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## Ergonomics Approach For Fashionable Apparel Design

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## Ergonomics Approach For Fashionable Apparel Design

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### Abstract:

Ergonomics or "human factors" is the science of designing equipment, the work place focused on the study of human fit and decreased fatigue and discomfort through product design. Ergonomics applied to fashion design requires taking into consideration how the clothes we design fit the people that are using them. When clothes fit to the user, the result can be more comfort, higher productivity, and less stress. Bio-polishing of cotton fabric in products is done to enhance fabric quality by decreasing the pilling tendency and fuzziness of (cellulose) fabrics. This paper aims to Create fashion designs using ergonomics aspects to fit the professional educator women. Apply the ergonomics aspects in 9 products from bio polished cotton fabric.

### Keywords:

*Ergonomics*  
*Fashionable Design*  
*Bio-polishing*

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### 1. Introduction

The relevant issues about clothing have been increasing in recent times. The increase number of consumers and users that search for differentiated and appropriate products to their needs and expectations is impacting on the design stages as well as on manufacturing process.

Thus, the understanding of specified segments of consumers and users emerges as a competitive strategy that is favorable to the development of products that are adequate and satisfactory to different individuals. Considering the principles of significance Ergonomics. <sup>(1)</sup> Ergonomics or "human factors" is the science of designing equipment, the work place focused on the study of human fit and decreased fatigue and discomfort through product design. Ergonomics applied to fashion design requires taking into consideration how the clothes we design fit the people that are using them. When clothes fit to the user, the result can be more comfort, higher productivity, and less stress. Ergonomics can be an integral part of design. <sup>(2)</sup>

The principles of ergonomics: The 5 important dimensions which better define Ergonomics:-  
 1-Comfort . 2- Aesthetics . 3- Safety .4- Ease of Use.5- Performance. <sup>(3-7)</sup>

**In this study** clothes for professional educator were chosen . Clothing is a tangible impression of personal values and is recognized as one of the symbols of communication that leads to social acceptance and is important to the development of

self-concept and individual's personality. Clothing is a factor in everyday human life and interactions with others. It can transmit a vast array of meanings such as identity, value, mood and attitude. Clothing is a systematic means of transmitting information about the wearer, meaning that multiple message might be sent to the perceive .When a professional educator dress professionally they obtain the respect and credibility necessary from students and the community in general. Students will tend to ape the behavior and appearance of their educator. An effect educator will therefore dress appropriate as a professional educator for good grooming .professional educator, therefore, need to wear clothing which is suitable for their duties . <sup>(8,9)</sup>

Cotton continues to be the world's major textile fiber despite of many synthetics. It is the oldest and most versatile of all fibers with good properties when blended with other fabrics.

The main reason for use of cotton is its good weaving qualities, low cost, high absorption, excellent, abrasion, stability to repeated blending. It can be safely ironed even at high temperature of 425 F degrees. It has excellent wash and wrinkle resistance and also good if resin treated. <sup>(10)</sup>

No other fiber can give a better performance than cotton as far as the comfort requirements of fabrics are concerned. Cotton materials are

flexible to fit into all types of economic group. By products of cotton are used for many purposes. <sup>(10)</sup>100% cotton fabric fitness to instructor it is stability to repeated blending .Bio-polishing of cotton fabric in products is done to enhances fabric quality by decreasing the pilling tendency and fuzziness of (cellulose) fabrics. This finishing process applied to cellulose textiles that produces permanent effects by the use of enzymes. This process removes protruding fibers & slob from fabrics, significantly reduces pilling, softens fabric hand and provides a smooth fabric appearance. <sup>(11-13)</sup>

**Bio-polishing** enhance fabric quality and keep instructor in a good appearance for a long time.

**So, the objective of this paper** is to develop strategic thinking in designing in order to achieve viable solutions for fashion designing. Create fashion designs using ergonomics aspects to fit the professional educator women. apply the ergonomics aspects in 9 products from bio polished cotton fabric.

## **2.Experimental work:**

### **Materials:**

#### **-Fabrics:**

100% woven cotton were used (were kindly supplied by Miser / Elmahla for spinning and weaving co.)and bio polished with cellulase enzyme (supplied by El-myestro Company, Egypt.)

