The use of glass technology and technical textiles in the production of printed textile hangings to increase the awareness of the aesthetic side in medical institutions

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Abstract

Technical Textile Technology has remained unique to developed industrial countries, and it was established to perform specified functions in applied fields that are connected to the most of life activities in general. Using Technical Textile has become more widespread as performance and functional qualities in various application, based on final uses starting from choosing fibers to methods of treatment, is the key for developing new products in textile field. Technical Textile plays a vital and effective role in all life fields like: economic and social field.

The research aims to show the possibility of making use of technical textile in applied art by making printed textile hangings, to make use of its various qualities at first place inflammability and electrical insulation, and by combining textile printing techniques and glass technology for its significant impact in adding distinguished characteristics and creative artistic appearance, and in finding solutions, decorative and aesthetical treatments for printed textile posters in medical institutions, with the objective of providing adequate psychological atmosphere for the patients and the designs that can improve the surrounding environmental conditions, contributing to increase treatment efficiency.

Keywords: glass technology-technical textiles- printed textile hangings- medical institutions

Research problem

The research aims to answer the following questions:

1- How possible is it to use glass technology and technical textile in to show the aesthetic and practical side in medical institutions?

2- How to combine applied arts specifications to create innovative and practical products.

3- How to protect a printed textile poster from environmental factors and how to increase its serviceable life?

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Research Aim

1- Studying technical textile, its types and various uses.
2- Combining applied art specifications to find new and innovative designs
3-Applying and utilizing technical textile in producing printed textile hangings to highlight aesthetic sides to provide adequate psychological environment for the patients.

Research importance

1- Considering the rarity of researches that study technical textile as a new material to utilize, this current research is a basic step to proceed from, and is considered a sort of motivation for researchers to increase their interest in technical textile, with the objective of utilising it to solve different applied and technological problems in creative methods.
2- Combining textile printing techniques and glass technology to get new designs
3- Reflecting the artistic sides on the patients in medical institution.

Research Hypotheses:

1- The researcher assumes that using technical textiles in the production of printed textile hangings to increase the awareness of the aesthetic side in medical institutions
2- There are concessional fields to take advantage of the plastic value of plant elements in order to provide a suitable psychological environment for patients**.**
3- Ability to take advantage of the various technological means of silkscreen printing and glass technology for high-quality printed designs are enriches the design fabrics pendants.

Research limits:

The research deals with the experimental aspect, using the flat silk screen and glass technology to achieve aesthetic and practical values distinct for the design of pendants fabrics.

Research Methodology:

Experimental method: The researcher relied upon in dealing with creative aspect in the design of fabric pendants and applied technology in different ways.

1- Introduction

Although technical textiles have attracted considerable attention, the use of fibers, yarns and fabrics for applications other than clothing and furnishing is not a new phenomenon. Nor is it exclusively linked to the emergence of modern artificial fibers and textiles. Technical textiles are known for their performance and functionality and get into many areas products of our daily life. The demand for technical textiles is directly related to overall economic developments and textile technology (28).
Technical products (broadly defined) already account for as much as 50%of all textile manufacturing activity and output. (171:1)
In 2016, the technical textiles areas are covering an important range of applications. Currently Tec textile Trade Fair organization has defined different application areas. (1:6) technical textiles extends far beyond the textile industry itself and has an impact upon just about every sphere of human economic and social activity. Fibers such as glass and carbon are abundant and renewable, lightweight, with low density and high toughness. Fibers such as glass and carbon have the potential to be used as a replacement for traditional (406:4).
so ,The research aims at the possibility of benefiting from these technical textiles in the field of applied art through the work of textile printed to benefit from its many properties, the most

important in the non-flammability and electrical insulation and through the integration of textile printing technology and glass technology have a great impact in the addition of some special characteristics And the appearance of innovative art and in finding solutions and treatments for the aesthetic of pendants fabrics

2 -Definition of technical textiles

The definition of technical textiles adopted by the authoritative *textile terms and definitions*, published by the textile institute1, is 'textile materials and products manufactured primarily for their technical and performance properties rather than their aesthetic or decorative characteristics'.(3:18) Technical textiles are defined also as textile materials and products used primarily for their technical performance and functional properties, sometimes as a component or part of another product to improve the performance of the product.(3:9)

3-Types of technical textiles:

The two worldwide International organizations who arrange an international exhibition for technical textiles are:

1- Messe Frankfurt of Germany.
2- Ossoka of Japan. (31)

General aspects of technical textile:

1- One of the most and faster growing areas for global textile industry.
2- Indispensable part of human life.
3- Encompasses immense range and diversity of raw materials, processes, products and applications.
4- Accounts for over one-quarter of all textile consumption in weight terms.
5- Plays crucial role in economic and infrastructural development (27).

