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FUNCTIONALITY AND SUSTAINABILITY OF PEAT FIBER - BASED TEXTILE

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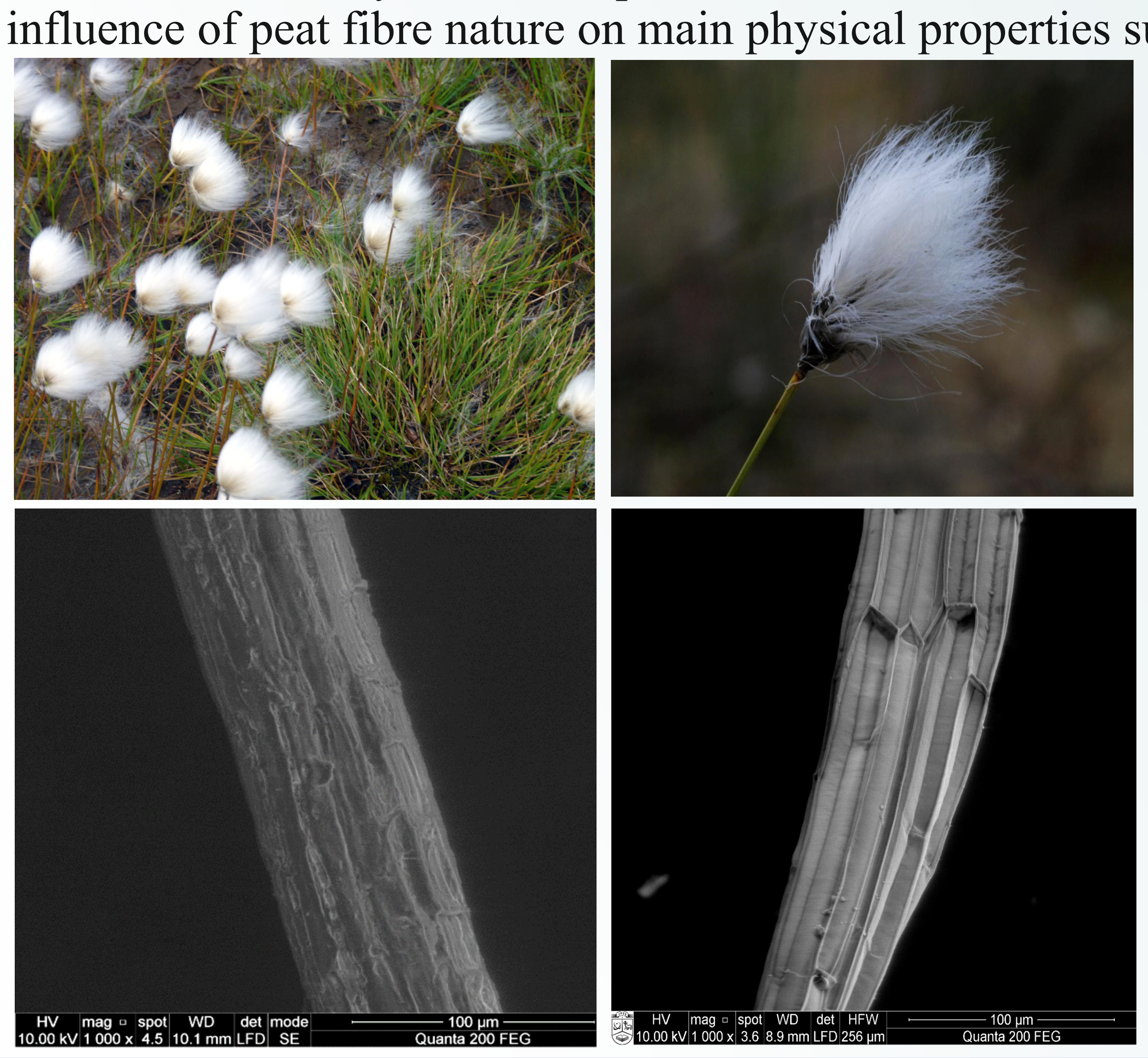
INTRODUCTION