#### **-Dyes and Materials:**

The dyes used are Remazol<sup>®</sup> Yellow 3RS (C.I.Reactive Yellow176), Remazol<sup>®</sup> Red 3BS (C.I.Reactive Red239) and Remazol<sup>®</sup> Blue BB, (C.I.Reactive Blue 220) and Remazol terquaze (C.I.Reactive Blue 21)(supplied by Dye Star Company, Egypt. )

-sewing threads, zippers, buttons, embroidery threads, beads, wooden beads.

-stencil sheet (commercial)

#### **-Techniques:**

-Models were drawn for the age group(30-45)years old.

- patterns were done according to ref. <sup>(14)</sup>

- cutting - sewing -trim by stencil printing, embroidery with (threads, beads, wooden beads).

#### **-In our work we considered the following: -**

-Fabric quality ,Item finishing, Fabric design, Co-ordinate color and Garment style

-Also considered the Socio-economic factors that influence teachers clothing include fashion, social class, age, income, educational level and price. <sup>(8,9)</sup>

## **3.Application of Bio-Finished Fabrics in**

## **Ergonomics Fashion Designs:**

### **Design(1) Product(1)**



**Fabrics:**100% Cotton fabric plain1/1(voil)for blouse and twill3/1 (gabrdine) for dress.

**Dyes :**Remazol(yellow176 3RS,Red 239 3BS, Blue 220 BB)

**Technique:** tie and dye in blouse and embroidery with wooden beads in dress.

**Structural view :**This design consists of two-piece outfit. blouse and long sleeveless dress.

### **Ergonomic Aspects in design (1)**

#### **Comfort aspects:**

The smooth texture of dress, simple design and suitable color increase the sense of comfort ability, dynamic and mobility.

#### **Aesthetic aspects:**

Lines in this dress are simple, the two vertical lines in princess on both side give symmetrical balance which give feminine appearance, the horizontal line created by the belt give attracting lock. the glamour of scarlet color in dress and repeating the semi circles which decorative with wooden beads give a good rhythm and allow the eye to move through the design. the gathering of elastic line in sleeve of blouse draws the attention to the blouse. using the green in blouse contrast with the semi circles which decorative with wooden beads and give good balance as well as emphasis that attract attention all over the design. <sup>(17-20)</sup>

#### **Safety aspects :**

The material used( fabric- wooden beads -button - sewing thread) is safety, good quality. model allows mobility and movement . waist bands of dress, collar and cuffs of blouse do not stop blood circulation or harm the skin.

#### **Ease of use aspects :**

Simple design with button wraps in both blouse

and dress allow ease of wearing and the back opening of end dress allow mobility while movement, it is easy clean and it can easy ironed.

**Performance aspects:**

The scarlet color considers to be warm colors it catches the eye of any one sees you. the use of scarlet color in dress create energy, balance, playfulness. green color in blouse give Harmony, balance, refreshment, rest, peace. model style which appropriate with age and co-ordinate color give high self-esteem, interest and interaction with students.<sup>(15)</sup>

**Design (2)**



**product(2)**



**Fabrics:** 100% cotton fabric twill 3/1 (Gabardine)

for jacket and plain 1/1 (popline) for jumpsuit

**Dyes:** Remazol® (Yellow 167, black B)

**Techniques:** Embroidery with hand stitch on jacket Stencil printing on the jumpsuit.

**Structural view :** This design consists of two-piece outfit. Simple sleeveless jump-suit and jacket with complete sleeves.

**Ergonomic aspects in design(2)**

**Comfort aspects:**

The smooth texture of dress, simple design and suitable color increase the sense of comfort ability and dynamic and mobility. mixing yellow and grey give sense of comfort for eye. while grey is neutrality the yellow is essentially stimulating energy. jumpsuit design supports more freedom in movement.

**Aesthetic aspects:**

In this design lines are simple. vertical lines in princess of jacket and jumpsuit create an effect of length and elegance because they lead the eye up and down through the body and increase the feminine look. horizontal line created by belt give

attracting look and creating balance and organization. mixing colors grey and yellow give the design unique look. using Stencil printing around neckline and the end of jumpsuit, Embroidery with hand stitch on jacket make the design more attraction.