4 –Applications:

• Mechanical functions, exchange functions, functionalities for living beings and Protective functions (21)

- **Mechanical functions:**

Mechanical resistance, reinforcement of materials, elasticity and tenacity

- **Exchange functions:**

Filtration, insulation, conductivity, drainage, impermeability and absorption

- **Functionalities for living beings:**

Antibacteria, antidustmites, bocompatibility (hypoallergenic textiles)
biodegradability / bioresorption. (22)
Antibacteria and dustmites
finishing bed

- **Protective functions:**

Thermal, fire, mechanical, chemicals, impermeable, breathable, antistatic, particles antirelease, electrical insulation, IR and UV rays, NBC (Nuclear, biological and chemical), high visibility, electromagnetic fields … (21)

5-Specialty and Industrial Fabrics

Specialty and industrial fabrics serve a wide array of markets, from awnings to auto airbags as well as new base fabrics used in road construction, erosion control and spoil containment in landfills.

Automotive textiles represent the most valuable world market for industrial textiles. These materials cover a broad range of applications, including upholstery and seating, floor covering and trunk liners, as well as safety belts, airbags, thermal and sound insulators, filters, hoses, tires and a variety of textile reinforced flexible and hard composites. The automotive textile industry is strong in many Asian countries, (8) Some of the common examples of Technical Textile products are: automotive bodies, civil and military aircraft, bodies, wings, engine components and Many other uses.

Future of the technical textiles industry

The future of technical textiles embraces a much wider economic sphere of activity than just the direct manufacturing and processing of textiles. The industry's suppliersinclude raw materials producers (both natural and artificial), (1) machineryand equipment manufacturers, information and management technology providers, R&D services, testing and certification bodies, consultants, education and trainingorganizations (16).

The following terms are all valid for the definition of non-traditional textiles or textiles of special use:

1- Industrial Textiles.
2 - Technical Textiles.
3 - High Performance Textiles.
4- High-Tech Textiles.
5- Engineered Textiles.
6- Industrial fabrics.
7- fabrics Technical (28).

6-Classification of technical textile:

Technical textile is classified as following according to area of application.

- **Agrotech:** agriculture, aquaculture, horticulture and forestry.
- **Buildtech:** building and construction.
- **Clothtech:** technical components of footwear and clothing.
- **Geotech:** geotextiles and civil engineering.
- **Hometech:** technical components of furniture, household textiles and floor coverings.
- **Indutech:** filtration, conveying, cleaning and other industrial uses.
- **Medtech:** hygiene and medical.
- **Mobiltech:** automobiles, shipping, railways and aerospace.
- **Oekotech:** environmental protection.
- **Packtech:** packaging
- **Protech:** personal and property protection
- **Sporttech:** sport and leisure. (3:17)

