UNIVERSITY OF ALBERTA

Moisture Management Properties and Characterization of Fabrics for Lusomé: Test Results of "Cooling" Sleepwear Product

Main Report

Prepared for Lusomé

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Purpose

The purpose of this project is to understand and characterize the moisture management properties of fabrics used in Lusomé sleepwear (powered by Xirotex™) compared to the performance of other brands making similar claims. These fabrics are compared to those used by competitors in the sleepwear market who promote cooling or moisture wicking properties of their product(s). Many bold claims have been made about cooling and moisture wicking pyjamas, by brands and the media, but these claims appear to be often unsubstantiated by scientific data. This report has been developed to educate consumers on the benefits of moisture management fabrics and how Lusomé fabrics compare to some competitor fabrics.

The moisture management capabilities of various fabrics blends used for sleepwear (compared to other popular sleepwear brands claiming cooling or moisture wicking) have been tested and compared with Lusomé's Xirotex™ moisture management technology. The results of these tests have been analyzed and are discussed in reference to the claims that are made about their efficacy in managing moisture during sleep.

Two fabric blends are used in Lusomé sleepwear products. The fabrication of these fabrics uses Xirotex™ moisture management technology. The fibre contents of each Xirotex™ fabric are:

- Product A: 61% cotton/34% polyester/5% spandex
- Product B: 38% cotton/34% polyester/25% micromodal/3% spandex

Background

Getting enough sleep on a daily basis is an essential part of a healthy lifestyle. The National Sleep Foundation and Health Canada recommend adults between the ages of 18 to 64 get seven to nine hours of sleep per day and adults 65 and older get seven to eight hours of sleep per day [1,2]. According to the Canadian Health Measures Survey (CHMS) conducted in 2014-2015, one in three Canadians aged 35 to 64 are not getting enough sleep and one in four Canadians aged 65-79 are not getting the daily recommended amount of sleep (see Figure 1) [2,3].

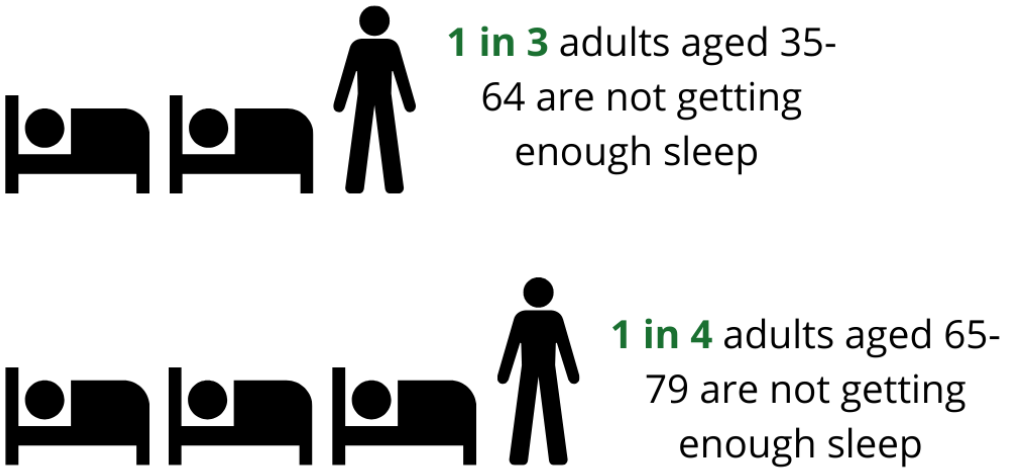

Figure 1: According to the Public Health Agency of Canada, many Canadians are not getting the daily recommended amount of sleep [2].

Night sweats can negatively impact sleep quality

One cause of sleep disturbance that can lead to people getting less sleep than the daily recommended amount are night sweats. In a study of 363 participants, 33.9% reported experiencing night sweats in the previous month. Of those who reported experiencing night sweats, 50% of them said they sweat through their sleepwear [4]. Clothing wetness affects how comfortable it is for the wearer [5]. Through personal experience, people would likely agree with the statement that wet clothing is uncomfortable to wear, but let's explore the reason for this.