**Safety aspects:**

The material used (fabric-zipper-sewing thread) is safety, good quality. in this design jumpsuit and jacket allows mobility and movement waistbands do not harm the skin or affect the blood circulation.

**Ease of use aspects:**

Full straight jumpsuit with combination of waistbands and zipper which make jumpsuit easy in dress up and undress. front opening of jacket makes it easy in dress up and undress. jumpsuit support more freedom in movement. the zipper and waist bands clearly suggest their function. it can easy wash and easy ironed.

**Performance aspects:**

Horizontal lines created by waist bands create relaxation or a calming mood where the vertical lines are more imposing and powerful while **Grey in jumpsuit** considered neutrality color. yellow color in jacket indicated Optimism, confidence, self-esteem, friendliness, creativity.<sup>(15)</sup>

**Design (3)**



**Product(3)**



**Fabrics:** 100% cotton fabric plain 1/1 (Popline) for jacket and twill 3/1 (gabardine) for pants.

**Dyes:** Remazol® (Red 239, turquoise Blue 21).

**Techniques:** Stencil printing on jacket.

**Structural view:** This design consists of two-piece outfit jacket with complete sleeve and classic pants.

**Ergonomic aspects in design(3)**

**Comfort aspects:**

This design is simple it gives feeling of dynamic and activity. jacket is looseness which give feeling of comfortable ability. The pants with waistbands and zipper which is more comfortable at wearing



**Aesthetic aspects:**

The joyful appearance and smooth look are presented in this design. the shiny color imparts an active and interesting effect on this design. lines are simple. vertical lines in princess of jacket create feminine appearance ,smooth look, give length and elegance. petit fuchsia in pants with its refreshes and terquaze blue with its coolness giving the spirit of youthful.<sup>(16)</sup>

**Safety aspects :**

Design is simple and allows mobility and movement. waist bands in pants do not stop bloodcirculation or irritate the skin.

**Ease of use aspects :**

This design is simple and support more freedom in movement. open and looseness jacket allows ease of wearing .simple pants with waistband and zipper allows ease of wearing. it can easy wash and ironed.

**Performance aspects:**

Vertical lines in princes of jacket are powerful .the use of *terquaze Blue in jacket and pink in pants* catch the eye. **Pink color** is warmth, femininity, stimulates and powerful. turquoise is a lovely color It is linked to calmness, serenity and peace of mind, as well as to mental clarity .Turquoise encourages creativity. It is also associated with balance and emotional stability. all this factor create high self-esteem and interaction with student.<sup>(16)</sup>



**Fabrics:** 100% cotton fabric twill 3/1(gabardine) for dress, plain1/1(Popline) for pants plain1/1(voil) for blouse.

**Dyes:** Remazol® (Red 239, Blue20)

**Techniques:** Stencil printing on the dress.

**Structural aspects:** This design consists of three-piece outfit , sleeveless dress, simple blouse and classic pants .

**Ergonomic aspects in design(4)****Comfort aspects:**

Simple design, smooth texture shiny color increases the sense of comfort ability.

**Aesthetic aspects:**

The texture of this design' fabric play a big role to add aesthetic aspects. the use of stencil printing on dress add interesting look and catch the eye. vertical line in pleats and button wraps of blouse and princess of dress create an effect of length and elegance because they lead the eye up and down throw the body. curved line in nick line of dress and cuts in front of dress add the feeling of soft, feminine and youthful. colors give the design a unique look blue with its coolness and petit fuchsia with its refreshness look giving a spirit of hope.

**Safety aspects:**

Design is simple and allows mobility and movement .cuffs ,collar in blouse and waist bands in pants do not affect blood circulation or irritate the skin.

**Ease of use aspects :**

The neckline of the dress allows ease of wearing ,open and cuts in the front of dress support more freedom in movement. blouse with looseness which give feeling of comfortable. the pants with waistbands and zipper which more comfortable at wearing, its excellent wash .it can be easy ironed even high temperature .

