



Importance of comfortable textiles & clothing for cancer therapy patients

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1. Introduction

Cancer therapy for the survival of patients is an agonizing process. Once diagnosed, the cancer patients go through the painful process from the stage of testing, treatment, procedures and after treatment with side effects. Patients and their family members were needed to be counselled to stay mentally strong and be prepared before the therapy starts with the complete idea about the whole painful process. The therapies drop the patient's strength rapidly and makes them weaken. At times the side effects were unheeded clinically in cancer management [1]. The older age group above 65 faces various side effects and many of their symptoms leads to an intense level [2]. Due to the painful treatment some patients withdraw the therapies or delays in taking the treatment. Though there are many advanced cancer therapies introduced with less painful process, most of the patients are not able to afford the cost of the treatment and not all other latest treatments can be treated for all types of cancer. As the cancer therapies with latest development are quite expensive for many people, they choose to

prefer the painful and affordable therapies which causes more side effects for a while. Patients who are undergoing therapies faces the challenges of side effects with multiple symptoms in the body. The common symptoms such as hair loss, burns & rashes due to expose in UV rays, fatigue, tiredness, heat, rashes, swelling, redness, itching, dryness, with multifarious bacterial, viral and fungal infections. Though the side effects were treated with separate doze of medicines, it has its limitations in dosages at every phase of treatment for its safety and effective purpose. Additionally, the side effects may manifold further causes and effects with inappropriate textiles and clothing for patients. Providentially, there are some of the supportive and comfortable clothing available to help mitigate some of the discomforts for patients.

2. Skin side effects for cancer therapy patients:

Side effects during cancer therapy are quite common in patients. Skin changes are one of the challenges faced by the patients during the therapy or in the beginning of the therapy. Rashes, light sensitivity, dryness, itchiness, colour changes, allergies are some of the most common side effects in skin. Mostly it appears in the scalp, face, neck, chest and upper back of the body. Castiello and Caporuscio [3] mentions that the rashes sometimes may occur very severe and causes pain, itchiness, burning or stinging. Occasionally, rashes also arise as a hive. Another type of rash is hand foot

syndrome which is otherwise known as palmar plantar erythrodysesthesia which shows the symptom of tingling, burning, itching, numbness, swelling, tender skin and inflamed skin resembling like sunburn. In an acute stage the symptoms may cause severe pain, struggle in walking and using the hands, slow in wound healing, sores, cracking, flaking or peeling skin. In other cases the skin becomes dry and itchy. If not treated it may become infected. The therapies usually makes the patients more sensitivity to light. It causes the patient to experience photosensitivity. The Cancer research in UK mentions, chemotherapy drugs are vesicant that affects the surrounding areas of the skin with the symptoms of swelling, stinging or inflamed skin which is known as extravasation or tissuing.

3. Fabrics that are not suggested for cancer therapy patients:

Textiles and clothing plays a major role in different ways at medical sector. Medical textiles has been classified to various protective, & hygiene products, non-implant health able materials, extra corporeal devices and implantable materials [4]. For patients who are in cancer therapy treatment will be benefited more in the area of healthcare/ hygiene products and non-implantable materials. They are bedding, clothing, surgical gowns, clothes, wipes etc., and wound dressing, bandages, plasters etc. During or after the cancer treatment, patients experiences acute changes in skin which may even cause a life threatening. Additionally the synthetic fibers in clothing or bedding also causes more skin irritation and skin related diseases, whereas fabrics which are made from the natural fibers are more safe and suitable to wear. Any product which are eco-friendly or sustainable could be suggested.

All the synthetic fibers were made from toxic chemicals. Some of the chemicals used while making the synthetic fabrics causes damages to the human body says

Singhs and Bhalla 2017. In general the author says some of the chemicals which are used to manufacture the manmade fabrics are noxious to the human bodies. They are sulphuric acid and nitric acid which were used in manufacturing of rayon and hexamethylene for making nylon can cause skin rashes, itching, redness, dermatitis and anorexia. Dimethyl formamide which is used in spinning process of acrylic can cause skin rashes and liver damage. Formaldehyde used in spandex, acrylic, nylon, polyester causes allergies to the skin and eye watering. Carbon disulphide which is emitted from rayon causes nausea, headache, vomiting, chest and muscle pain. Hexamethylene diamine can even cause damage to the liver, kidneys and brings infertility in men. Terephthalic acid which is used in making polyester and acrylonitrile in acrylic are very carcinogenic and had bad effects on central nervous system. The fabrics that are treated with special finishes using chemicals are also harmful, such as Barium sulphate used for antistatic finish on the polyester, causes hyper skin pigmentation, dermatitis, dizziness and headache [5].