Why does some clothing feel more comfortable than other clothing?

The feeling of comfort related to clothing is often difficult for people to describe. It has been defined as a pleasant state that results from the physiological, psychological, neurophysiological, and physical harmony between a human and their environment [6,7]. However, the easiest way to describe clothing comfort is the absence of discomfort [6,8]. It is recognized that a number of factors, such as fabric and fit, can cause clothing to be uncomfortable. Beyond the inherent properties of the clothing, environmental factors, like the temperature of the place where the clothing is being worn can influence how comfortable a piece of clothing is perceived to be [5]. Recognizing the complexity of the interactions between the environment, humans, and their clothing, as it relates to comfortable sleepwear and night sweats, feeling dry is paramount. This is apparent because the sensation of wetness has been identified as a cause of clothing discomfort during physical activity. Some of the

reasons wet clothing is uncomfortable include feeling “chilled” as moisture evaporates from the skin and the clinging sensation we feel from wet clothing against the skin [5]. This “chilling” sensation can be particularly evident when damp cotton is worn directly next to the skin.

Interestingly, humans do not have wetness receptors in their skin to signal whether something is wet or dry [9]. Instead, humans learn to perceive wetness through a combination of thermoreceptors (temperature sensors) and mechanoreceptors (tactile/touch sensors) [9]. When investigating the effect of fabric wetness on feelings of discomfort, it was found that the sensation of fabric clinging to the body was the biggest factor contributing to discomfort, and sensations of fabric roughness was the next [5]. The saturation level of clothing plays a role in how much it clings to the body, therefore, it is important to have fabrics that move moisture away from the skin and can dry before feeling saturated with moisture to maintain wearer comfort [5].

How is moisture management tested?

Fabrics deemed to have moisture management capabilities transport moisture vapour and liquid water, like sweat, away from the body. According to the American Association of Textile Chemists and Colorists (AATCC), the results obtained from a moisture management test will be dependent on the fabric’s inherent or engineered ability to transport water vapour or liquid moisture [10]. The moisture management tester (MMT) has become the standard measurement tool to characterize liquid moisture transport behaviours of fabrics. The MMT quantitatively measures the multidimensional transport of moisture through fabrics – from the top surface to bottom surface and the spreading along the surfaces [11]. A specimen is placed in the MMT, which has concentric rings of moisture sensors above and below the specimen to measure and record the presence of liquid moisture. Hu et al. introduced different measurements to be taken by the MMT to characterize the liquid moisture management capacity of the fabric – this became a standard test method for textiles by in the AATCC Test Method 195: Liquid Moisture Management Properties of Textiles [10]. The wetting time is measured for the top (WT_T) and bottom (WT_B) surfaces of a fabric specimen, as are the absorption rate of the top (AR_T) and bottom (AR_B) surfaces, the maximum wetted radius of the top (MWR_T) and bottom (MWR_B), and the spreading speed along the top (SS_T) and bottom (SS_B) surfaces [10,11]. The accumulative one-way transport capability (OWTC) and the overall liquid moisture management capability (OMMC) are also

measured. The OMMC is an index often used to generally assess a fabric's capacity to transport liquid moisture because it considers the AR_B, the OWTC, and the SS_B [10,11].

What do moisture management test results mean?