**Performance aspects:**

Vertical princess Lines of dress create a feeling of self-importance ,dignity. They lead the eye to move up and down. blue color Intelligence, communication, trust, efficiency, duty, logic, coolness, reflection, calm. pinkish fuchsia Physical tranquility, nurture, warmth, femininity, all this factor creates high self-esteem and interaction with students.<sup>(15)</sup>



**Fabrics:** 100%cotton fabric (twill3/1 (gabardine), for pants(plain1/1(Popline) for blouse).

**Dyes:** Remazol® (Yellow 3RS 176, Red 3BS239,Blue BB 20)

**Techniques:** Embroidery stitches on blouse and pants.

**Structural view :** This design consists of two-piece outfit, blouse and classic pants .

### **Ergonomic aspects in design(5)**

#### **Comfort aspects:**

Smooth look ,simple design with looseness of blouse and joyful color give feeling of dynamic and comfort. blouse with V neckline and pants with waistbands and zipper which more comfortable at wearing.

#### **Aesthetic aspects:**

The use of different type of lines straight in pants, diagonal in V neckline shape and hem line create the optimum beauty and keep the symmetrical balance from being boor. repeated the diagonal line in V neckline and hem line give good harmony, gathering in the end of sleeve draw the attention to the blouse. the good distribution of green, blue and red in the decorative Embroidery stitches around the neck line match with the pants and its Embroidery stitches . green color in pants with its refreshment and mustard yellow color with its energy give the design sprit of cheerful and happiness.

#### **Safety aspects :**

Design is simple and allows mobility and movement. waist bands in pants do not stop blood circulation or irritate the skin.

#### **Ease of use aspects :**

This design is simple and support more freedom in movement . V neckline and looseness of blouse allows ease of wearing .simple pants with waistband and zipper allows ease of wearing. it is easy wash. it can easy ironed.

#### **Performance aspects:**

This design is simple. Green color for Harmony, balance, refreshment, rest, , peace while the yellow will lift our spirits and our self-esteem; it is the color of confidence and optimism. all this factor creates high self-esteem and interaction with student.(15)

**Design(6)**

**Product(6)**



**Fabrics:** 100% cotton fabric (twill3/1(gabardine) for jacket, plain1/1(voil) for dress).

**Dyes:** Remazol® (Terquaze blue 21)

**Techniques:** Tie and dye in dress and Embroidery stitches in dress and jacket.

**Structural aspects :** This design consists of two-piece outfit jacket with complete sleeves and long sleeveless dress.

### **Ergonomic aspects in design(6)**

#### **Comfort aspects:**

In this design smooth texture of dress, loosely dress increase the sense of comfort ability and dynamic and mobility .

#### **Aesthetic aspects:**

In this design lines are simple , vertical line in princes of jacket and dress create effect of length and elegance because they lead the eye up and down through the body ,give symmetrical balance and feminine appearance .horizontal line created by waist bands give attraction look and balance. terquaze blue with its coolness give the spirit of youthful .the degradation of terquaze and off -white by tie and dye technique in dress make the design soft and attractive.(16,17)

#### **Safety aspects :**

Design is simple and allows mobility and movement. The attachments(button -sewing thread) which used is safe and good quality.

#### **Ease of use aspects :**

This design is simple and support more freedom in movement, semi square neckline and looseness of dress allows ease of wearing .open jacket allows ease of wearing. it is easy wash. it can easy ironed.

#### **Performance aspects:**

Straight lines in pleats, rows of buttons of dress, princess of jacket create a feeling of elegance, bold and powerful .terquaze Blue in jacket is a lovely color It is linked to calmness, serenity and peace of mind, as well as to mental clarity .Turquoise encourages creativity. It is also associated with balance and emotional stability. all this factor create high self-esteem and interaction with student.(15)

**Design (7)**

**product (7)**



**Fabrics:** 100% cotton fabric (plain1/1( Poplin) for blouse and skirt.

**Dyes:** Remazol® (Red 3BS 239, Blue BB 220 Terquaze blue 21, yellow 3RS 176)

**Techniques:** Stencil print and embroidery with beads in collar

**Structural view:** This design consists of two-piece outfit long tunic and simple skirt .

**Ergonomic aspects in design (7)**

**Comfort aspects:**

The texture of this design plays a big role to add comfort aspects .

**Aesthetic aspects:**

Vertical line in princess create the feminine appearance and smooth look. They give the impression of added height and slimness. using only one color refers to the unity. also the use of one color and floor length (purple) give feel of thin and tall also in addition the circle in the end of tunic draws the attention to the tunic and give interest. the terquaze color in the end of sleeve is balanced with collar and give good rhythm and allow the eye to move throu the design from up to down or otherwise

**Safety aspects:**

Design is simple and allows mobility and movement. The attachment(button -sewing thread) which used is safe and good quality .waist bands in skirt do not stop blood circulation or irritate the skin.

