Response to Reviewer 1 Comments

Dear reviewer, we are very grateful for all your comments that allow us to improve article!

Point 1: The description of materials and characterization methods is complete even if some information could be added (see comments on the attached file).

Response 1: The knitted structures studied differed in texture, thickness, surface area, extensibility, compactness/openness, all of which could have an effect on flammability and thermal comfort. The plain knitted structure is a single knitted structure. It is commonly used for underwear, has a smooth surface, and is also the thinnest of all the structures studied. 2:1 rib and 2:1 tuck rib are double knitted structures and therefore thicker than the plain structure. They have repeated and very pronounced vertical ridges. The 2:1 tuck rib is more open than the 2:1 rib due to the combination of tucks and long loops. Both structures are stretchable in width, which allows for a close fit on the body. Single piqué is a single structure and is often used for sportswear because its wavy texture allows for a larger surface area. Tucks make the structure more open and porous. The triple tuck structure has an even more pronounced wavy texture than single piqué and thus a larger surface area. Three consecutive tucks in combination with extended loops make the structure porous and distinctly relief-like.

Point 2: The results are generally clearly analyzed. However, the authors often remain on observations without giving some reasons (at least hypothesis) of the differences between the various cases presented (for example, there is a lack of explanation for the difference on the reaction to the flame due to the knitted structures, due to the types of yarn or to the fiber modacrylic).

Response 2: During the design of the experiment and prior to the design of the structure of the knitted samples, it was assumed that a very pronounced vertical rib structure could strongly influence the burning behaviour in the vertical direction compared to the burning behaviour in the transverse direction, since the rib structure should allow the flame spread in the wale direction, i.e., in the direction of the ribs, while in the course directions, i.e., perpendicular to the ribs, the flame spread would be hindered. It was also assumed that the wave-like texture of the triple tuck structure may hinder the flame spread in both directions. **T**he plain knitted structure could be the least flame resistant among the studied structures due to its smooth surface. The vertical direction of the loop limbs could have an effect on the stronger flame spread in the wale dir**e**ction compared to the course direction where the loop limbs could form a barrier.
Knitted fabrics with incorporated tucks that have a pronounced wave texture, such as the triple tuck structure, or longitudinal ridges such as the 2:1 tuck rib structure, perfectly meet the non-flammability criteria and at the same time are comfortable due to their wettability and absorbency (triple tuck structure) and their stretchability due to the folded ribs (2:1 tuck rib structure).
For testing the influence of type of MAC fibre, spinning process, and structure of knitted fabric on the flammability of the knitted fabrics, the sum of the afterflame and afterglow times in course and wale directions of each knitted fabric was used for multi-fcator ANOVA. It was found out that only the structure of the knitted fabrics had a statistically significant effect on the afterflame and afterglow time at the 95.0% confidence level, as the p-value was 0.0262, i.e. lower than 0.05.
Affordable personal protective flame resistant underwear available on the market is usually made of blends of modacrylic fibres with cotton or lyocell. In our research, we found that knitted fabrics made of modacrylic/cotton meet the non-flammability requirements for personal protective clothing. However, we also found that the 35% cotton content in the blend was not sufficient to ensure rapid wetting and rapid water absorption and could result in poor sweat removal from the skin.

Therefore, we proposed a blend of 55% modacrylic fibres, 30% sustainable lyocell fibres, and 15% polyacrylate fibres, which has an extreme LOI value of 40% and excellent water retention value which is close to that of lyocell fibres. Based on the TGA measurements carried out, all fibre blend components are stable up to 200 °C, modacrylic even up to 220 °C and lyocell up to 250 °C. In addition, modern synthetic clothing made of microfibers is known to be breathable (water vapour permeable) and soft to the touch. Therefore, one of the blends we studied contained modacrylic macrofibres and the other standard modacrylic fibres to see if there were differences in sorption properties and flame resistance between them. The yarns were produced with different ring spinning processes, i.e. conventional, compact and Sirospun, to find out which yarn has the best utility properties. Knitted fabrics in five different structures were made from all the yarns, and the influence of structure on flammability and sorption properties was also studied.