With 10 different values given in the results of a moisture management test (as seen in Table 2), it can seem overwhelming at first. The wetting time (WT) indicates the how long it takes after the beginning of the test for the top (WT_T) and bottom (WT_B) surfaces to start being wetted [11]. To interpret this number as it relates to moisture management sleepwear, one should look for a low WT_B value because this can indicate that moisture is moving through the fabric from the skin surface to the outer surface quickly. The MMT test runs for 120 s, so a WT_B value of 120 s means that no liquid moisture was detected on the bottom surface of the fabric. The maximum wetted radius (MWR) indicates how far moisture spreads from the centre of the fabric where moisture is initially added [11]. The MWR indicates how well a fabric wicks moisture in the transverse direction, so along the surface of the fabric. Moisture management fabrics should have a large MWR value. A larger MWR on the bottom surface (MWR_B) is desirable because if moisture can spread farther along the surface, it creates a large surface area from which moisture is able to evaporate from the fabric so it can dry faster [12]. The evaporation of moisture from clothing results in a cooling effect [13]. The OWTC is another number that can give valuable information about the moisture management ability of a fabric. This number measures the difference in the moisture accumulation between the top and bottom surfaces of the fabric over the duration of the test [11]. A high OWTC value indicates that moisture is quickly and efficiently moved from the side of the fabric that is against the skin away from the body to the outer surface of the fabric. Again, this is desirable for moisture management sleepwear because when moisture is moved away from the body to the outer surface of clothing, it feels more comfortable for the person wearing the clothing [11].

As previously mentioned, the OMMC value is great to look at for a quick overview of moisture management performance. Grades from one to five are assigned to the fabric specimens based on their performance in the MMT test [10]. A higher grade means that the fabric's ability to move moisture from the top to the bottom is superior. In practice, this means that the fabric is better at moving liquid moisture away from the skin towards the outer surface of the fabric – likely leaving the skin feeling drier and more comfortable. The OMMC index is measured on a scale of 0 to 1. A value of .80 or higher on the OMMC index is a grade of 5,

which means it shows the best liquid moisture management properties. When looking at the relationship between OMMC and the uncomfortable sensations of clamminess and dampness, it was found that fabrics with a higher OMMC resulted in lower ratings of these uncomfortable sensations – meaning that the fabrics with the higher OMMC index were more comfortable to wear when a person was sweating [11].

What is moisture regain?

The MMT measures the movement of *liquid* moisture through a fabric, but the absorption of moisture *vapour* is also of interest. Moisture regain helps give an indication of a fibre's ability to absorb moisture vapour. The textiles and materials international standards organization ASTM International defines moisture regain as "the amount of water resorbed by a dried material at specified equilibrium conditions of temperature and humidity, compared to the mass of the dried material" [12]. Moisture regain is measured by oven-drying a fabric to remove all the moisture within it that was absorbed from the environment and then weighing it to obtain a "dry weight". The fabric is then exposed to pre-determined environmental conditions with a specified temperature and humidity – the humidity is important here because the amount of moisture in the air is a highly influential factor in how much moisture the fabric will be able to take up from the air. For textiles, moisture regain is usually measured at 20°C (68 °F) and 65% relative humidity (R.H.). The difference in mass is measured to determine how much moisture the fabric has taken up [12].

Moisture regain is a measure of fibre hygroscopicity. If the air is more humid then a hygroscopic fibre would hold even more moisture. Whereas, a non-hygroscopic fibre would not change very much at all from a low humidity environment to a high humidity environment. Wool, silk and viscose rayon are examples of hygroscopic fibres. Polyester is an example of a non-hygroscopic fibre.

What is air permeability?

An aspect of clothing comfort that is often referenced by brands and the media is "breathability". This term was originally coined to describe waterproof fabrics that are able to allow moisture vapour to transport from the skin through the fabric to the environment (e.g., the moisture permeable membrane of Gore-Tex®). Now, the term is used more widely to apparel fabrics that are not waterproof and are inherently "breathable". Broadly speaking, "breathability" is used to describe the flow of water vapour through a fabric, which is an important aspect of clothing comfort. The flow of moisture vapour through a fabric can be