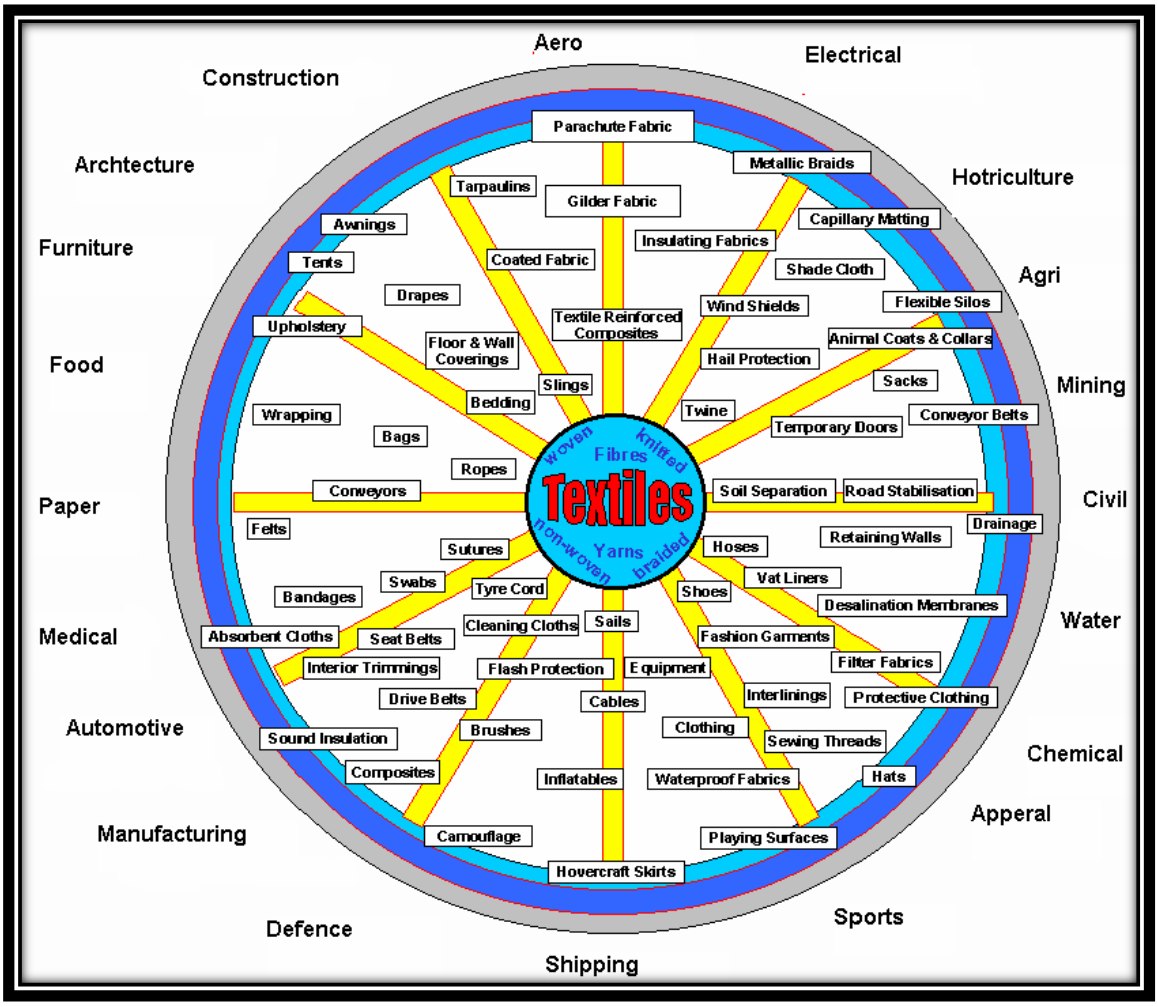


Fig (1): Classification of technical textile (25)

6-1- Agro textile:

Textiles used in Agriculture are termed as agro textiles. They are used for crop protection, fertilization, etc. The essential properties required are strength, elongation, stiffness, and bio-degradation, resistance to sunlight (27).

6-2-Buildtech:

These textiles are used in the construction of buildings, dams, bridges, tunnels and roads collectively comprise the "Buildtech" sector. (27) Textiles used in construction - concrete reinforcement, façade foundation systems, interior construction, insulations, proofing materials, air conditioning, noise prevention, visual protection, protection against the sun, building safety (19).

6-3-Clothtech:

Broadly defined, clothtech includes technical components of clothing (such as breathable membranes), shoe reinforcement and construction as well as rainwear.

6-4-Geo-textile:

Geo-textile are smart textiles that consist of a stable network that retains its relative structure during handling, placement and long-term service.. Generally, textiles used in the ground are termed "Geo-textile."

Fig (2): Geo-textile in road construction (19)

6-5-. Hometex:

The textile, which including both clothing and furnishings are called hometech, lies in the field of household textiles and furnishing and especially in the use of loose fibers in wadding and fiber fill applications. (13:17)

Fig(3): Home textile(27)

6-6-Industrial textile:

Indutech is the name given to textiles that are used for diverse industrial applications like filtration, conveying, cleaning etc. This area of technical textiles contains solutions and products for mechanical engineering and for varieties of industries, e.g. conductive textiles and 3-D textile products.

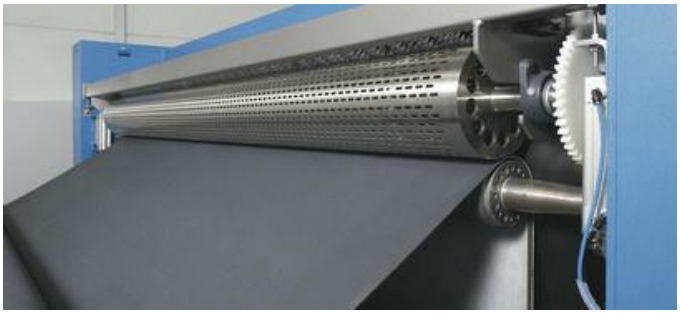


Fig (4) : Industrial textile (27)

6-7- Medical textile:

Medical textiles are one of the most important, continuously expanding and growing fields in technical textiles. The largest use of textiles is for hygiene applications such as wipes, babies' diapers (nappies) and adult sanitary and incontinence products (71).