4.Comfortable textiles and clothing for Patients:

The most important thing to be considered in clothing for patient is comfort. Patients skin will be very sensitive especially after chemo therapy and radiation therapy. Comfortability in clothing depends on the fiber choice, yarn selection, fabric structures and silhouettes for the end user. Essentially the comfortability of clothing depends on the stimuli and sensations of the garment, that changes based on the human activity and the environmental climatic conditions, states Lamotte 1977 & Hollies 1979 [6]. Better quality of the end product depends on choosing the right fabrics which gives the performance characteristics in it. According to Tiwari 2010 [7], the comfort level in clothing varies from people to people who wears at

different situations. It is divided into aesthetic and functionality performance. Aesthetic is more on the appearance of the fabric when functionality is more on the usage performance while wearing the product, defines Vermeersch et al.,(2018) [8]. Slater 1985 & Hatch 1993 declares that the comfortability implicate the physiological, psychological and physical aspects between the wearer and the environment. The fabric properties defines the comfortability with the physical, chemical and structural characteristics. By selecting the type of fibers, yarn, yarn smoothness for its fabric structure, fabric thickness, fabric composition, additional coating, dyeing, finishing also influences the comfortability in the fabrics. The choice of clothing for cancer patients depends on the specific need and particular application of the fabric. Clothing which are soft, breathable, cool, light weight, stretchable and other enhanced properties like anti-bacterial, anti-microbial, anti-fungal, anti-inflammatory and UV protective that are featured in the fabric is highly urged with the environmental attributes that can be supported. Natural fibers has some of the properties which can comfort the patients like breathability, softness, coolness and warmness, antibacterial, UV protective etc.,

5. Natural fiber Properties that can comforts patients in Textiles & Clothing:

In medical textiles different types of fibers, yarns and fabrics are used according to their performances based on a purpose and its use. Preferably for patients, fabrics that are made out of natural fibers are advisable. The natural fibers has good modulus values in properties, it has low density, considerable tenacity, less cost, recyclable, nontoxicity and also easily available. Hence natural fibers were opted in first place. Specifically, when it comes to cancer therapy patients these properties will support for the comfortability to wearer in many terms. To be more precise

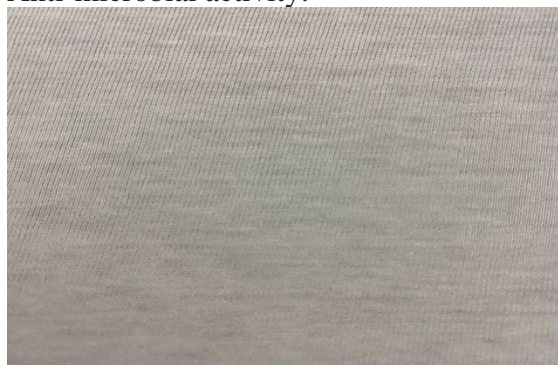
the choice of fabric depends on the region, locating the body reaction for the treatment given and the weather conditions. Cotton, silk, rayon, Bamboo and also some other regenerated fibers like Lyocell are also suggested for its comfortable biological, physical and chemical properties in safer clothing and bedding to protect the skin from discomforts says Sharmila Anish 2013 [9]. Cotton is one of the oldest and globally picked fabric for textiles and clothing. Cotton is Very comfortable to any one from kids to old aged people. It's very sustainable, hypoallergenic, odour free, Good absorbency, versatile, less maintenance and high tech recommends Australian cotton [10]. Silk is an expensive option where not everyone can afford. Also it will be more suitable for cold weather conditions to keep warm. Silk is an another option to make specific clothing categories for patients as it has a wide range of medical application properties such as breathability, absorbency, elasticity, thermal regulation, drying speed [11]. Besides silk has anti-microbial, UV protection, Wound healing properties explains Łukasz Mazurek et al., [12].

With an expectation of enhancing the value in the fabric, cellulosic fibers are made from the wood pulps such as Bamboo Viscose, Viscose Rayon, Modal, Lyocell etc. These fabrics have a great quality in light weight, soft, smooth, cool, low cost, biodegradable and recyclable. Along with Bamboo has properties like anti-bacterial, anti-microbial, UV protection, anti-fungal, power insulating, moisture wicking and it is very good for skin [13]. The generalised term of viscose is regenerated fiber obtained by viscose process for lyocell as well. The fiber made out of oak, birch and eucalyptus tree wood pulp are lyocell [14]. It is 50% more absorbent than cotton. Like bamboo lyocell is hypoallergenic, lightweight, highly breathable, antimicrobial, moisture wicking, and is wrinkle resistant, good drapability and doesn't cling. It keeps the skin cool, dry and makes the skin feel

great. Lyocell is no wonder acclaimed as a miracle fabric [15].