measured by a moisture vapour permeability test, however, a simpler test that correlates well with moisture vapour of non-waterproof fabrics is air permeability [13]. The air permeability of a fabric or garment is highly influential in overall comfort as well as how moisture evaporates [14]. Air permeability is measured by creating a pressure drop on either side of a fabric sample and determining the rate at which the air flows through the fabric [14]. This can be thought of as how easily wind or a breeze can get through the fabric. In hot conditions, it is advantageous to have clothing with higher air permeability so cool breezes, for example, can penetrate the fabric to remove heat and moisture from the body. Conversely, in cold conditions, it would be desirable to have fabrics with low air permeability so cold winds are not able to reach the body and cause cooling [14]. Sleepwear designed to reduce the discomfort felt by people who experience night sweats should have higher air permeability so that hot air and moisture is not trapped between the body and the clothing. Fabric properties that influence the air permeability include its thickness, pore sizes, the fibre and yarn type, and the presence of finishing treatments. When fabrics are good at absorbing moisture, the air permeability can decrease as the fibres within the fabric swell with moisture [14].

What is the benefit of sleepwear with excellent moisture management?

When the body's temperature increases, it begins sweating to try and cool itself down to a comfortable temperature (37°C/ 98.6°F) [6]. Sweating cools the body because evaporation of the sweat causes heat loss. This process can occur without the person noticing they are sweating (i.e., the sweat is released as vapour). Once the sweat rate reaches a point where evaporation cannot keep up the skin becomes saturated (i.e., the sweat becomes liquid). At this point, the clothing worn by the sweating person will also become wet. Therefore, it is important for clothing to be able to manage both moisture vapour and liquid moisture. An interesting phenomenon occurs between a person's body and their clothing where a unique "microclimate" is created, which differs from the outside environment and the person's body [15]. It is important to have clothing with adequate ventilation and moisture vapour transmission to allow moisture vapour to escape from within the skin-clothing microclimate. The fibre content of a fabric, the thickness of a fabric, and the porosity of a fabric all influence the moisture vapour permeability [15]. The moisture regain of fibres can give an indication of how the fibre content will influence the moisture vapour uptake of a fabric.

When sweat becomes sufficient that it saturates the skin and liquid sweat can be felt, the liquid moisture management capacity of a fabric becomes crucial as wet clothing can collapse

against the skin resulting in a clammy feeling. Moisture management fabrics transport moisture toward the outer surface of the fabrics away from the skin. The moisture should then spread on the outer surface so it can evaporate to the surrounding atmosphere. Efficiently drawing moisture away from the body reduces the humidity in the body-clothing microclimate to help keep the skin dry [16].

What contributes to better moisture management?

Moisture management in clothing is a complex phenomenon with interplay of several variables. To begin, water vapour and liquid water move through clothing differently. Water vapour primarily moves from areas of high concentration to areas where there is less moisture in the air whereas liquid water moves through the sequential processes of wetting and wicking [17]. Wetting occurs when liquid contacts the clothing and goes through the processes of adhering, spreading, and penetrating the fabric and its fibres. The types of fibres in the fabric can influence the fabrics ability to be wetted out [17]. Wicking can occur after the fabric is wet. Liquid can move through a wicking fabric because of a force called capillary action. Channels created in the void space between fibres within a yarn and between yarns in a fabric allow liquid to be transported along their length [18]. Fibre characteristics like whether it is hydrophilic (water-loving) or hydrophobic (water-fearing) also influence how liquid water is able to move along the channels within a fabric [18].

What role does the fibre content play in keeping sleepwear comfortable?

The type of fibre used to make a fabric plays a significant role in how it responds to moisture. Natural fibres, like cotton, are generally hydrophilic, meaning they like to bring water into their structure [19]. It makes them absorbent, which is one reason why cotton towels are favoured for drying off after a shower – a cotton fibre has lots of spaces within its molecular structure for water to be held. Synthetic fibres, like polyester, on the hand, are generally hydrophobic. They have few spots within their chemical structure to hold water molecules [19]. Polyester tends to let water pass along its fibres so it can be good at transporting liquid moisture. Since polyester does not absorb water into its internal fibre structure garments made from polyester can dry much more quickly than those made from cotton [19].

The opposing attraction natural and synthetic fibres have for water creates unique opportunities to blend fibres based on the desired moisture management outcome. Alone, neither the natural or synthetic fibre will be able to both absorb and release moisture, which is required for optimal comfort. However, a blend of natural and synthetic fibres can create a

perfect harmony of good wetting and wicking ability. This is what Lusomé has achieved with their Xirotex™ fabric.

