

COMPARATIVE STUDY ON CASEIN FABRIC AND TAFFETA FABRIC: A SUSTAINABLE APPROACH FOR NEW FASHION MATERIAL

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ABSTRACT

Natural fibres are at an eco-fashion movement that seeks to create garments that are sustainable at every stage of their life cycle, from production to disposal. The aimed exploration in this has brought many new fibres that can serve the needs of Textile industry. Sustainable products are the need of the hour and so it has become more attractive research field which can overcome the environmental issues. A fact is that generally over looked, all-natural fibres are not eco-friendly fibres while few man-made fibres can be. We have made an attempt in this research work to explore Casein fabric applications. A comparative study of physical, chemical and mechanical properties between Casein and Silk Taffeta fabric had been carefully demonstrated. Very encouraging results have been obtained.

Keywords: Air permeability, Casein fibre, Comfort, Fastness properties, Strength.

I. INTRODUCTION

Casein fibre commonly known as milk fibre produced from the huge amount of discarded milk and it is obtained by the acid treatment of skimmed milk. Apparently, it takes about 100 pounds of skim milk to make 3 pounds of Casein fibre and it contains 18 types of amino acids extracts. These fibres resemble as wool, having a soft warm handle also providing good thermal insulation¹. It has got valid international ecological textile certification of Oeko-Tex Standard 100, approved it in April 2004. Commercial Casein is generally made in two forms; Rennet Casein and Acid Casein. Acid Casein is widely used for spinning of textile fibres. It is made by precipitation from milk by mineral acids, or by separation after allowing the milk to sour. The dried product is made into a solution using dilute caustic and this process is similar to that of other synthetic fibres. Casein fibre offers new business opportunities for the dairy industry to compete in green market. The fabric has its own special characteristic like silky, smooth, comfort, high moisture regain and very desirable for high fashion articles¹⁻⁵.

II. EXPERIMENTAL SECTION

2.1 Materials

100% raw Casein fabric was purchased from Champs Agro Unit Pvt Ltd, Mumbai, India. Silk Taffeta RFDfabric was purchased from Ichalkaranji, India. Hydrogen Peroxide, Sodium Carbonate and Detergent chemicals (LR grade) used for pre-treatment purposes. Red Telon AFG, a red dye purchased from DyStar, India. Dyeing process carried out by Mathis Labomat machine. Fabric details as mentioned below table no.1.

Table-1: Fabric details

PARTICULARS	CASEIN	TAFFETA
Weave	PLAIN	PLAIN
EPI	98	85
PPI	84	97
Warp Type	CASEIN	POLYESTER
Ne Count	60	35.4

Tex Count	10	16
Weft Type	CASEIN	SILK
Ne Count	50	118.12
Tex Count	12	5
GSM	81	76

2.2 Methodology:

2.2.1 Bleaching process:

Bleaching process was carried out for Casein fabric as per below recipe;

- Hydrogen Peroxide (50%) - 4 vol
- Sodium Carbonate - 2 gpl
- Stabilizer - 1 gpl
- Detergent - 0.5 gpl
- Temperature - 60°C
- Time - 30 min
- MLR - 1:30

2.2.2 Dyeing process:

Casein and Silk Taffeta fabrics dyeing was carried out by using Mathis machine as per below conditions;

- Dye - 1%
- Acetic acid - 2%
- Ammonium acetate - 5 gpl
- Temperature - 70°C
- Time - 30 min

III. RESULTS & DISCUSSIONS

3.1 Tensile Strength

Casein yarn has a moderate strength as that like of Polyester staple yarn while Silk is a high strength filament yarn. The same is reflected during fabric strength testing. Taffeta being heterogeneous fabric it has extremely high strength in Weft way direction, due to use of Silk and higher PPI. Figure 1 result also indicate the same.

