liberec in 2003.
Making the experiment follow this scheme: Wimhurst induction electricity, solution, lantern, a sheet of black sturdy paper. Generation of electric power implies making a thin layer of the solution on the sturdy paper.
Observe the proces of its origination and draw a sketch of the originated phenomenon. Deduct the differences in the properties of the sturdy paper surface without nanopolymers and with nanopolymers.

Worksheet A1

Material gentleness

The properties of area textiles depend on the properties of length textiles (fibre, thread, yarn) and on the structure of the area textile. To be able to define the area weight (gentleness of the area weight) we have to measure the length, width and weight of the textile. Textile gentleness corresponds with the ratio of its weight per an area unit. Gentleness of area textiles is given by the g·m-2 unit.

Task:

Define the area weight of each particular textile sample.

Tools:

Various samples, a meter, scales

Procedure:

Measure the sizes of the samples

Measure the weights of the particular samples

Calculate the area (S) of the samples

Calculate the gentleness of the area textile _s

Physical properties:

Calculation of area textile gentleness:

$$\rho_s = \frac{m}{S}$$

Summary:

The area textile gentleness of the samples is:

1) .....

2) .....

3) .....

Table:

samples	width m	length m	weight g	area m^2	**gentleness** g/m^2
Sample 1:					
Sample 2:					
Sample 3:					

Worksheet B1

Hydrophoby

It is the material property not to create any bonds with water. The test of hydrophoby is made by dropping water on a horizontal surface and observing the reactions of the drop on the textile.

Task: Fill in the scale of drop reaction assessment, define the hydrophoby of area textiles and followingly compare the observed differences.

Tools: textile samples, a dropper, water, a bowl, cloth

Procedure:

1) Prepare a pot of water, a dropper and the samples

2) Fill in the names of the textile samples in the table

3) Fill the dropper with water and wipe carefully all rests of water on the surface of the dropper

4) Drop water carefully on each of the samples, from the height of approximately 1 cm from the sample

5) Observe the reactions on the samples for 30seconds and record the results in the table. Use this scale for the assessment:

Grade 1	The drop does not suck well, the shape is oblong, the contact area is very small
Grade 2	The drop is still oblong but the contact area is quite large
Grade 3	The drop is sucked in more or less in more than 5 seconds
Grade 4	The drop is immediately sucked in completely

6)Repeat the process for all other testing liquids.

7)Fill the results of you observation in the table.

Table:

samples		Grade of hydrophoby
Sample 1:		
Sample 2:		
Sample 3:		

Summary:

Which of the materials is the most/least hydrophobic?

Worksheet C1
Absorbing power
To detect the amount of water in the fibre we have to know the weight of the dry fibre (m1) and the weight of the damp fibre (m2). The amount of water is calculated as the difference of the weight of the dry fibre and the weight of the damp fibre rated to the weight of the damp fibre. The amount of water is given in percentage.
Task: Determine the absorbing power (the amount of absorbed water) of the particular sample.
Tools: textile samples, a pot for water, scales

Procedure:
Weigh the dry sample
Soak the sample in cold water (cca 20 ° C) for 1 minute
Take the sample out and leave it drip off for 2 minutes
Weigh the damp sample
Calculate the absorbing power N
Repeat the procedure for each

Properties:
For the absorbing power:

$$N = \frac{m_2 - m_1}{m_1}$$

Table:

	m_1 *g*	m_2 *g*	m_2-m_1 *g*	Absorbing power N %
Sample1:				
Sample 2:				
Sample 3:				

Calculations:

Summary:

Which of the samples has got the least absorbing power?

Worksheet B2

Thickness of a hair

The human hair is very thin and you cannot measure it by the mean of ordinary meters, such as a ruler. Even if we measured it by the mean of more expensive meters, the precision would be very small. The only method we can use is the method of difraction of a coherent monochromatic radiation beam (laser).

Task: Measure the radiant of your hair

Tools: laser pointer, a meter, a hair, a shade made of a sheet of graph paper, calculator, sellotape

Procedure:

Prepare a hair and fix it in front of the laser

Target the laser beam at the hair and set the shade in such a position to be able to watch the interferrence pattern (light and dark stripes)

Measure the needed parametres and calculate the radius of the hair by the means of the aforementioned property

If the light waving falls on the hair whose width is comparable with the wavelength of light then the light difraction happens. Coherent light waves begin to interfere and you can see a pattern of dark and light stripes (light maxima and minima) on the shade behind. You will use the following property to calculate the values.

$$hair\ diameter\ = \frac{2d\lambda}{s} \cdot 10^{-6}[mm]$$

of the same order (the middle of the two first dark points on the shade) in millimetres, d is the distance of the fibre from the shade in millimetres and wavethlenght of the used lifgt is = 532 nm.