6. Better performances of Anti-microbial activity in selected woven and knitted Fabrics.

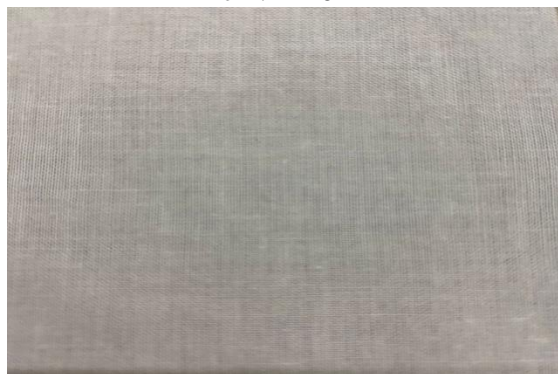
After a review on different natural and cellulosic fibers, 100% Cotton in Woven shown in Pic 1 named as (CW04A), 40% Bamboo 60% Cotton in woven (Bamboo in weft & cotton in warp) shown in Pic 2 and mentioned as (CBW03A), 100% Organic Cotton in Knits shown in pic 3 and quoted as (CK01A) and lastly 100% Bamboo viscose in knits shown in pic 4 and titled as (BK02A) were performed for Anti-microbial activity.



Pic 1. CK01A



Pic 2. BK02A



Pic 3. CBW03A

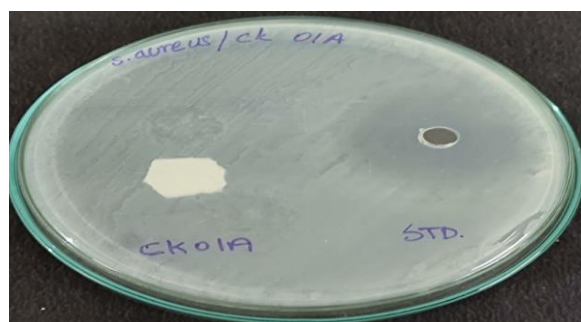


Pic 4. CW04



Pic.5 LSJ010

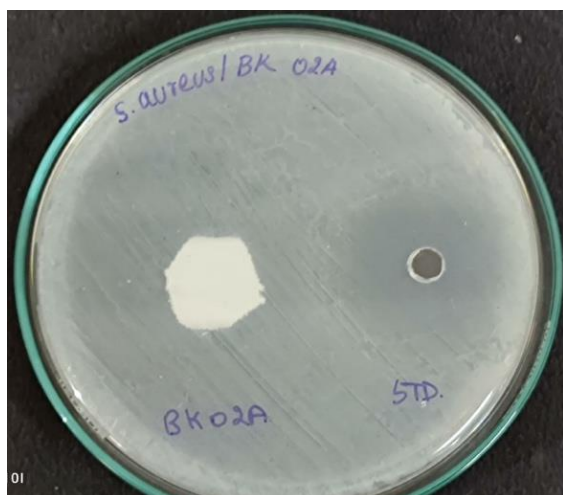
The antibacterial activity for the above mention fabric was determined by Well Diffusion method (Bauer *et al.*, 1996). MHA plates were prepared by pouring 20ml of molten media into sterile Petri plates. After solidification of media, 20-25 μ l suspension of bacterial inoculums was swabbed uniformly. The sterile paper discs were dipped into required solvents then placed in agar plates. After that, the plates were incubated at 37°C for 24 hours. Assay was carried into triplicates and control plates were also maintained. Zone of inhibition was measured from the edge of the well to the zone in mm. The tested cell suspension was spread on mullerhintonagar plate and potato dextrose agar. Wells were put into the agar medium



using sterile forceps. Then plates were incubated at 37°C for about 24 hours and control was also maintained. Zone of inhibition was measured from the clear zone in mm. Antibacterial activity was performed by agar diffusion method.

Pic 01 CKO1A

Van der Watt *et al.*, 2001. The stock culture of bacteria, *Staphylococcus aureus* was received by inoculating in nutrient broth media and grown at 37 °C for 18 hours. The agar plates of the above media were prepared. Each plates was inoculated with 18 hours old cultured bacteria's which were swabbed in the sterile plates. All the plates shown in Pic 01 CK01A, Pic 02 BKO2A, Pic 03 CBWO3A, Pic 04 CW04A, Pic 05LSJ0010 were incubated at 37° C for 24 hours and the diameter of inhibition zone was noted in mm.