Point 3: (pdf article) Authors should comment the choice of these different structures.

Response 3: We partially answered the point 3 in response 2. Several studies have been conducted to investigate the influence of material composition and fabric structure on the sorption and flammability properties of knitted fabric (mentioned references 62,79).
Knitted fabrics in five different weft structures have been selected according to the existing use for underwear and according to the differences in the topography of the structures..

Point 4: (pdf article) Give the type of atmosphere for thermal analyses.

Response 4: Dynamic thermogravimetry of fibres was performed using a Netzsch STA449 C Jupiter DTA instrument (Netzsch-Gerätebau, DE). Fibres of 3 mg were heated at a rate of 10 °C/min in a nitrogen atmosphere.

Point 5: (pdf article) Cl-Zn-J

Response 5: The yarns were treated with a drop of Cl-Zn-I reagent composed of zinc chloride, $ZnCl_2$ (66 g), water (34 g), and potassium iodide, KI (6 g) to stain the cellulose in the lyocell fibres.

Point 6: Correlation between wetting time and thickness of the knitted fabrics ?

Response 6: Regarding the effect of fabric thickness, it should be noted that fabric thickness is measured under load (standard ISO 5084:1996). When the load is applied to the fabric, the fibers and yarns within the fabric structure are compressed. This compression causes the fabric to become denser, reducing its thickness. The extent of this compression and thickness reduction depends on several factors, including material composition, fabric structure, and inherent properties of the fabric. Since the examined knitted structures consist of different types of knitted structure elements (loops, tucks, miss yarns) in different combinations, the thickness reduction due to standard loading may also vary. In addition, the plain and single piqué structures are single knitted structures produced on a single-bed knitting machine, while 2:1 rib, 2:1 tuck rib, and triple tuck are double knitted structures produced on a double-bed knitting machine and are therefore likely to have a higher thickness. As a result, it is difficult to establish a realistic correlation between the thickness of the fabric in the unloaded state and the wettability by measurements based on standard test methods.

Point 7: Authors should comment a little more in detail the influence of the presence of tucks in knitted structures on the wetting properties.

Response 7: Wetting time depends on the wettability of a fabric surface (i.e. the ability of a liquid to spread and adhere to the surface of a textile material, surface texture) and on the diffusion of the liquid from the surface through the fabric, with the thickness and structure of a knitted fabric having an influence. A rough, relief-like knitted surface provides more contact points for liquids, potentially improving wettability. The plain and the single piqué structures are single knitted structures made on a single-bed knitting machine, while the 2:1 rib, 2:1 tuck rib, and triple tuck are double knitted structures made on a double-bed knitting machine and therefore likely have greater thickness and thus greater potential for diffusion of liquid from the surface through the fabric. It should also be noted that the combination of influencing factors such as material composition, yarn and fabric structure, and processing can have complex and interactive effects on the wettability of knitted fabrics. In the case of the knitted structures studied, the rough surface of the triple tuck structure with many contact points and the fabric thickness due to the relief-like structure contributed to the higher wettability. In contrast, a smoother surface of the plain knitted structure has a smaller contact area, yet the liquid spreads easily on the fabric due to the low contact angle, indicating good wettability.

Point 8: Authors should recall the difference between the two standards which could explain the difference between the results.

Response 8: The main difference between DIN 53906 and ISO 15025 is in the position of placing the gas burner with a flame on the tested sample. In the case of DIN 53906 standard, the burner is placed vertically below the tested sample, directly to the bottom edge, while ISO 15025 standard specifies the gas burner to be placed perpendicular to the surface of the tested sample and is, as mentioned before, specifically intended for testing the materials intended for fire fighter's protective clothing. In both cases, the tested specimens are vertically oriented and exposed to the flame for 10 s.