Methods

Five commercially available sleepwear garments that claim to have special benefits for enhancing sleep comfort were selected as competitor brands to Lusomé Xirotex™ products. All fabrics were tested with the MMT to measure their moisture management capabilities. The tests were conducted by Intertek Testing Services Ltd. in accordance with the AATCC test method 195 [10]. A description of the fabrics is presented in Table 1.

Table 1: Description of fabrics

Company (Item tested)	Fibre Content
Lusomé (Product A)	61% cotton/ 34% polyester/ 5% spandex
Lusomé (Product B)	38% cotton/ 34% polyester/ 25% micromodal/ 3% spandex
Company A Karen Neuburger (Mauve Sleep T)	60% cotton/ 40% polyester
Company B Lunya (White sleep tank)	46% TransDRY® cotton/ 45% Supima cotton/9% XT2 polyester
Company C Cool Jams (Black Sleep T)	100% polyester
Company D Soma Cool Nights (Black Sleep T)	93% rayon/ 7% spandex
Company E Joyaria (Black chemise)	95% viscose/ 5% spandex

Moisture regain was not tested directly for this report; however, moisture regain values can be estimated based on the standard values given by the Canadian General Standards Board (CGSB) in CAN/CGSB-4.2 No. 0-2001: Textile test methods: Moisture regain values, SI units used in CAN/CGSB-4.2 and fibre, yarn, fabrics, garment, and carpet properties [20]. The estimated moisture regain values were calculated based on the proportions of fibre content described in Table 1.

Air permeability was measured for the two Xirotex™ fabrics only (Product A and B). Air permeability was measured at the University of Alberta in the Department of Human Ecology following the ASTM D737-18 test standard [21].

Findings

The results of the MMT tests are shown in Table 2. Fabrics were tested to get a sense of how they perform in relation to the claims that are made about their performance. The key value of interest in the table is the OMMC. As mentioned in the section "What do moisture management results mean?", the OMMC value can range between 0 and 1. Values over 0.8 (which translates to grade 5) have the best moisture management. As seen in Table 2, of the seven fabrics tested, the two Lusomé Xirotex™ fabrics were the only fabrics to achieve an OMMC of grade 5. The OWTC of the Xirotex™ fabrics were also among the highest – Product A had the highest OWTC of the fabrics tested meaning liquid moisture was quickly and easily moved to the outer surface of the fabric away from the surface closest to the skin [11].

Moisture regain values for polyester, cotton, rayon (which includes viscose and modal) and spandex were used to calculate the moisture regain for each fabric (see Table 3). Of the fabrics included for this report, all but one of the fabrics (i.e., Company C) had multiple fibres within the fabric structure. Of the fibres used in the fabrics included in this report polyester has the lowest moisture regain value of 0.4%, while viscose rayon has the highest moisture regain value of 11.0%. Cotton falls in between these with a regain value of 8.0% and spandex has a modest regain of 1.3% [20].

Air permeability values for the two Lusomé Xirotex™ fabrics are shown in Table 4. The results indicate that they are highly air permeable at greater than 800 L/m^2*s. For some context, a woven fabric that might be used to make a uniform for Chefs working in a kitchen is about 60 L/m^2*s [22] or the scrubs worn by healthcare professionals in a hospital is about 40-50 L/m^2*s [23]. Whereas, a light-weight t-shirt made from a single jersey knit fabric can range from 370-1390 L/m^2*s depending on the fibre content, fabric thickness, and fabric weight [24]. The knitted fabric structure of Xirotex™ fabrics allow for air to permeate which also means moisture vapour can easily escape the fabric. As most sleepwear are knit fabrics then Lusomé's competitor brands fabrics would have high air permeability as well.