**Ease of use aspects :**

Simple design of skirt with open middle end of back support more freedom in movement. opening in the shoulder line with buttons give easily wearing. .cotton fabric adequate to this model. . it is easy wash. it can easy ironed.

**Performance aspects:**

Vertical Lines in princess lines communicate a feeling of self-importance , strength and spirituality purple is the color of Spiritual awareness, containment, vision, luxury, truth, quality .circle color in the end of tunic and terquaze color in the end of sleeve and collar create cheerful happiness feeling in addition to mode of attraction and catch the eye.(15)

**Design (8)**



**Product(8)**



**Fabrics:** 100%cotton fabric plain1/1(Popline) for jacket and pants

**Dyes:** Remazol® (Blue BB 220, yellow 3RS 176)

**Techniques:** Tie and dye , trim with buttons and wooden beads.

**Structural view :**This design consists of two-piece outfit jacket and loosely simple pants .

**Ergonomic aspects in design(8)**

**Comfort aspects:**

Simple design and the smooth texture plays a big role to add comfort aspects.

**Aesthetic aspects:**

lines in this design are simple .using the princess lines in jacket expresses the feminine and smooth feelings. repeating the decorated pocket in the two side of jacket give a good rhythm and allows the eye to move through the design from up to down or otherwise. using green with coolness in jacket and degradation of tent green in pants give harmony, balance, refreshment and attract attention to the design.(17)

**Safety aspects :**

Design is simple and allows mobility and movement. the attachment(button-zippers -sewing thread) which used is safe and good quality. waist bands in pants do not stop blood circulation or irritate the skin.

**Ease of use aspects :**

Simple design. cotton fabric adequate to this model loosely pants support more freedom in movement .zipper in jacket and in pants allow ease of wearing .it is easy wash. it can easy ironed.

**Performance aspects:**

**Green** is color of harmony, balance, refreshment, rest, ,peace.

Vertical Lines in princess lines communicate a feeling of self-importance, strength and spirituality.(15)

**Design (9)**



**Product(9)**



**Fabrics:** 100% cotton fabric (plain1/1(Voil )for



pants).

**Dyes:** Remazol® (Blue BB 220)

**Techniques:** Tie and dye, embroidery with beads .

**Structural view:** Hareem pants design

### Ergonomic aspects in design (9)

#### Comfort aspects:

Using blue with its coolness in pants and degradation of blue in pants give sense of comfort for eye. in this design loosely, pants support more freedom in movement.

#### Aesthetic aspects:

In this design lines are simple. blue with its coolness give the spirit of youthful .the degradation of blue and off white by tie and dye technique in pants make the design soft and attractive.

#### Safety aspects:

Design is simple and allows mobility and movement .the attachment(zipper- elastic-sewing thread-beads) which used is safe and good quality. waist bands and cuffs in pants do not stop blood circulation or irritate the skin.

#### Ease of use aspects:

This design is simple and support more freedom in movement .cotton fabric adequate to this model. looseness of pants allows ease of movement .waist bands with zipper and cuffs with elastic allows ease of wearing. it is easy wash. it can easy ironed.

#### Performance aspects:

Simple design with smooth texture gives a level of activity. Blue is Intelligence, trust, efficiency, serenity, duty, logic, coolness, reflection, calm It is the color of clear communication. simple design with smooth texture gives a level of activity. all this factor creates high self-esteem and interaction with student.<sup>(15)</sup>