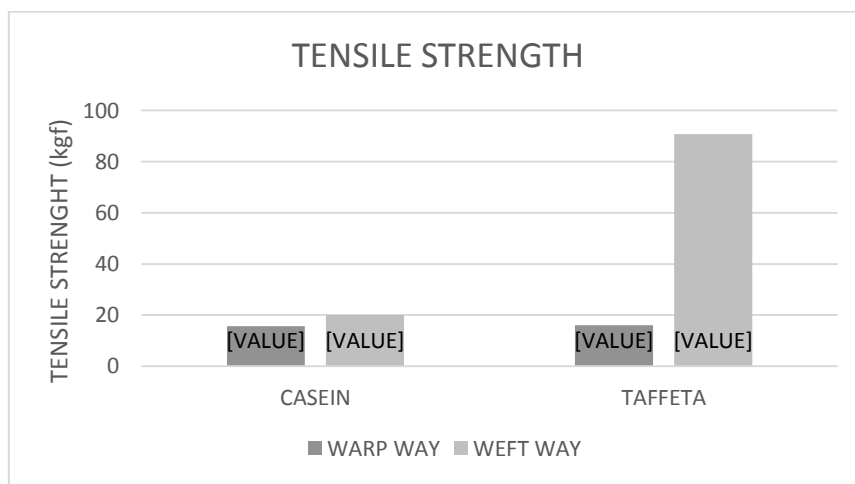


Fig.-1: Tensile strength

3.2 Elongation

The elongation measured along with tensile strength shows moderate results for both the fabrics. From figure 2 results of weft way elongation of casein fabric is maximum of all with the value of 8.14%, it indicates that elongation happened in fabric width direction.

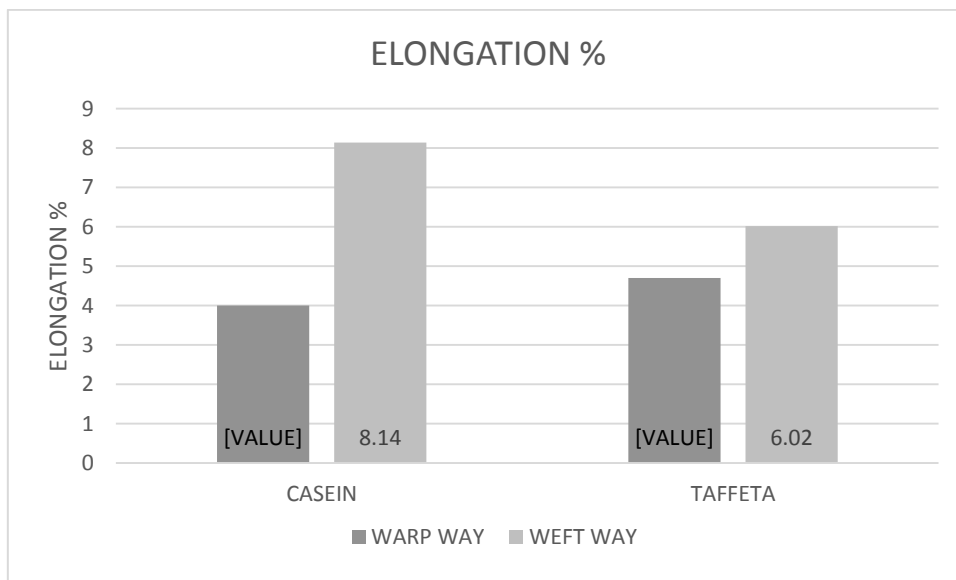


Fig.-2: Elongation

3.3 Moisture regain

The milk protein contains the natural humectants factor, which can capture moisture and maintain the skin's moisture. It makes the skin tender and smooth and reduces wrinkles. Figure no 3 result also shows that Casein fibre have good moisture content (9.73%) which is higher than Silk Taffeta and even Cotton.