Fig (5) : Medical textiles(27)

6-8-Transport textiles :

These textiles are used in the manufacture of automobiles and aircraft. Carbon composites are mostly used in the manufacture of airplane parts while carbon fiber is used for making higher end tyres. Nylon gives strength and its bursting strength being high is used as air bags in cars.

6-9- Packaging textiles:

Packaging textiles include all textiles packing material for industrial, agriculture. (16:17)

6-10-Protective and safety clothing and textiles (PROTECH)

Protection against heat and radiation for fire fighter clothing, against molten metals for welders, for bullet proof jackets etc, all these things are obtained by usage of technical textiles with high performance fibers. (17,18:17) In bullet proof jackets, special fiber aramid is used which have high tenacity, high thermal.

Some of the technical materials were used in this research to benefit from its multiple properties in fire resistance and electrical insulation, which is one of the most important characteristics and high durability and increase the useful life and the length of the default for use of glass fiber and carbon fiber polyester ester for the work of textile hangers in innovative technological ways and integrating the printing techniques of handmade textiles and glass technology. (27)

7-Glass fiber:

Glass has, for many years, been one of the most underrated technical fibers.

, glass is increasingly being recognized as a sophisticated engineering material with excellent fire and heat-resistant properties. It is now widely used in avariety of higher performance composite applications, including sealing materialsand rubber reinforcement, as well as filtration, protective clothing and packaging.

The potential adoption of high volume glass-reinforced composite manufacturing techniques by the automotive industry as a replacement for metal body parts and components, as well as

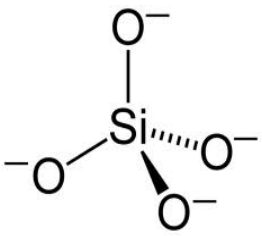
by manufacturing industry in general for all sorts of industrial and domestic equipment, promises major new markets. (8:17)

- **Glass fiber can be defined as:**

"A material consisting of extremely fine filaments of glass that are combined in yarn and woven into fabrics, used in masses as a thermal and acoustical insulator, or embedded in various resins to make boat hulls, fishing rods, and the like." (12)

- **Glass Structure:**

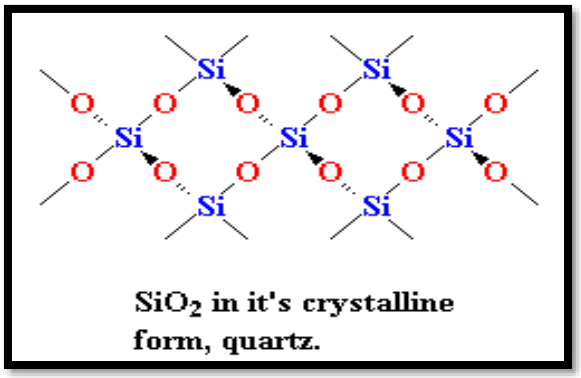
The basic component of glass fibers is silica (silicon dioxide SiO2) derived from ordinary sand.



Sand consists of an irregular network of silicon atoms held together by Si—O—Si bonds (24).

In its crystalline form its basic structure is that of a tetrahedron, with four oxygen atoms surrounding a central silicon atom.

It has no true melting point but softens up to 2000°C, where it starts to degrade. (1:3)



SiO_2 in it's crystalline form, quartz.

- **Manufacturing Process:**

1- Direct Melt Process

2- Marble Melt

- **Properties:**

- **High Strength**: The high strength-to-weight ratio of glass fiber makes it a superior material in applications where high strength and minimum weight are required.

- **Fire Resistance**: glass fiber is an inorganic material and will not burn or support combustion. It retains approximately 25% of its initial strength at 1000°F (540°C).

- **Chemical Resistance**: Most chemicals have little or no effect on glass fiber. The inorganic glass textile fibers will not mildew or deteriorate. Glass fibers are affected by hydrofluoric, hot phosphoric acids and strong alkaline substances. (126:3)

- **Electrical Properties**: Glass fiber is an excellent material for electrical insulation. The combination of properties such as low moisture absorption, high strength, heat resistance and low dielectric constant makes fiber glass fabrics ideal as a reinforcement for printed circuit boards and insulating varnishes.

