

Biotechnology in Fashion- A Review

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Abstract- Biotechnology can be broadly defined as "using organisms or their products for commercial purposes." Fashion is an expression it will always be unique to everyone. Contribution of biotechnology in fashion is gradually becoming new rage. This present review represents biotechnology in fashion designing and majorly highlighting microbial cellulose (biopolymer, most abundant and renewable natural resource on earth) for cloth making. The process utilizes *Acetobacter xylinum*, a non-hazardous and non-pathogenic bacterium, to produce cellulosic nano-fibers -chemically similar to cotton-. These nano-fibers form a dense structure, as we call it, the Microbial Non-Woven (MNW). Experts predict that fashion garments and clothing and home furnishings made from new class of biodegradable, environment friendly products could become a \$15 billion business in few years, emulating the success of organic food and beauty products.

Key words - Biotechnology, Fashion, *Acetobacter xylinum*, Microbial Cellulose

I. Introduction

Biotechnology is not a single technology. Rather it is a group of technologies that share common characteristics -- working with living cells and their molecules and having a wide range of practice uses that can improve our lives. . Biotechnology can be broadly defined as "using organisms or their products for commercial purposes." As such, (traditional) biotechnology has been practiced since the beginning of recorded history. It has been used to bake bread; brew alcoholic beverages, and breed food crops or domestic animals. But recent developments in molecular biology have given biotechnology new meaning, new prominence, and new potential. It is (modern) biotechnology that has captured the attention of the public.

Fashion is an expression it will always be unique to everyone. Fashion is a popular style or practice, especially in clothing, footwear, accessories, makeup, body or furniture. Contribution of biotechnology in fashion is gradually becoming new rage. Biotechnology in fashion can be expressed by means of microbial derived clothes. Cellulose is one of the most abundant polysaccharides and is considered as an inexhaustible and unique source of new materials for a wide number of applications [1]. Cellulose from bacterial source is called bacterial cellulose (BC). Bacterial cellulose is an exopolysaccharide produced by various species of bacteria such as in the genera, *Gluconacetobacter*, *Agrobacterium*, *Achromobacter*, *Azotobacter*, *Rhizobium*, *Sarcina*, *Salmonella*, *Enterobacter*, etc [2-4]. Bacterial Cellulose has many desirable properties such as high purity (free of lignin and hemicelluloses), high crystalline, a high degree of polymerization, a nano-structured work, a high wet tensile strength, a high water holding capacity, and good biocompatibility [5]. The American Chemical Society reported in February 2007 in the Science Daily [8] that biotechnology's next high-value product could be microbial cellulose, a form of cellulose produced naturally by bacteria. Along with this bacterial cellulose is receiving great attention for its wide applications in Fashion and Textile industry.

There is lot of connection between biotechnology and fashion since from 2006. BIO (Biotechnology Innovation Organization) was used as a platform to display apparels, gowns and other dresses made from corn (polyactic acid - polyester) rather than petroleum. BIO staffers who did the catwalk at a special session in a variety of biotech based clothes: a racerback tank dress, Korean crew cream jacket, short sleeve shirt with floral accents and a sheer INGENEO gown with wings.

INGEO is one of the world’s first commercially available families of fibers made entirely from renewable resources. It is produced from natural plant sugars and corn using a patented technology. The polyactive polymer is branded as INGEO and is biodegradable.

II. Methodology

Production of cellulose and transforming it into garments:

Method 1:

1. Glucose rich media is prepared and *Acetobacter xylinum* is inoculated
2. Incubated for 10 days
3. Pellicle cellulose is formed which is treated with 2 methods
 - Chemical treatment
 - Alkali/detergent treatment
4. Cellulosic nano-fibers are formed. These nano-fibers chemically similar to cotton-. These form a dense structure, as we call it, the Microbial Non-Woven (MNW)
5. Compared to cotton, MNW possesses superior properties such as high purity and density, shape retention, high water uptake, enhanced tensile strength, and larger surface area when wet

Method 2:

1. The material and garments (Fig. 1) was made from the bacterial fermentation of wine, beer or most alcoholic beverage as a possible pathway (Fig. 2.)
2. Culture of naturally occurring *A. xylinum* was employed, a vinegar producing bacteria, in a vat of wine.
3. The *A. xylinum* have the central role in this process by converting the alcohol as well as any suitable carbon source in the vat into cellulosic micro-fibers.
4. This microbial cellulose is chemically similar to cotton. Therefore, the garments are made from microbial cotton.
5. The microbial cotton was formed on the surface of the wine, almost as if the bacteria are trying to form a raft to flow on the wine in order to have access to oxygen in the air.
6. The bacteria's end product is vinegar, which makes the garment smell a bit pungent; however, the garments are more environmentally friendly than genetically engineered cotton plants. The 2-dimensional form that we extracted from the vat is then formed into a garment.
7. Perfected a culturing technique that will allow the bacteria to form a 3-dimensional garment that will be seamless (6)

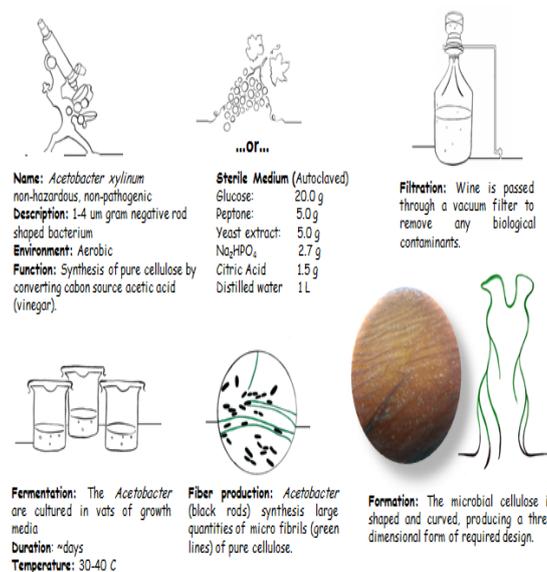


Figure 1: Adopted from J.Eryilmaz et al., (2013)

Method 3: Bio Couture

1. Take 30 liters of green tea add 500g sugar and dissolve it
2. Pour this solution in bath spa and maintain temperature at 30⁰c
3. Add microorganism (*A. xylinum*) and acetic acid
4. After 3 to 4 weeks the cellulose is formed
5. it is washed with cold water and dried on wooden plywood
6. This cellulose can be molded in 3 dimensional to get clothes

III Conclusion

Looking and being looked at, wearing and being worn is the career of the self. All technologies are also technologies of looking and wearing. You see ecology, the cooperation of species is itself deep FASHION. The idea of bio-synthesizing full garment pieces out of substances added into a solution and a straight-forward chemical cross-linking treatment after can potentially obviate majority of the steps involved in standard garment production. These involve but not limited to spinning, weaving, cutting, sewing, and many other steps known in textile industry as pre-treatment and as finishes. The former is due to direct bio-synthesis into any shape, whereas the latter is due to its purity or to the simplicity of its surface chemistry. Bio-based fabrics are all set to swamp the shelves around the world in a few years. Experts predict that fashion garments and clothing and home furnishings made form new class of biodegradable, environment friendly products could become a \$15 billion business in few years, emulating the success of organic food and beauty products. It is an “EVER GREEN” combination of technology and fashion (Biotechnology in fashion) which can only end with life.

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