Benefit from Flax Fiber Cross Section Shape in Fabrics Design

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Abstract

Human has invented textile industry since ancient times, in search of what protects the body from external factors surrounding him, from different climatic changes and other environmental factors.

Flax fibers are found in the outer shell of the stalk of the flax plant, these fibers are distinguished by their appearance in the form of polygonal cells under the microscope, which are pentagon or hexagon shapes, and have an outer wall that separates each one from the other.

These fibers are attached to each other by lignin, forming bundles that consist of large number of flax fibers, which are separated during the maceration process.

Many pieces of linen fabrics were found in the era of the ancient Egyptians, which were made from flax yarns, also ancient Egyptians used linen fabrics in their daily clothes, as well as in shrouding their dead after the mummification process.

This research benefits from flax fiber shape in textile design, and the use of the microscopic shape of the cross-section of them to draw number of textile designs inspired from the cross-section shape of these fibers, to produce fabrics that are suitable for upholstery fabrics, using (Ned Graphic Textile Program) to implement the design ideas.

Using (Photoshop software program) to make some changes in the shape of the fiber sector, and add some effects to these designs.

6 ideas were designed from the flax fibers cross-section shape, choosing three color groups for each of these designs, where each design consists of five different colors (two colors of warp: two colors of the weft: one color blend between one color from warp and one color from weft). Use the graph to determine the percentage of five color appearance used in each design.

Key words

Flax Fiber- Cross Section- Textile Design- textile program- Double Weave.

الملخص

ابتكرالانسان صناعة النسيج منذ القدم، بحثا عن ما يحمي جسده من العوامل الخارجية المحيطة به من تغيرات مناخية مختلفة وعوامل بيئية اخري، وكانت اول خامة استخدمها الانسان قديما في صناعة الاقمشة هي خامة الكتان.

توجد الياف الكتان في اللحاء الخارجي لساق نبات الكتان ، وتتميز الياف الكتان بظهورها علي هيئة خلايا متعددة الاضلاع تحت الميكرسكوب، والتي تكون خماسية او سداسية الاضلاع، ولها جدار خارجي يفصل كل شعرة عن الاخري.

وتلتصق هذه الالياف مع بعضها البعض بواسطة مادة اللجنين مكونة حزم تضم كل عدد كبير من الالياف النباتية المتصلة، والتي يتم فصلها اثناء عملية التعطين.

وتم العثور علي العديد من القطع النسيجة الاثرية في عصر المصريين القدماء، والتي كانت المصنوعة من خامة الكتان ، حيث استخدمها المصريين القدماء في ملابسهم اليومية، وكذلك في تكفين موتاهم بعد اجراء عملية التحنيط لهم.

هذا البحث يتناول خامة الكتان من حيث استخدامها في مجال تصميم المنسوجات، والاستعانة بالشكل الميكرسكوبي للقطاع العرضي للالياف الكتان، واستنباط عدد من التصميمات النسجية المستوحاه من شكل القطاع العرضي لهذه الالياف،لانتاج اقمشة تصلح كاقمشة مفروشات ، مع الاستعانة ببرنامج المنسوجات (Ned Graphic) لتنفيذ الافكارالتصميمية .
واستخدام برنامج (Photoshop software) لإحداث بعض التغيرات في شكل القطاع للالياف، واضافة بعض التأثيرات على هذه التصاميم.
تم تصميم عدد 6 افكار مستوحاه من شكل القطاع العرضي لالياف الكتان، اختيار ثلاث مجموعات لونية لكل تصميم من هذه التصميمات، حيث يتكون كل تصميم من عدد خمس الوان مختلفة (لونين من السداء: لونين من اللحمة: لون خلط بين لون من السداء ولون من اللحمة).
الاستعانة بالشكل البياني لتوضيح نسبة ظهور الخمسة الوان المستخدمة في كل تصميم من الافكار التصميمة محل البحث.

الكلمات المفتاحية
الياف الكتان- القطاع العرضي- تصميم النسيج- برنامج النسيج- النسيج المزدوج.