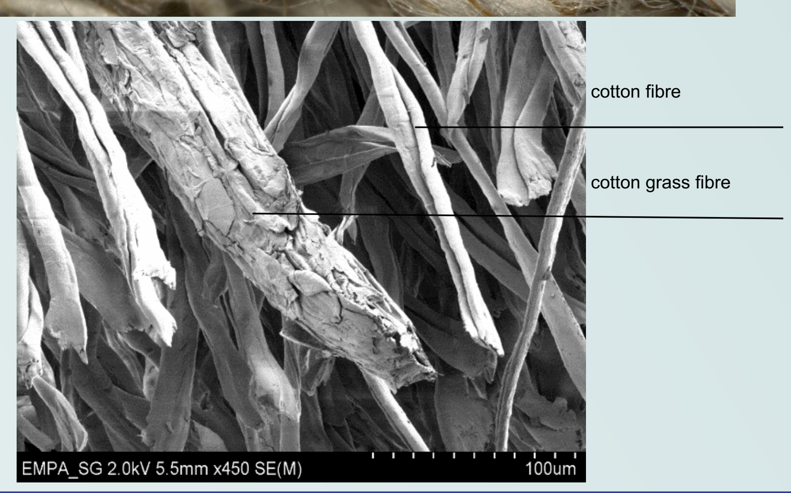
Nowadays textile industry has undergone considerable changes because of growing requirements of consumers for more specified and sophisticated products. In the first place came natural fibers, which are characterized by their exceptional ecological properties. Special attention is paid for natural cellulose based fibres. Natural cellulose fibres are recognizable as being from a part of the original plant. Thus the natural cellulose-based peat fibres have now been gradually accepted by textile industry as an alternative to cotton or linen fibres. Peat fibre is constituent of sheathed cotton grass sedge *Eriophorum vaginatum* growing in bogs and bogy soils. The original vegetation – trees, bushes – gradually perish over the centuries and they become peat. Peat fibres are obtained from the surface of the bog as by-product of energy generation industry because the top layer for energy is not used. The fibres that the peat industry doesn't need can be spun into the yarns, woven or knitted into garments [1,2]. So, the peat fibres are a by-product (a waste product) of the peat harvesting industry and could be successfully used in the textile industry.

GOAL of this study - to develop knits from the new natural peat fibres and their combination with widely used woollen, cotton and elastomeric Lycra yarns and to investigate an influence of peat fibre nature on main physical properties such as air permeability, static water adsorption and also knits dimensional stability.



MATERIALS AND TESTING METHODS

The fabrics were knitted in a single jersey knitting pattern on a circular 14E gauge one needle-bed knitting machine Matec Techno New (Italy). All investigated knitted fabrics have been produces in JSC “Vegateksa” (Lithuania). All experiments were carried out in a standard atmosphere for testing according to Standard LST EN ISO 139:2005. Structure parameters of knits, such as the actual loop length, wale and course density, were analysed according to Standard LST EN 14971:2006.
Dimensional stability of knitted fabrics, i.e. shrinkage value after washing and drying was investigated according to Standard ISO 26330:1993.
Air permeability tests of the investigated knitted fabrics were provided according to Standard EN ISO 9237:1997 by equipment L14DR (Karl Schroder KG, Germany) using the head area of 5 cm^2 and pressure difference of 100 Pa.
The static water absorption was measured according to BV S1008 „Bureau Veritas Consumer Products Service“ internal test method.