- **Thermal Conductivity**: A low coefficient of thermal expansion combined with low thermal conductivity properties makes glass fabric a dimensionally stable material that rapidly dissipates heat as compared to asbestos and organic fibers (24).

8-Carbon fibers:

Carbon fibers are one of the strongest known materials today. Carbon fiber is a material consisting of extremely thin fibers about 0.005-0.010 mm in diameter consists of carbon atoms (). The density of carbon fiber is also considerable lower than the density of steel, making it ideal for applications requiring low weight. The properties of carbon fiber such as high tensile strength, low weight, and low thermal expansion make it very popular in aerospace, civil engineering, military, and motorsports along with other competition sports.(33)

- **Applications of Carbon Fiber**:

Sporting, Equipment, Automotive Parts, Aerospace Engineering, Civil Engineering, Medical Applications, Environmental Applications and Things at Home. (30)

9-Composite:

A composite material is one in which two or more materials that are different (structure, properties) are combined to form a single structure with identifiable interfaces at multi-scales to achieve properties that are superior to those of its constituents. In general, composites can be defined as a select combination of dissimilar material formed with a specific internal structure and with a specific external shape or form. Composites are designed to achieve unique mechanical properties and superior performance characteristics not possible with any of the component material alone (20).

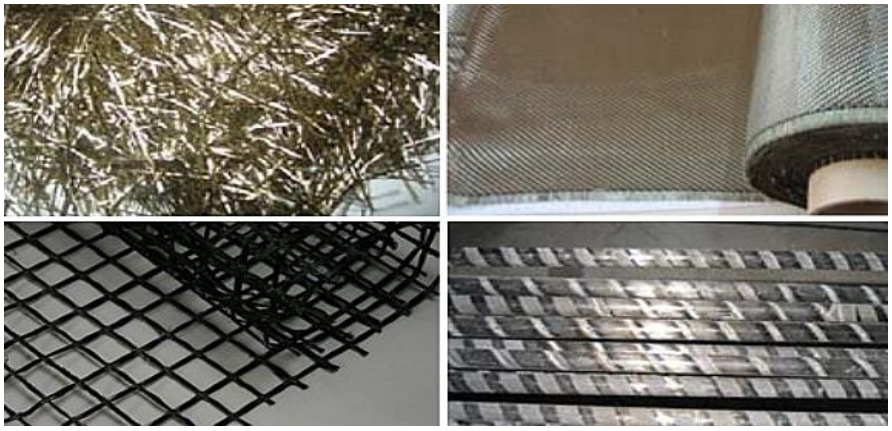


Fig (6): Textile composites (20)

- **Application of glass technology to technical textiles in the production of printed textile hangings :**

In this research we are going to study the application of printing technique using screen printers, on different types technical materials and types of glass with different shades and sizes of stained and powder glass, using oxide to colour glass as it has been used red iron oxide, cobalt oxide, and yellow iron oxide that can be exposed to high temperature inside burning ovens used to form glass and we are going to study some kinds of the glass in use and its qualities.

printed textile hangings:

A printed textile fabric can be produced by a wide variety of methods, some of these require expensive equipments but others need only a very modest outlay. All methods represent the means of transferring the creative talent of the designer to the fabric. They differ basically in

the speed with which reproduction of the original design may be effected. The design is transferred to the fabric through the printing paste. (5) Textile printing is still an industrial art rather than a scientific technology. Printing or production of colored motives and designs on textiles may be considered colouring of its separate parts the size and shape of which depend on the printed pattern (14)**.**

Silk screen printing

Silk screen printing is widely used in the textile printing industry. Flat-hand flat castles are considered to be the most widespread and the practical part has been implemented using a flat sheet. Some types of printing presses have been published in various non-traditional and recently, which added to the fabrics printed silk balloons some of the characteristics and different artistic appearance (11).

We will review the use of different types of crushed glass with varying bikes and the color of its use to add some aesthetic properties in the practical application.

Experimental Work

Materials of Experimental Work

-**Fiber**: Glass Fiber and Carbon Fiber were used throughout this work.

Kindly supplied by National Research Center, Egypt.

-Glass: Flat Glass, Egyptian glass and imported glass multicolor

-Colour: This research was carried out by the glass oxides of various bore high temperature

- Chemicals and auxiliaries

All the chemicals used in this thesis are listed in Table (1).