Lasser wavelength λ [nm]	Distance of the hair from the shade d [mm]	Distance of the first minima s [mm]	**Hair diametre** [mm]

Summary:

Did you manage to define the thickness of your hair? How many nanofibres of the diametre of 500 nm would you have to lay alongside to be of the same thickness as your hair? (1 µm=1000 nm).

How many times is a nanofibre thinner than your hair?

Worksheet C1
Artificial fibres

Artificial fibres are man-made materials which can be formed. Majority of them are polymers (they consist of a large number of molecule groups which are bound). The biggest advantage is the fact that the production of these materials is easy and cheap. This is the reason we can find them used anywhere, not only in textile industry but even in construction industry, in food and drink packagings as well as in automotive industry.

This all owes to the field of physics - the physics of polymers.

Task: Which plastic is the most suitable for making clothes?

Tools: a PET bottle, a plastic bowl made of low-density polyethylene (LDPE), a bag of high-density polyethylene (HDPE), aluminium foil, a wooden pick, a cooker

Procedure:

1)Make 3 bowls from aluminium foil.

2)Cut different kinds of plastic into smaller pieces (1cmx1cm) and put them into the bowls.

3)Place the bowls onto the cooker and heat them until the plastic melts.

4)Dip one end of the pick into the melting polymer and moving the pick slowly out create a plastic fibre. Beware! The fibre can be very hot after having taken it out, therefore leave it to cool down on the counter.

5)Record the results of your observation in the table.

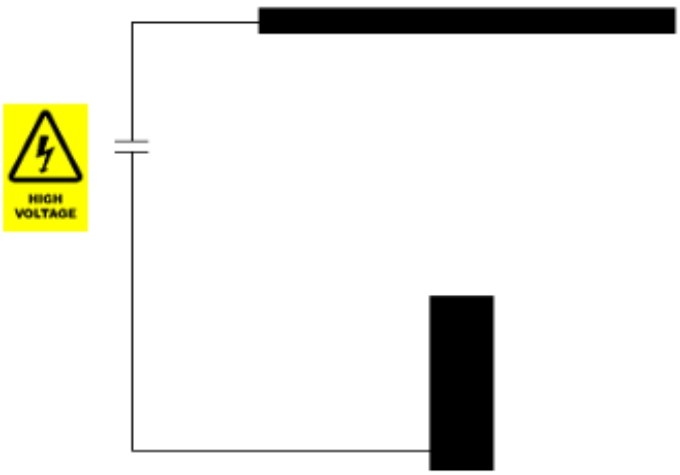
Kind of plastic	Did you manage to make it into fibre?	Is the elasticity of the fibre good or poor?	A suitable fibre for textile production?
Bowl LDPE			
Bag HDPE			
Bottle PET			

Summary:

Which plastic would you recommend for textile production from artificial fibres? Reason your decision.

Task C2
Technology nanospider
The Technical University of Liberec got famous thanks to the patent of prof. Jirsák. It is the method of electrostatic fibrillization from wet surface. This method enabled the industrial production of nanofibre layers on ordinary textiles which led to significant improvement of ordinary textiles properties. The principle of these extraordinary fibres is ingenially simple. Letś start its exploration!
Task: Create your own nanofibre
Tools: Wimshurst induction electricity, 10 % solution of PVA (polyvinylalkohol), a glass rod, black sturdy paper, a lantern, copper conductors, a stand with electrodes

1)Insert a strip of the sturdy paper under the top electrode. Apply one drop of 10 % solution of PVA by the mean of the glass rod on the bottom electrode.
2)Spin the handle of Wimshurst induction electricity in the direction indicated by the arrow while lighting up the space between the electrodes. Beware! Do not touch the metal part of the equipment. You would suffer a small shock!
3)Observe the polymer drop, the weir of nanofibres even the small cones which creat on the drop.
4)After carrying out the experiment remove the rest of PVA from the bottom electrode. You can také the samle of nanofibres you produced.

Sketch the process of the fibre generation which you observed.


Závěr:

Touch the nanofibre layer. What happens having touched it? Can you explain the phenomenon? Why does it happen?

The nanofibre layer contains very small pores. There is such a quote: the smaller the spaces in a net the smaller fish you catch. Could you deduce the practical use of nanofibre layers textiles?