1. Introduction

Many of the Ancient Egyptian tapestries were made from Flax Fibers, which were used by the Ancient Egyptians in their daily clothes, as well as in the shrouding of their dead after mummification.

Flax fibers have received great attention since ancient times to be used in many of textile productions, this fiber should be dealt with carefully in all stages to extract fibers from their stalks.

This research is dealing with flax cross section to use it in the field of textile design, and the development of a number of textile designs inspired by the shape of flax fiber cross-section.

In the production of woven fabrics, textile materials are a source of inspiration for the textile designer.

This search has been studying and analyzing the shapes of the cross sections of flax fiber, as a natural textile material, because flax fiber has a semi-geometric shape of its cross section.

2. Background

2.1 Flax Fibers

Flax Fibers are characterized by their appearance as polygonal cells under the microscope, which are pentagonal or hexagonal, and have an outer wall which separates each one of these fibers.

These fibers stick with each other by lignin, forming bundles of each large number of continuous plant fibers, which are separated during administration[1-4].

Flax fiber (also known as common flax or linseed), which has been planted throughout the world for millennia, is the source of many products which have existing, high-value in markets of textile's products.

Flax fiber which is extracted from the stalk of the flax plant, is soft, lustrous and flexible, bundles of fiber that have the appearance of blonde hair, results in long fibers and short fibers, hence the description "flaxen" [5].

It is stronger than cotton fiber but with less elasticity, and it's the source of industrial fibers that are being used currently in many industrial fields [1, 6].

Flax fibers are found in bundles in the outer bark of the flax stem. Each bundle consists of a large number of fibers bound together[7].

2.2. Flax Fiber Cross Section

The base chemical polymer in flax fibers is cellulose, which reaches up to 79.56% of the constituents of flax fiber [8].

In a single fiber, there are several different layers that make up the fiber's structure which is the primary wall, secondary wall, and the center lumen from outside to inside[9, 10].

The cellulose is deposited as spiral layers inside the flax hair, which gives the characteristics of flax fibers, of durability, elasticity and absorption of moisture [4, 11].

in addition to lignin, which its amount reaches up to 9.4% of the construction of the fiber [1].

The diameter of the flax hair is about 10 microns. Figure (1) shows pictures of some cross sections of flax fibers under the electronic microscope [12].

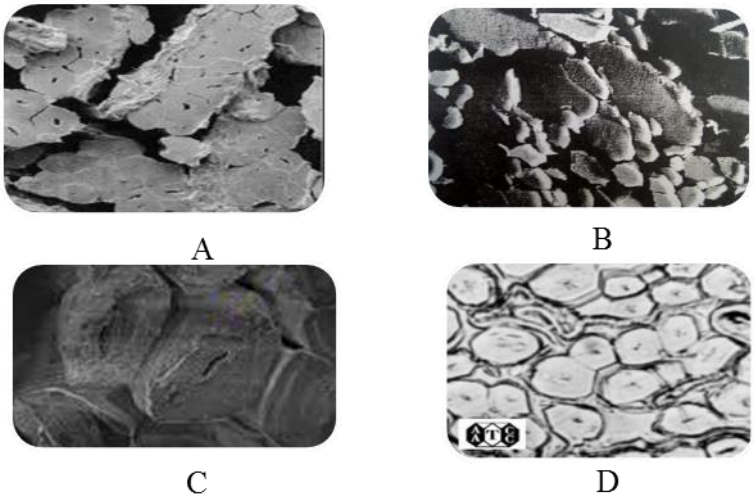


Figure 1(A-B-C-D) [13, 8, 14, and 15]: Some images of cross sections of groups of flax fibers under electronic microscope

The design and production processes are both subjected to total digital control, of which the design data of the jacquard fabric, from design to weaving is all processed, controlled, and transmitted in the computer [16], figure 2. represents these steps for textile design process.