Table (1): Specifications of the used chemicals and auxiliaries

Chemicals	Function	Source
Epoxy	Adhesive Epoxy resin is known for its strong adhesive qualities, making it a versatile product in many industries. It offers resistance to heat and chemical applications	El-Gomhoriah Pharmaceutical Chemicals Co., Egypt
catalyst	A catalyst accelerates a chemical reaction. It does so by forming bonds with the reacting molecules, and by allowing these to react to a product	El-Gomhoriah Pharmaceutical Chemicals Co. Egypt

Procedures:

- **Preparation of glass materials**:

In this work, three different glass were used, then they were grinded with a laboratory hammer, milled to pass through a 20 mesh to have a fine powder.

- **Printing technique:**

Flat manual screen printing was used in this work with a thickness of 20μm.

- **Steps to printing:**

- Design must first be screen printed using Epoxy adhesive. Depending on the type of adhesive, it may be best to use a catalyst as well, about 5% by weight.

- For the best results, use a thick stencil (preferably using a capillary film of 200 microns or higher) to lay down a thicker adhesive coating.

- While the printed design is still wet, the glass beads can then be sprinkled on using the following methods:

Sprinkle the beads glass onto the printed adhesive by hand while the fiber still is on the platen. Then use a blind screen (a screen with no art exposed on it) to press the glass down into the fabric more evenly by running a squeegee lightly over the screen mesh.

- Take the printed garment off the platen and place the fiber print side up into a tray containing the glass. Arrange the beads in a mound over the wet print, then take a stiff cardboard or plastic sheet larger than the size of the print and push the beads into the adhesive.

- Finally Burning inside furnaces in different temperatures

Experience (1)

10cm/7cm	Design dimensions
Fiber glass	technical textile type
Plant elements	Elements and vocabular
Printed Design for Wall Hanging	lFunctional purpose
Direct hand printing method	Technology
Manual silk screen printing	Applicable method
Cobalt Oxide, Manganese oxide	color

	
After the burning process	**Before the burning process**

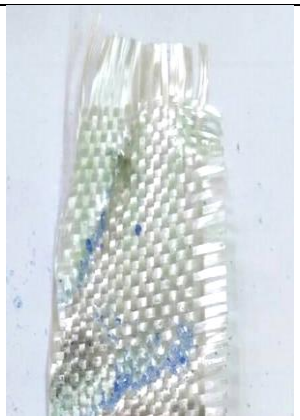
Conclusion:

In this research, the samples were burned in glass forming furnaces at different degrees at, 750 °C, 800 °C after the burning process the print design was clearly visible Increasing degree of temperature increases the degree of clarity of the design of the research samples.

Various types of glass oxide have been used on high temperatures, Cobalt Oxide and manganese oxide.

Experience (2)

10cm/7cm	Design dimensions
Fiber glass	technical textile type
Plant elements	Elements and vocabular
Printed Design for Wall Hanging	Functional purpose
Direct hand printing method	Technology
Manual silk screen printing	Applicable method
Printing paste: Epoxy90 %(Adhesive) 5% catalyst powder glass	Printing paste:
Glass powder	color

	
after the burning process	**Before the burning process**

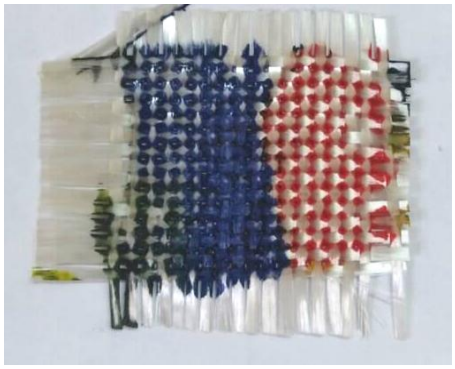
Conclusion:

the research samples were burned in glass forming furnaces at different degrees (700 ^{o}C,800 ^{o}C,870 ^{o}C) .

The crushed glass was used in varying degrees and the glass powder and Egyptian glass also were used.

Experience (3)

10cm/7cm	Design dimensions
Fiber glass	technical textile type
Plant elements	Elements and vocabular
Printed Design for Wall Hanging	Functional purpose
Direct hand printing method	Technology
Manual silk screen printing	Applicable method
manganese oxide, red iron oxide	color

	
after the burning process	**Before the burning process**

Conclusion:

The samples were burned in glass forming furnaces at different degrees (700 ^{o}C,800 ^{o}C,870 ^{o}C). Various types of glass oxides have been used on high temperatures: manganese oxide, red iron oxide.