Workshop II - Smart safety features

Instructions

- Dividing students into groups of six (10 mins)
- Introducing into the issue (15 mins)
- Practical activity-part 1 (90mins)
- Break (15mins)
- Practical activity -part2 (45 mins)
- Products presentations (40 mins)

Tools and items for the use

- recyclable apparels
- LED diods
- batteries
- silver thread
- solar cells
- velcro
- magnets
- sewing kits

Manual for each group

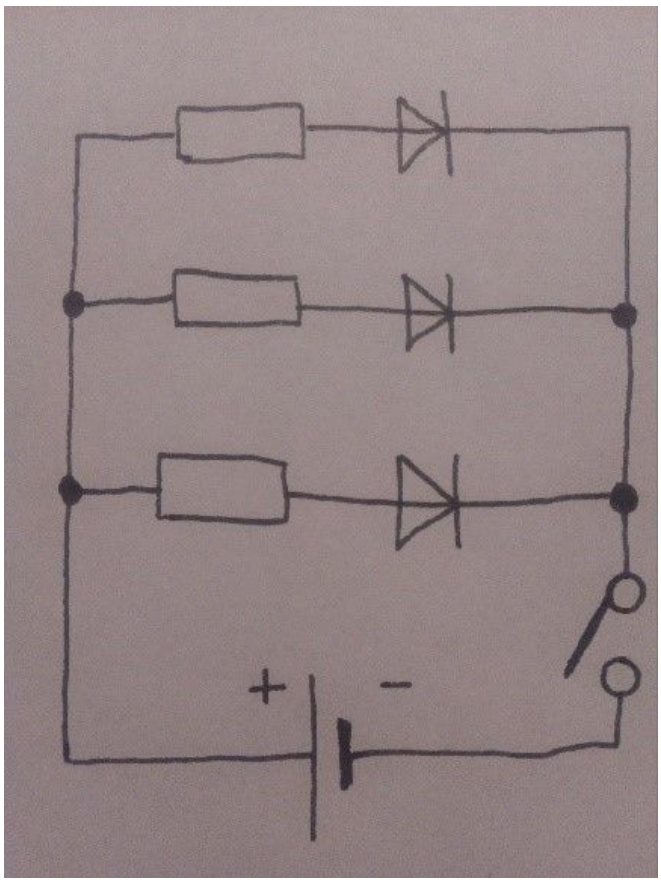
1) Make up a design of a smart safety feature by the means of the below mentioned materials and tools
2) Produce the designed safety feature
3) Prepare a presentation on your product
   materials used
   procedures
   exclusivity of your product
   purpose of the product

Safety features production instructions:

Tools: scissors, diods, silver thread,... 	Penetrate the cloth with the sharp ends of the diod. 	Bend the ends of the diods and connect them with the terminal parts of the resistor, whose outputs are bent as the picture shows. 
Fix one diod terminal to the diod and the cloth. 	Repeat this procedure as many times as needed for more diods and resistors. 	The contacts of diods on one side and contacts of resistors on the other side are sewn together by a thread. See the view of the opposite side with the sewn up welt. 
The thread which is supposed to be joined to the battery must be connected to the opposite part of the welt. Its end must be fixed to the batery. 	Cut out such a shape of the cloth to be slightly bigger than the battery itself so as it could cover the whole battery to be sewn over. 	Stitch the battery on three sides, solder the thread to the welt and finally sew the last part of the cloth to cover the batery wholely. 

The final product:

The connection scheme:

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Workshop III – Denim Art Work

Denim Art Work
Motto: Reuse, renew, recycle

Task: Create a denim collage presenting a significant landmark of your city/country.

Tools and materials:
1) Recycable denim apparels of different colour shades
2) Polystyrene boards
3) Scissors, blades or knives, sheets of paper, pencils, glue, different contoure colours to highlight the shapes
4) Acrylic colours, painting kits

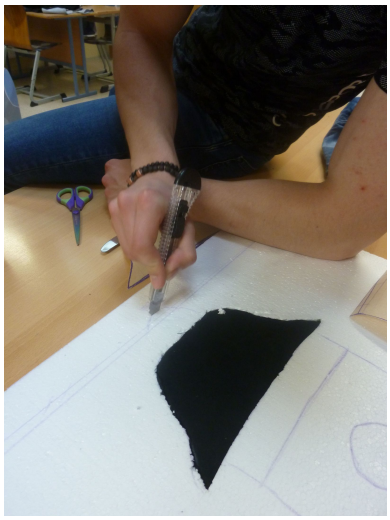
Instructions:
1) Divide students into groups of 6-8 people who create various designs and choose the one to be made

2) Cut out each particular part of the paper design

3) Copy all the shapes on denim fabric

4) Add 50-70 mm to the shapes on each side and cut them out

5) Copy the design on a polystyrene board and cut the particular parts of it by the means of
a blade into the depth of 3 mm



6) Put the cut-out denim parts of the design on the copy on the board

7) Press in the added pieces into the cut-in lines by the means of knives

8) Finally paint the background of the originated denim landmark with acrylic colours and highlight its contours

9) Prepare a presentation of your work

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