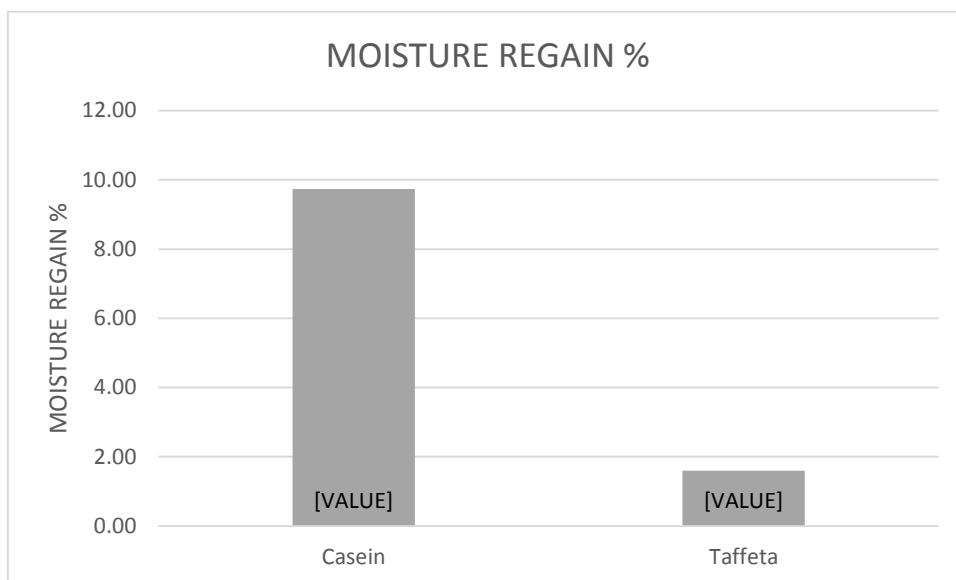


Fig.-3: Moisture Regain (%) values

3.4 Air permeability (AP)

In general air permeability is depends upon GSM, thickness, fabric porosity, weaving style and yarn structural property. Moisture absorption and cross-sectional factors are having less influence on air permeability. The results depicted in figure no 4, that Casein fabric has very high AP value than Silk taffeta (21.23 >4.45). Since weaving style and GSM of the both fabrics are similar, the huge difference is a result of the fibre properties and staple or filament yarn. Inherently, Polyester and Silk will result into poor AP while Casein will have significantly higher AP values.

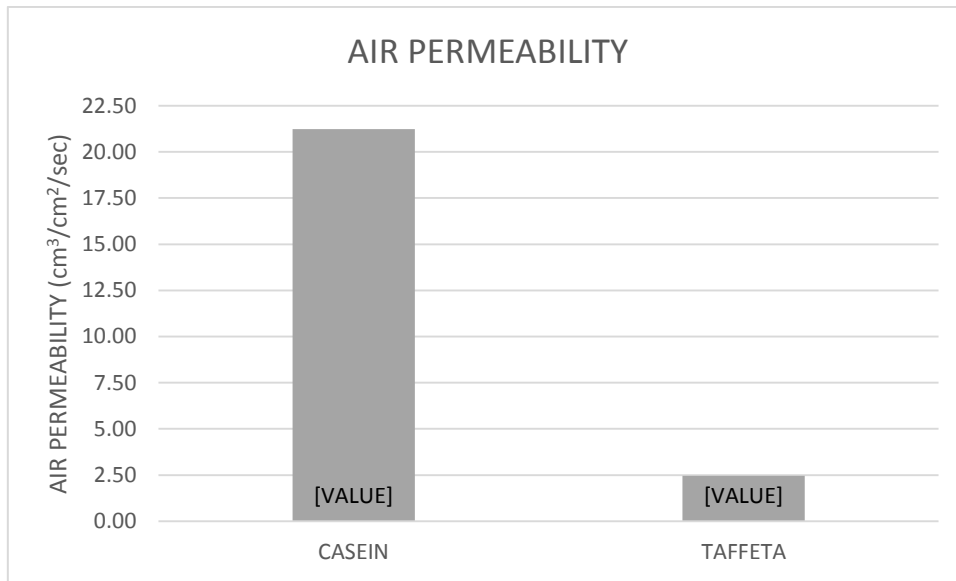


Fig.-4 Air permeability

3.5 Crease Recovery angle (CRA)

Casein fabric have a homogeneous nature in warp and weft direction. Taffeta is heterogeneous nature (warp-PET & weft-Silk). Casein is protein fibre once creased and pressed at new location hydrogen bond or ionic bond will form. Therefore, creasing is easy. However, recovery is less than silk, as silk is triangular multifilament yarn showed better crease recovery. Also, PET has equivalent recovery with Silk. Cumulatively both are superior to Casein as proved in figure no 5 data.