Pic 02 BKO2A

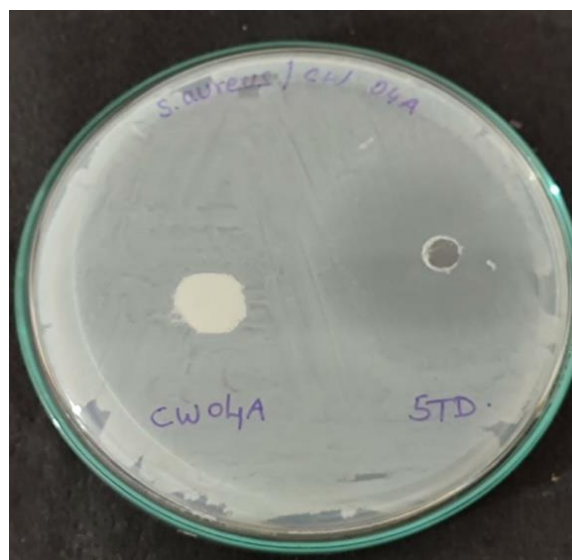


Pic 03 CBWO3A

Pic
04CW04A



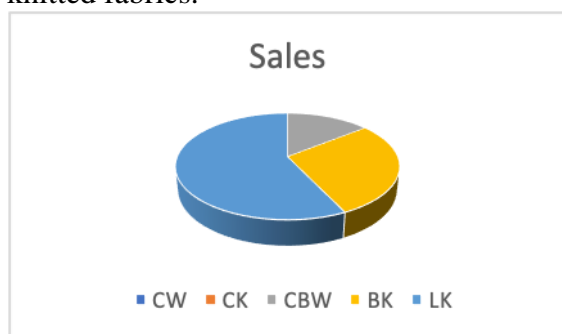
Pic 05LSJ0010



Observing from the well diffusion plates the following results were obtained and its given below in the table.

Table 1. Anti -bacterial activity

As a result, the knitted fabrics were better than woven fabric in the anti-bacterial activity. Lyocell Performed 2mm in the zone of inhibition and bamboo performed 1mm in the zone of inhibition. Comparatively both Lyocell and Bamboo were better than Cotton woven and Cotton knitted fabrics.



Overall, there are many fabrics available but the choice of Lyocell and bamboo Knitted fabrics can be suggested for Chemotherapy patients and further functional finishes can be enhanced. To analyze better performance of the fabric in comfortability Kawabatta test or tests related to that can be done.

References:

1. Altun İ, Sonkaya A. The Most Common Side Effects Experienced by Patients Were Receiving First Cycle of Chemotherapy. *Iran J Public Health*. 2018 Aug;47 (8) : 1218-1219. PMID: 30186799; PMCID: PMC6123577.
2. Victoria Wochna Loerzel. Symptoms experience in older adults undergoing treatment for cancer. *Older Adults, Cancer, Adverse Effects, Mental Health, Physical Functioning* 2015,42(3), E269-E278. DOI: 10.1188/15.ONF.E269-E23
3. Lauren Castiello, MS, AGNP-C /Jessica Caporuscio, March 31, 2021, <https://www.medicalnewstoday.com/articles/skin-changes-after-chemotherapy#rash>
4. Annapoorani, S. Grace. "Recent developments in medical textiles

Concentration	Zone of inhibition Specimen	Standard (Chloramphenicol)
CK01A	No zone	10 mm
BKO2A	1mm	10 mm
CBW03A	0.05mm	10 mm
CWO4A	No zone	10 mm
LSJ010	2mm	10mm

implantable devices A an overview. " *GJRA* 2 (2013): 12.

5. Singh, Zorawar & Bhalla, Sunita. (2017). Toxicity of Synthetic Fibres and Human Health. *Advance Research in Textile Engineering*.10121015.10.26420/advrestexteng.2017.

6. Lamotte, R.H. 1977. Psychophysical and neurophysiological studies of tactile sensibility. In *clothing comfort* (N.R.S. Hollies and R.F. Goldman, Eds.) pp. 83-105, Ann Arbor Science Publishers Inc, Ann Arbor

7. Tiwari M. December 2010. Thermal comfort of textile materials and its assessment. *Textile Review Magazine*.2-13

8. Vermeersch et al., 2018, *Advanced Characterisation and testing of Textiles*, Wood head publishing. P 60.

9. Sharmila Anish M et al., 2013, Clothing comfortability of cancer patients. *International Journal of Science and Research (IJSR)* ISSN (Online): 2319-7064, Volume 4, Issue 7.

10. https://australiancotton.com.au/supply_chain/the-features-and-benefits-of-cotton.

11. <https://www.comfortworld.co.uk/long-live-clothes/the-special-properties-of-silk.html>

12. Mazurek Lukasz et al., 2002, Silk Fibroin biomaterial and their beneficial role in skin wound healing. *Biomolecules*. 2022 Dec; 12(12): 1852. Published online 2022 Dec12. doi: 10.3390/biom1212

1852,PMCID: PMC9775069,PMID: 3655
1280.

13.<https://oeteo.co/blogs/news/bamboo-fabric-what-is-it-and-benefits-for-baby>

14.<https://www.truenorthgear.com/news/lyocell-the-sustainable-fiber#:~:text=Lyocell%20is%20produced%20by%20dissolving, into%20a%20variety%20of%20products.>

15.<https://www.makefashionbetter.com/contact-us>