Table 2: MMT Results

Company (Item tested)	WT_T (s)	WT_B (s)	AR_T (%/s)	AR_B (%/s)	SS_T (mm/s)	SS_B (mm/s)	MWR_T (mm)	MWR_B (mm)	OWTC (%)	OMMC	Grade
Lusomé (Product A)	3.35	2.90	33.81	56.94	4.66	4.95	24.00	25.00	395.93	0.87	Grade 5 M – Meets the provided requirement
Lusomé (Product B)	6.56	6.28	40.31	94.74	2.08	2.33	20.00	23.33	557.53	0.83	Grade 5 M – Meets the provided requirement
Company A	3.66	3.37	42.81	54.76	4.11	4.15	23.00	25.00	149.53	0.59	Grade 3 F – Below the provided requirement
Company B	2.48	2.84	9.55	16.70	7.41	7.07	19.00	18.00	421.06	0.59	Grade 3 F – Below the provided requirement
Company C	2.95	3.13	44.76	53.97	5.30	5.29	25.00	26.00	87.49	0.52	Grade 3 F – Below the provided requirement
Company D	7.70	119.43	48.83	0.70	0.75	0.01	5.00	1.25	-436.01	0.0	Grade 1 F – Below the provided requirement
Company E	6.63	119.95	32.47	0.00	0.74	0.00	5.00	0.00	-543.06	0.0	Grade 1 F – Below the provided requirement

WT_T: Wetting Time (Top); WT_B: Wetting Time (Bottom); AR_T: Absorption Rate (Top); AR_B: Absorption Rate (Bottom); SS_T: Spreading Speed (Top); SS_B: Spreading Speed (Bottom); MWR_T: Maximum Wetted Radius (Top); MWR_B: Maximum Wetted Radius (Bottom); OWTC: Accumulative One-Way Transport Capability; OMMC: Overall (liquid) Moisture Management Capability

Table 3: Estimated Moisture Regain

Company	Fibre Content	Estimated Regain (%)
Lusomé Product A	61% cotton/34% polyester/5% spandex	5.1
Lusomé Product B	38% cotton/34% polyester/25% micromodal/3% spandex	6.0
Company A	60% cotton/40% polyester	5.0
Company B	46% cotton Transdry®/45% Supima cotton/9% XT2 polyester	7.3
Company C	100% polyester	0.4
Company D	93% rayon/7% spandex	10.3
Company E	95% viscose/5% spandex	10.5

Values estimated based on CAN/CGSB-4.2 No. 0-2001 [20]

Table 4: Air Permeability

Company	Fibre Content	Air Permeability (L/m^2*s)
Lusomé Product A	61% cotton/34% polyester/5% spandex	857.1
Lusomé Product B	38% cotton/34% polyester/25% micromodal/3% spandex	828.8

Interpretation

Are the claims made by sleepwear companies supported?

Using the results from the MMT tests and the estimated moisture regain values that were calculated based on the fibre content of the fabrics, the claims made on the product websites were analyzed (see Table 5). Based on the test results, the claims made by some companies might be overstated.

Table 5: Evaluation of Sleepwear Claims

Claim	Fibre Content	Estimated Moisture Regain	WT_B	MWR_B	OMMC	Is the claim supported?
Lusomé Xirotex™ fabrics						
Moisture is pulled away from the skin, leaves skin feeling dry [25] (Lusomé) (Product A)	61% cotton/34% polyester/5% spandex	5.1 %	2.9 s	25 mm	0.87	This fabric achieved excellent moisture management results with liquid moisture rapidly being detected on the bottom surface of the fabric and the liquid was easily spread. It had the highest grade for the OMMC index meaning it has an excellent ability to move moisture from the fabric surface closest to the skin to the outer surface. When moisture is drawn to the outer surface of the fabric and spread along the surface it encourages evaporation to occur more rapidly. This can leave the wearer feeling cool and dry. This fabric has hydrophobic fibres closest to the skin so they won't absorb moisture as readily, meaning the fibres directly against the skin shouldn't feel wet. However, the presence of cotton means that moisture vapour can still be absorbed so the skin shouldn't feel clammy. This fabric also has high air permeability which means air and water vapour can easily pass through. Moisture will be pulled away from the skin leaving the wearer drier.
Moisture is pulled away from the skin, leaves skin feeling dry [25] (Lusomé) (Product B)	38% cotton/34% polyester/25% micromodal/3% spandex	6.0 %	6.3 s	23 mm	0.83	While not wetting quite as quickly as Product A (above), the liquid moisture still spreads out far on the bottom surface. Just like the fabric of Product A this fabric also has an excellent OMMC, good moisture regain and due to the combination of hydrophobic and hydrophilic fibres in the blend wetness can be drawn away from the skin and dissipated to the environment which helps keep the skin cool and dry. The moisture regain is slightly higher than for Product A because of the highly absorbent modal fibres.