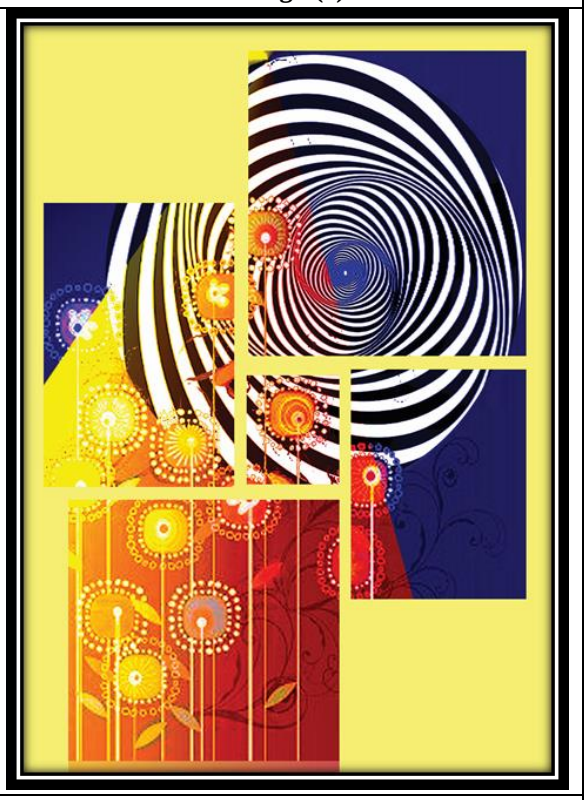
After the burning process the print design was clearly visible Increasing degree of temperature increases the degree of clarity of the design of the research samples.

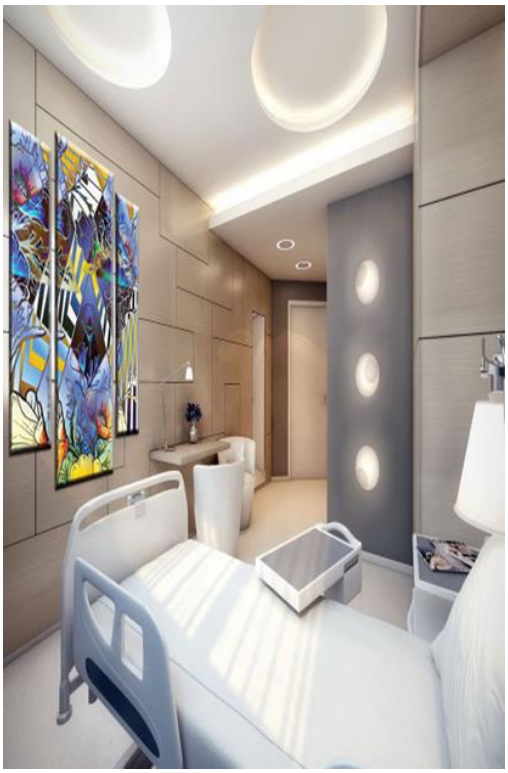
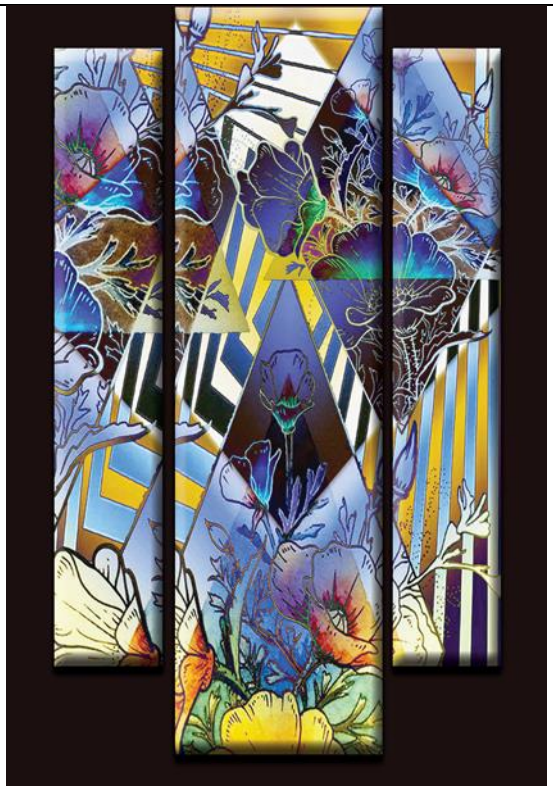
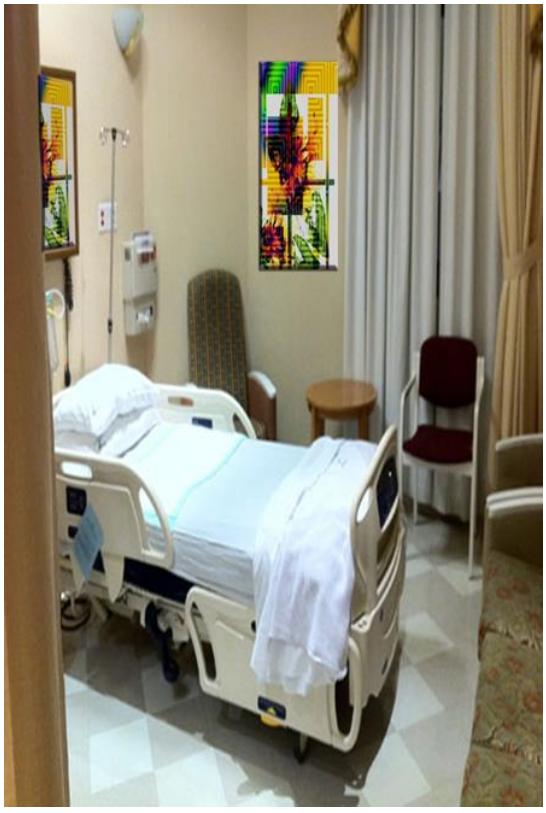
Designs and application using computer:

used some of the important computer programs like Adobe.III-ustrator -Photoshop CS5 to create innovative designs based on the plant element and to increase the awareness of the aesthetic aspect of medical institutions as the artworks can contribute to pain relief, and it attracts the attention of patients, visitors and employees alike and gives them positive energy and give a touch Human beings on a rigid building and cultivate a sense of support and affection in an environment lacking identity and spirit. The design was done using the computer and exploited its possibilities in zooming in and out and incorporating the selected plant elements and also in some designs were integrated more than a plant element with the line of different types and exploit the possibilities and energies of the dynamic line of the spiral and refractive line.

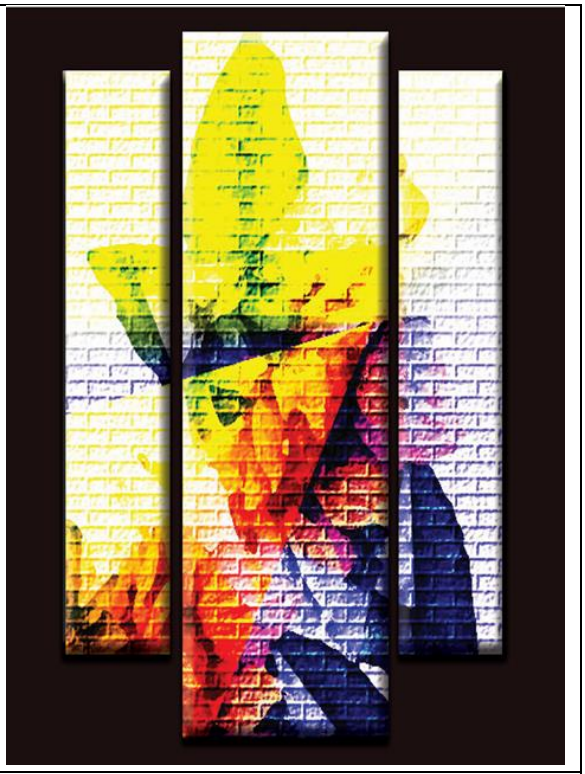
Application has been done in some of the pictures of medical institutions taken from the Internet and presented a visualization of the method of application.

	
Design (2)	**Design (1)**
	
(33)Application (1)	**Design (3)**

	
Design (4)	**Design (5)**
	
Design (6)	**(34)Application (2)**

	
(33)Application (3)	Design (7)
	
Application (4)	Design (8)

Application (5)



Design (9)

Design (10)

Design (11)

Conclusions:

1- Develop a designer creative ability to create textile hangings

2- Using technical textile to highlight the aesthetic and practical sides of a medical institutions.

Recommendation

1- Combining applied art specifications to find new and creative designs
2- Directing the designer's thought to conduct further experiments of combining the techniques of handmade textiles printing and glass technology to enrich printed textile pendants with newly created aesthetic values.
3- Medical institutions need some change achieved by using printed textile hangings that help the patients to recover
4- the possibility of utilising textile in designing printed hangings with a contemporary artistic vision.

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