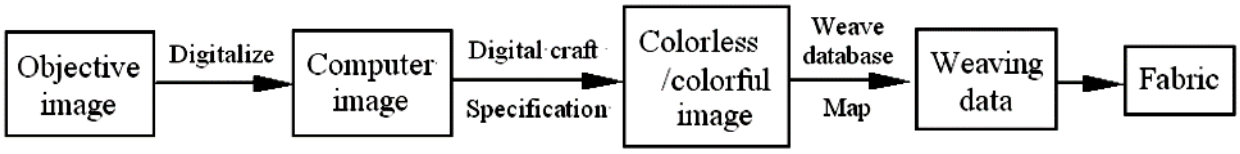


Figure 2: Textile Design Process

Since the theory of computer technology originated from the principle of figured information control over jacquard, it is applicable to digitize objective images with digital technology, and to put these digital images under innovative digital design directly into structural design [17].

This design concept and method have thoroughly removed the constraint of hand drawing, injecting innovation for jacquard into the overall process of designing[18].

The linear fibers cross-sectional sector was used to create designs inspired by these cross sections that can be used as upholstery fabrics, in some steps to have a textile design[16, 19].

3. Materials and Methods

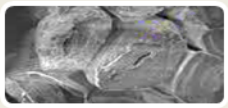
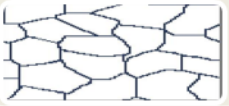
3.1. Designs Preparation

Double weave has been used in this paper, to produce fabrics that can be used by its two face, using Satin 5 construction in face and back to have a pure color from warp and weft yarns, and using twill weave construction to have the blend ratio between warp and weft yarns.

3.2. Design processes

The design process used Ned Graphic software to create all designs, there are some steps to have designs from flax fiber cross section, which are represented on table (1)

Table (1): Designs Preparation Steps

	1- Selection one of the cross section shape of flax fibers[14]
	2- Draw the external frame of flax cells walls
	3- customization of flax cells
	4- Drawing flax cells without lignin
	5- Put color ideas

4. Results and Dissections

After completion and access to the appropriate designs, we can implement these designs to be used as upholstery fabrics, with five different colors for each design.

4.1. Design ideas

Design and Color ideas were represented in Figures (3, 4, 5, 6, 7 and 8).