INVESTIGATION

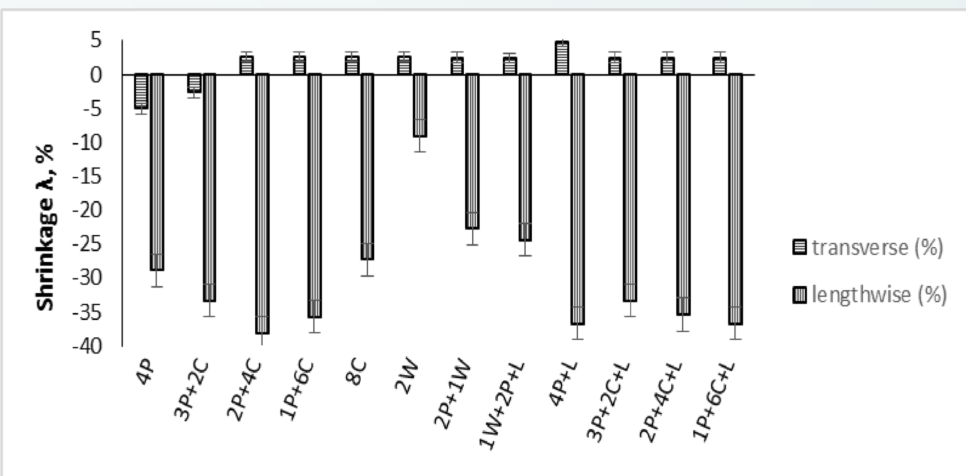


Figure 1.

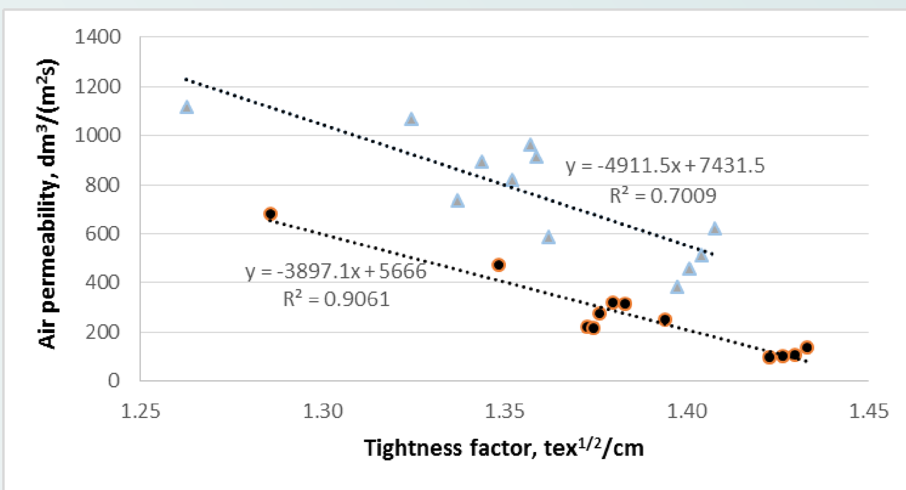


Figure 2.

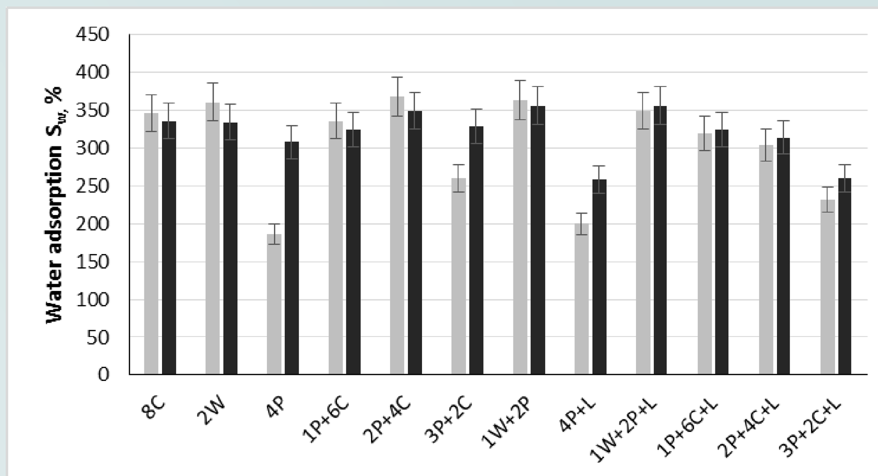


Figure 3.