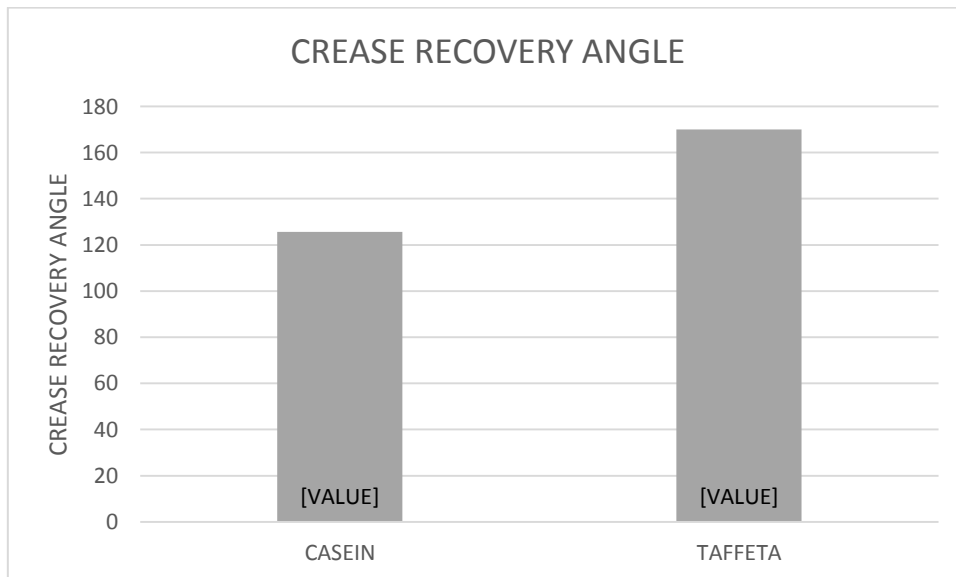


Fig.-5: Crease recovery angle

3.6 Stiffness

The test results have depicted in figure no 6, that stiffness of Casein is pretty low when compared to Taffeta. The higher bending modulus of Taffeta is because of the filament-based yarn present in both directions. The yarn being stiff has resulted into a stiffer fabric.

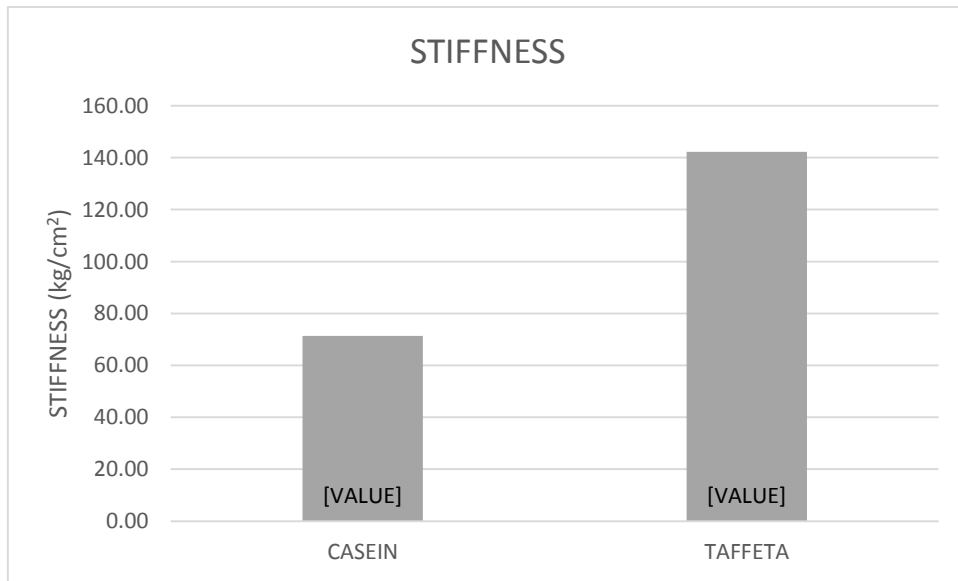


Fig-6: Stiffness

3.7 Drape

Casein fabric is a protein-based fibre and has better flexibility than silk and PET. The Less stiff Casein has better drape and so lower drape coefficient of 19.04% when compared to Taffeta having 51.35%, this also mentioned in figure no 7.

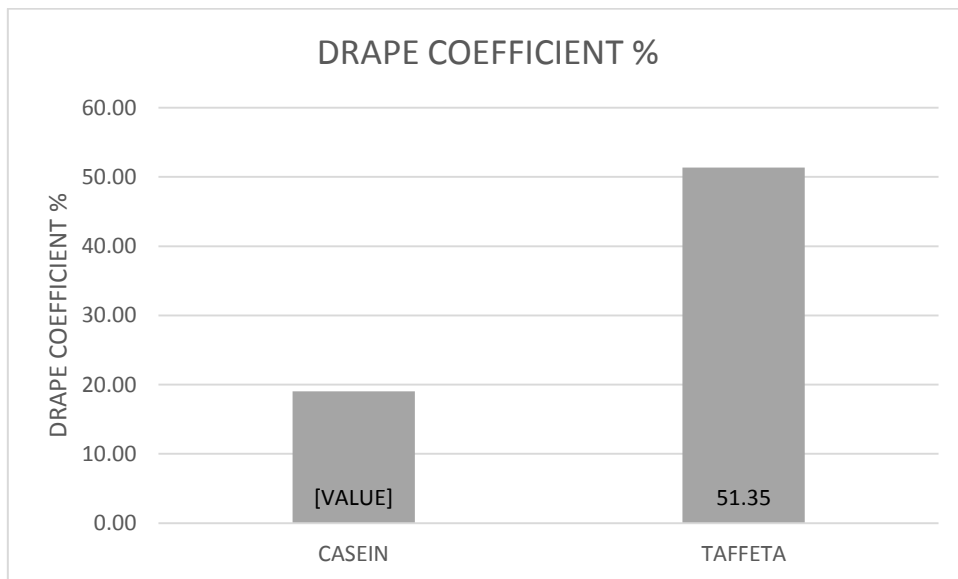


Fig-7: Drapability of Casein & Taffeta

3.8 Tear strength

Taffeta fabric contains Silk and PET (weft and warp respectively) heterogeneous fibres, shown better strength as compared with Casein fabric (homogeneous fibre). The resistance to allow the tear to propagate is highest when it has to propagate through silk (Weft way), Casein also shows reasonable results and in figure no 8 indicates the values.