Figure 3: Design 1

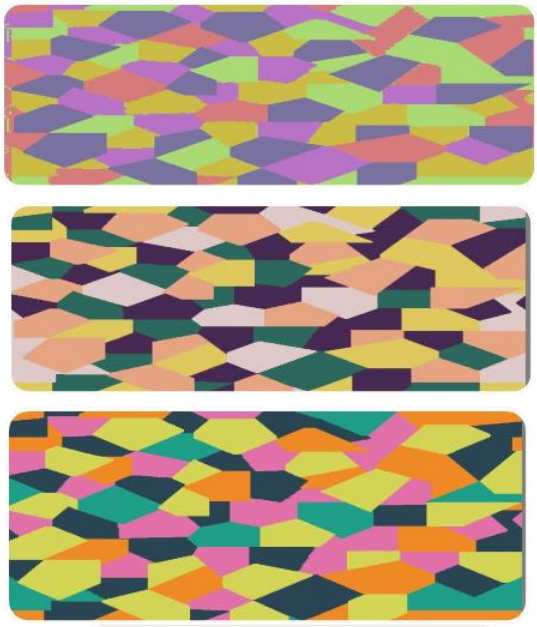


Figure 4: Design 2

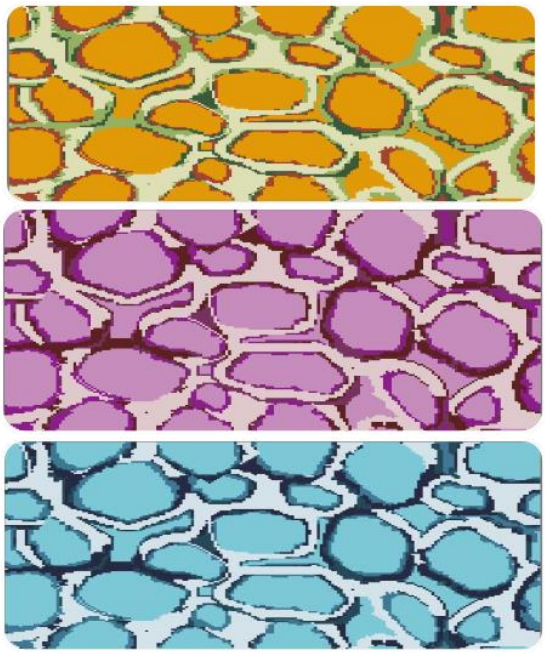


Figure 5: Design 3

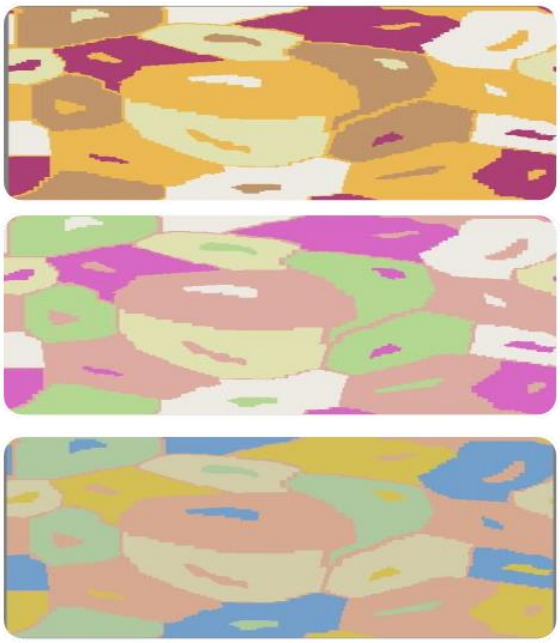


Figure 6: Design 4

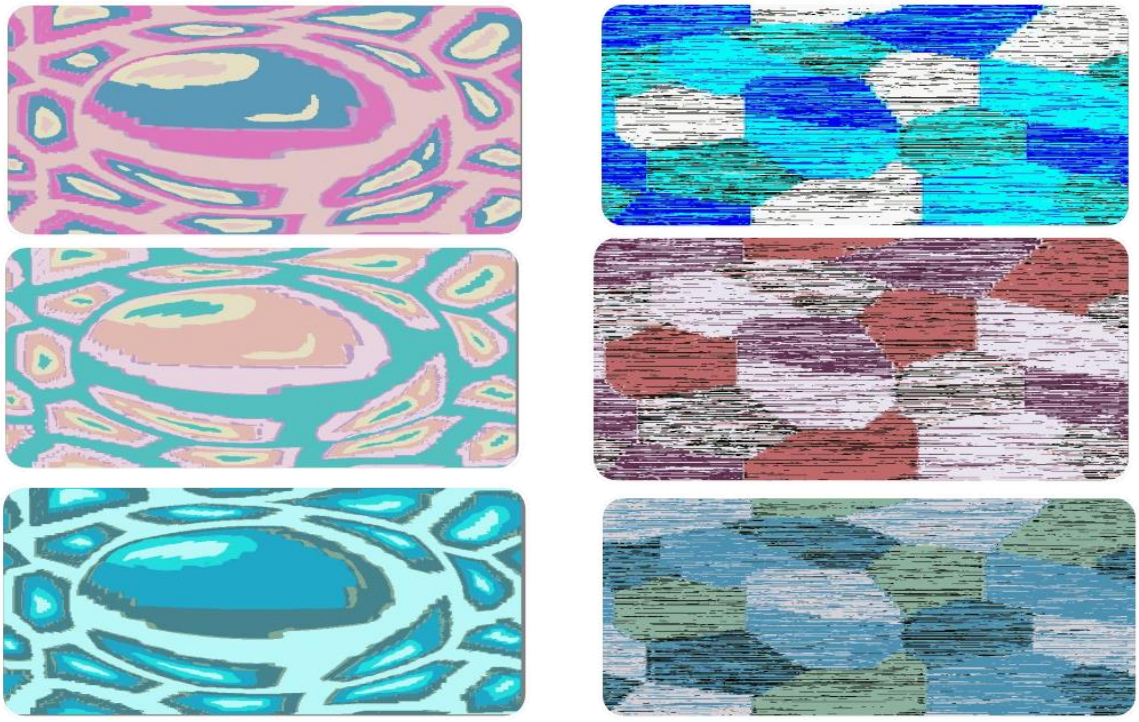


Figure 8: Design 6

4.2. Reading of Design ideas

Reading designs to produce the ideas of these designs, and show three different color ideas for each one of these designs.