Competitor's sleepwear fabrics						
Cool and dry all night [26] (Company A)	60% cotton/40% polyester	5.0 %	3.4 s	25 mm	0.59	This fibre blend can absorb some moisture vapour from the skin because of the hydrophilic cotton fibres. The arrangement of the fibres in this fabric supports some moisture transport from the inner surface – closest to the skin – to the outer surface for evaporation based on the OMMC value of 0.59. While, the fabric wet quickly on the bottom surface and spread far both sides of the fabric would remain wet with liquid moisture. Because of this the OMMC was not as high as Xirotex™ fabrics (Products A & B). It might not keep the wearer dry all night if the sweating is sufficient to saturate the cotton.
Keeps you feeling cool and dry, breathable [27] (Company B)	46% cotton TransDRY®/45% Supima cotton/9% XT2 polyester	7.3 %	2.8 s	18 mm	0.59	TransDRY® cotton is treated with a finish to support the transport of moisture away from the body. Based on the OMMC value of 0.59, there is adequate movement of water from the surface closest to the skin toward the outer surface of the fabric. The bottom surface also wets quickly, but the liquid did not spread quite as far as the previous fabrics tested. The cotton content of this fabric also allows for the absorption of moisture vapour. This fabric may keep you dryer than some others tested in this report. However, it will not draw liquid moisture away from the skin as quickly as Xirotex™ fabrics (Products A & B) based on this examination of test results.
Quick drying, moisture wicking, thermoregulation [28] (Company C)	100% polyester	0.4 %	3.1 s	26 mm	0.52	The use of 100% synthetic fibres means this fabric will not allow moisture into the fibre structure. However, the polyester fibres will contribute to its ability to wick moisture within the fabric and dry quickly. An OMMC value of 0.52 puts this fabric in the mid-range of the moisture management scale meaning it moves some moisture from the surface next to the skin to the outer surface of the fabric. The test results show that the liquid moves rapidly through the fabric to the bottom surface and the liquid spreads far. Yet, the spreading difference between the two sides of

						the fabric are not as large as that of Xirotex™ fabrics (Products A & B). Since 100% polyester absorbs barely any moisture (evident by the low moisture regain of 0.4%) suggests the onset of sweating will occur faster and the perception of skin wettedness may occur more quickly than a fabric that is able to absorb some of the moisture vapour as a person sweats. So, while the fabric will be quick drying and can wick liquid moisture it may not provide the highest comfort during sleep.
Cool to the touch, won't cling to the body, keeps you dry [29] (Company D)	93% rayon/7% spandex	10.3 %	119 s	1.25 mm	0.00	Viscose rayon is a fibre manufactured from cellulose. Cellulose is hydrophilic which means there are many places within its structure where water is attracted and can enter. This makes it highly absorbent. With an estimated moisture regain of 10.3%, this fabric will absorb moisture from the skin as moisture vapour. Being hydrophilic it is unusual that the fabric did not spread liquid moisture further following testing with the MMT. This might be due to a residual finish remaining on the fabric following manufacture giving the fabric some hydrophobic properties. Such a finish may wash off when laundered and the moisture management would likely improve following use and washes. But with the extremely low OMMC value measured in these tests any changes following use are unlikely to make it perform as well as other fabrics tested for this report. If a person sweats so much that the fabric becomes saturated then the sensation of clamminess will occur and the person could feel chilled when their body temperature lowers. This fabric may provide adequate comfort when there is none to minimal liquid sweating, but saturated rayon fabrics do cling to the skin and the wearer would not feel dry if sweating a lot.