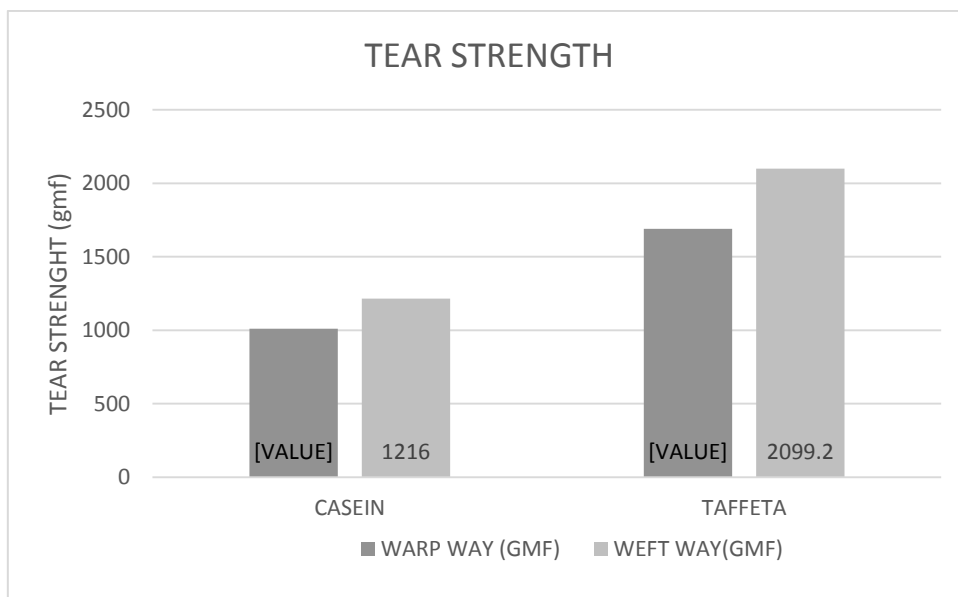


Fig.-8: Tear strength

3.9 Washing fastness

Fastness properties like washing, rubbing and perspiration results are mentioned in below table no 2. Results are not much change in both the fabric. It might be the fibre properties.

Table-2: Colour fastness to washing, rubbing and perspiration

COLOUR FASTNESS TO		Casein Rating	Taffeta Rating	
A	Washing			
		Grey Scale	3	4
		Staining Scale	4	4
B	Rubbing			
	Dry	Grey Scale	4	4
		Staining Scale	4	4
	Wet	Grey Scale	3	4
Staining Scale		4	4	
C	Perspiration			
	Acidic	Grey Scale	3	3
		Staining Scale	4	4
	Alkaline	Grey Scale	4	3
Staining Scale		4	4	

(Rating 1 = Very poor, 2 = Poor, 3 = Average, 4 = Good, 5 = Very good)

3.10 Pilling Propensity

The pilling resistance of Taffeta is better than Casein. The rating in the below mentioned table is obtained after 18000 revolutions,5 hours.

Table-3: Pilling Propensity

Sample	Rating
Casein	2
Taffeta	4

(Rating 1 = Very poor, 2 = Poor, 3 = Average, 4 = Good, 5 = Very good)

IV. CONCLUSIONS

Casein Fabric is hydrophilic in nature and having high moisture regain than cotton, Silk and wool fibre. It has got far better Air permeability when compared with Taffeta. The mechanical properties relating to tensile strength, elongation and pilling resistance are moderate to inferior in comparison with Taffeta. Tear strength is extremely high for Taffeta against Casein. The Casein fabric is very flexible and have extremely good drape and moderate bending modulus making it more formable to be used as garment. Colour fastness properties are more or less same as that of Taffeta and no significant changes were observed. In a nutshell, better moisture regain and air permeability it is a highly breathable fabric, and can find potential application in garment manufacturing. Fabric being flexible, the formability required in garments is also well served. In regards of other mechanical properties, blends with some other similar materials the purpose can be meet. Moreover, in a world where natural based sustainable products are in demand more research can done further.

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V. REFERENCES

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