### 4.Conclusion:

After analyzing, it can be concluded that the design of a product can be done keeping environmental concerns into consideration. the understanding of specified segments of consumers and users emerges as a competitive strategy that is favorable to the development of products that are adequate and satisfactory to different individuals. Considering the principles of significance Ergonomics. Ergonomics or "human factors" is the science of designing equipment, the workplace focused on the study of human fit and decreased fatigue and discomfort through product design A thorough research about long term fashion trends is important in designing the cycle of the product. Developed Intuitive approach towards the extended life of a product to use resources to its optimum level. • It enhances an ability to understand and apply long term fashion trends, endurance for classics. • Develops ability to think

design with a sense of responsibility. •

### References:

1. **É. P das Neves., A. CBrigatto&L. CPaschoarelli,** "Fashion and Ergonomic Design: Aspects that influence the perception of clothing usability." *Procedia Manufacturing*, 3, 6133-6139.(2015).
2. **S. O.Allsteel, & E. T.Allsteel.** "Ergonomics and design a reference guide". *Muscatine (IO): AllsteelIncorporation(2006)*.
3. Process Contracting Limited, Bridge ergonomics, ISO TC8/SC5 , May (2004).
4. **A.Das, &R.Alagirusamy,** "Science in clothing comfort". WPI Publishing.(2010).
5. **S. B.Martins, & L. B. Martins,** "Ergonomics, design universal and fashion". *Work*, 41(Supplement 1), 4733-4738.(2012).
6. **S. B. Martins,** "Ergonomics and Fashion: the OIKOS methodology for usability and comfort evaluation in clothing and fashion". *Work*, 41(Supplement 1), 6059-6067(2012).
7. **G.Montagna, &C.Morais,** "Fashion design and garment performance: Human factors in fashion design projects. *Advances in Ergonomics In Design, Usability & Special Populations: Part I*, 16, 47.(2014).
8. **D. M. Riungu,** "Factors Influencing Clothing Selection and Buying Practices among Primary School Teachers": A Case of Mwimbi Division, Meru South District. *Unpublished Master's Thesis Kenyatta University(2009)*.
9. **E. C.Sampson,** "Teachers' perceptions of the effect of their attire on middle-school students' behavior and learning".(2016).  
[10- https://bieap.gov.in/Pdf/CGTPaperII.pdf](https://bieap.gov.in/Pdf/CGTPaperII.pdf)  
<https://bieap.gov.in/Pdf/CGTPaperII.pdf>  
Classification and general properties of textile fibres - Bieap.(2016).
11. <https://textilelearner.blogspot.com/05/what-is-biopolishing-of-textiles.html>(2017).
12. What is Biopolishing of Textiles? | Process of Bio-polishing in Textile.(2014).
13. **G. U.Mohammad**"Effects of biopolishing on the quality of cotton fabrics using acid and neutral cellulases, Uddin Textiles and Clothing Sustainability"(2015).
14. **D.Saravanan, S. N. Lakshmi, R.K. Senthil and N.S.Vasanthi**"Biopolishing of Cotton Fabric with Fungal Cellulase and its Effect on the Morphology of Cotton Fibers". *Indian J. Fiber and textile Res.* 38(2): 156- 160,( 2013).
15. **C.Ein,** "How to design your own clothes and make your own patterns". Doubleday(1975).
16. **15-Z.O'Connor,**"Color psychology and colortherapy": Caveat emptor. *Color*



- Research & Application*, 36(3), 229-234.(2011).
17. [https://www.colorpsychology.org/blue/turquoise/](https://www.colorpsychology.org/blue/turquoise/Psychological%20Properties%20Of%20Color%202016) Psychological Properties Of Color 2016
  18. **Richard S. & Jenny U.** ‘*Fundamental of fashion design*’ First edition, AVA Publishing SA, United Kingdom ,(2006) .
  19. **Maha M.T.Eladwi, Rania N. Shaker, Aya S. Mahmoud, HebaAllah H. Fathy and Sarah M. Sharaf**’ Utilize Trash Materials as a Source of Extreme Fashionable Designs ‘*Elixir Fashion Design 98 42662-42666 (2016)*
  20. **Maha M.T.Eladwi, Rania N. Shaker, Aya S. Mahmoud, HebaAllah H. Fathy and Sarah M. Sharaf**’ Recreating Garments Designs Waste as a New Fashion Trend ‘*Elixir Fashion Design 95 40601-40605(2016)*
  21. **Maha M.T.Eladwi, Rania N. Shaker, Shima H. Abdelrahman, Aya S. Mahmoud,**
  22. **HebaAllah H. Fathy, Sarah M. Sharaf**’ Upcycling Used Garments to Recreate Sustainable
  23. Fashion Designs Treated by Soil Release Finishing ‘*Vol-2, Issue-8, Aug- (2016)*