Cooling, breathable, great for people who experience night sweats [30] (Company E)	95% viscose/5% spandex	10.5 %	120 s	0.0 mm	0.00	This is a similar fibre composition as the previous garment (Product D) tested and would likely result in the same feelings of comfort/ discomfort while sleeping. In these MMT tests the liquid never wet the bottom surface. Like Product D, there is probably some residual finish that made the fabric surface hydrophobic. This finish could wash off after a few laundry cycles. Nonetheless, with the highly absorbent viscose fibres this garment could become saturated with liquid moisture if excessive sweating was to occur. This can leave an individual feeling "chilled" if their metabolic rate decreases and they remain in the damp/ wet clothing. Therefore, it is unlikely to be a good sleepwear item for people who experience night sweats.

Summary

Sleepwear that will help manage night sweats should move moisture away from the skin to the outer surface of the garment where it can dry by evaporation. Evaporation of sweat also helps cool the skin [14]. As the overall goal of sleepwear designed to manage night sweats is to keep the wearer feeling cool and comfortable, good moisture management is an essential property. Xirotex™ fabrics used in Lusomé sleepwear have excellent moisture management properties, which have been demonstrated through moisture management testing. The grade 5 rating of these fabrics means that moisture is effectively transported from the inside of the fabric, closest to the skin, to the outer surface where it will be able to evaporate [10]. Lusomé is committed to consumer education to help individuals make informed decisions about the sleepwear that will best meet their needs. Some brands and the media make claims that do not appear to be supported by evidence. Through third party testing, Lusomé has demonstrated how their fabrics have a higher OMMC than competitor brands. Furthermore, like most knitwear fabrics their fabrics allow air and moisture vapour to pass through the structure. Due to their blend of hydrophobic polyester fibres and hydrophilic cellulosic fibres the fabrics facilitate rapid spreading of liquid moisture from the inside to the outside surface of the fabric. This can leave the surface next to the skin feeling dryer. The hydrophilic fibres on the outside surface of the fabric enable absorption of water vapour ensuring no clamminess is felt to disrupt the comfort during sleep. This means that when an individual starts sweating while wearing Lusomé Xirotex™ sleepwear, their skin should feel dryer faster than it would if they were wearing sleepwear comprised of one of the competitor's fabrics that were tested.

Key Takeaways

- Moisture management test results indicate how well moisture is transported through a fabric. Multidirectional moisture transport is measured; from the inside surface to the outside surface and spreading along each surface.
- Moisture management can be graded on a scale from 1-5, with 5 indicating the best moisture management.
- Lusomé Xirotex™ fabrics were tested in comparison with fabrics selected from other sleepwear brands who made claims about their ability to provide a cool, comfortable night's sleep.

- Of the fabrics tested for moisture management, Lusomé's Xirotex™ fabrics were the only fabrics to achieve a grade 5, indicating its enhanced ability to transport liquid moisture from the surface closest to the skin toward the outer surface where it can dry by evaporation.
- Moisture regain indicates a fabric's ability to absorb moisture vapour from the air. This can serve as an indication of how much moisture a fabric is able to absorb based on its fibre content.
- Moisture regain was estimated for the fabrics that underwent moisture management testing. Due to their blend of hydrophobic (water-fearing) synthetic fibres and hydrophilic (water-loving) cellulosic fibres, Lusomé's Xirotex™ fabrics had a moderate moisture regain in the range of 5.1 to 6.0%. These results suggests that Lusomé fabrics will absorb moisture vapour from the body to keep it feeling comfortable rather than clammy.
- Like most knitwear fabrics, Lusomé Xirotex™ fabrics have high air permeability which means air and moisture vapour can easily pass through the fabric structure.

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