As it was expected, all knitted samples shrunk in lengthwise direction in high level because it was the first wet treatment after knitting. The lowest shrinkage value in lengthwise direction was obtained for woollen knitted sample, however knits from woollen and peat yarns combination reached the shrinkage values more close to other cellulosic knits, made from peat, cotton yarns and their combinations. In the transverse direction, investigated fabrics changed their dimensions noticeably less (up to 3-5%). And only the pure peat fibre knit and the peat/cotton knit with the highest amount of peat fibre yarns shrunk in transverse direction (Figure1).

The dependence of permeability to air of knits on tightness factor is presented in Figure 2. The shrinkage after washing and drying cycle was very high, especially in lengthwise direction, air permeability of washed knitted samples crucial decreased and this decrease obviously correlates with the shrinkage level. Shrinkage of woollen knit has got the lowest value (less than -10%), accordingly the decrease in air permeability of this fabric is the lowest – 1.6 times lower than of the knit before washing. Shrinkage of knits of pure peat, cotton fibre yarns and their combinations was more than -25%, accordingly air permeability of these fabrics decreased even 2.8-3.8 times. As shrinkage values of peat/cotton/lycra blended knits were more than -30%, air permeability of these fabrics decreased even more – 4.0-4.7 times. Such crucial drop in permeability to air arises not only for the reason of structure's tightening through shrinkage but also because of the felting of elementary fibres on the surface of the yarns as well as on the surface of the knit. This fact is proved by the air permeability dependence on the tightness factor.

Results of the water absorption of knitted investigated fabrics are presented in Figure 3. As it can be seen from the results presented, pure peat fibre knits and combined peat/cotton fibre knits of variants 3P+2C and 3P+2C+L (with the highest amount of peat fibre) demonstrate the lowest values of static water adsorption. In the main cases difference in static water absorption values before and after washing vary in the ranges of errors, though absorption values of unwashed pure peat fibre knit or knit plated with Lycra yarn and their combination with the lowest amount of the cotton yarns are significant lower than of the same knits after washing cycle. It could be because of the additional chemicals used in the peat yarns production that reduce hydrophilicity of the yarns and can be removed during washing. After washing, static water absorption of peat fibre knits remains the lowest, however this difference is not so high as before the washing.

CONCLUSIONS

- All the investigated knitted fabrics shrunk in lengthwise direction in high level – up to -38% as it was the first wet treatment after knitting.
- In transverse direction investigated fabrics changed their dimensions noticeably less - up to 5%.
- Structural changes of the knits after washing and drying significant decreased their air permeability – up to 4.7 times. Decrease of air permeability after washing arises not only due to structure's tightening but also because of the felting of elementary fibres on the surface of the yarns as well as on the surface of the knit.
- Air permeability of the pure peat fibre knit is only in 5% less than of pure cotton fibre knit because of the smoother, less hairy surface of the cotton yarn. Air permeability of pure woollen knit has 14-18% higher than of the pure cotton and the pure peat fibre knits, though the loop length in all knits is similar. Permeability to air of the knits plated with elastomeric Lycra yarn decreased in 43-48% comparing with the knits without the Lycra yarn
- Static water adsorption of pure peat fibre knits and combined peat/cotton fibre knits with the highest amount of peat fibre is lower than of woollen and cotton knits, however after washing static water absorption of peat fibre knits remains the lowest but this difference is not so significant as before the washing.

References:

1.Suni S, et al. Use of a by-product of peat excavation, cotton grass fibre, as a sorbent for oil-spills. *Marine Pollution Bulletin* 49 p. 916-921 (2004);
2.Mikučionienė D, Čepukonė L. Comparative Analysis of Knits from Peat Fibre and its Combinations with Other Natural Fibres. *FIBRES & TEXTILES in Eastern Europe 2017*; 25, 2(122): 8-13.

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