Design 1: Produces the cross section of flax cells with different sizes, and lignin, with strait lines for cells walls, and make some effects on surface of the design.

Design 2: draw outlines cross section of flax cells with different sizes, without lignin or cells lumens.

Design 3: Produces the cross section of flax cells with different sizes, and lignin, with curves lines for cells walls with dark color, to make cells more clear.

Design 4: Gives the flax cells cross sections more roundness, without lignin, and make cells appear lumens.

Design 5: Gives bunch for the flax cells cross section in the middle of it, to make it look like a stretched surface**.**

Design 6: Draw cross section in flax cells with four different colors, and use the fifth color to make shredding on the surface of the design.

4.3. Design color percentage

These color ideas are prior to the implementation of the design on the jacquard weaving machine according to the executive specification unit of the jacquard which is used.

Table (4) represents the percentage of appearance of each color as shown in figure (8).

Table (4): results of color percentage

	Design 1	Design 2	Design 3	Design 4	Design 5	Design 6
A warp	25.7	28.3	47.6	34.3	34.7	44.4
B warp	23.3	22.2	24.7	22	23.6	22.7
A weft	20.5	18.9	11	15.9	22.5	20.3
B weft	19.8	18	10.1	14.9	10.4	11.6
Blend	10.7	12.5	6.5	12.9	8.9	1.0

Shown in table 4 and figure 8, the appearance of each color in different design is degradable from the highest percentage to the lowest percentage, which gave good influence on customers that occur by using satin weave for the constructions in the face and back of fabrics.

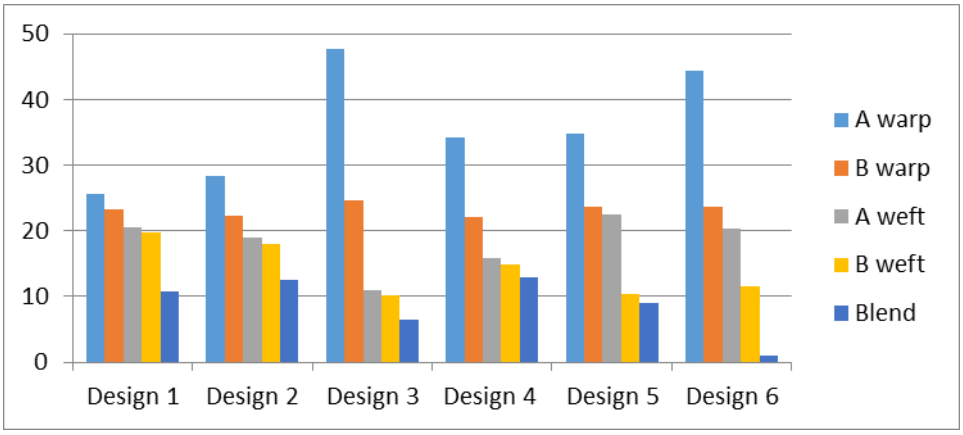


Figure (9): chart of design color percentage

5. Conclusion

In this research we aspire for optimization of the use of textile fibers, and use fibers cross sections as a new source of textiles designs for upholstery fabrics.

Flax fiber cross section was used in this research as a design source, and using a textile program (Ned Graphic), to show how it can be made? and the way that was used to implement this design with different constructions.

Many other natural textile fibers can be used as a textile design source, that each of natural textile fibers has its own cross section, and can determine these fibers easy from their cross sections.

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