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(54) Dyeing process.

(57) A process for dyeing a fabric in which the dye achieves an irregular level of migration throughout the fabric comprises subjecting the fabric to creasing, immersing the fabric in water bearing the dye and subjecting the fabric to microwave radiation. The order in which the above steps are carried out depends on the fabric used and the type of effect desired. The effect created on the fabric is one of a varying colour concentration in either random or regular patterns depending on the type of creasing used.

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Description

DYEING PROCESS

This invention relates to a process for dyeing fabric, more particularly for dyeing fabric in such a way that the fabric is dyed in a distinctive, graded manner.

Most fabric dyeing is controlled to colour the fabric to an even depth of colour or colours. There are occasions through when it is desired to dye fabrics in colours and/or patterns of uneven depths of colours. The fashion of tie-dyeing was an example which gave a distinctive style of dyeing. Tie-dyeing is achieved by taking a piece of fabric, tightly binding a part of it in such a way that migration of dye to the tied portions is restricted, and immersing the fabric into water containing a water soluble dye. Tie-dyeing, through, had disadvantages, including the relatively restricted range of patterning or grading imposed by the binding. It is difficult to achieve anything other than substantially circular patterns by this method. The time taken and the cost of the fabrics also imposed certain constraints on the experimentation needed to achieve a desired effect.

The present invention seeks to provide an improved process for dyeing fabrics in which the migration of the dye is uneven, more particularly to a different style of distinctive dyeing which results in the fabric being colour graded in a novel and attractive way.

According to the present invention, there is provided a process for dyeing fabric, in which the migration of the dye is uneven, comprising subjecting at least a part of the fabric to creasing, subjecting at least a portion of the part of the fabric to wetting and at least one water-soluble dye and subjecting the fabric to microwave radiation.

The process of the invention may comprise any one, or any combination of the following preferable features:

(i) the fabric may be creased prior to immersion in the dye,

(ii) the fabric may be creased after an initial immersion in water, which may or may not include the dye,

(iii) the fabric may be creased before any microwave radiation is applied to it,

(iv) the fabric may be creased after one or more applications of microwave radiation,

(v) the fabric may be recreased between applications of microwave radiation,

(vi) in addition to the water-borne dye, the fabric may be subjected to common salt,

(vii) in addition to the water-borne dye, the fabric may be subjected to a dye fixative,

(viii) the dye may be added to the water before immersion of the fabric in it,

(ix) the dye may be added to the water after immersion of the fabric in it,

(x) the microwave radiation may be applied after the dye is added to the water,

(xi) the dye may be added to the surface of the water, without agitation, before or after immersion of the fabric in it, and/or before application of microwave radiation to it,

(xii) more than one dye may be added to the water together or at different stages of the process,

(xiii) dye(s) may be added to the water at spaced apart locations thereof,

(xiv) microwave radiation may be applied to the water before immersion of the fabric therein,

(xv) microwave radiation may be applied to the water and fabric for a single continuous period,

(xvi) microwave radiation may be applied to the water and fabric in a series of two or more periods, optionally with cooling inbetween,

(xvii) the microwave radiation may be at the same or different powers, for the same or different periods,

(xviii) the fabric may be completely or partially immersed in the water,

(xix) the fabric may be crumpled in the hand to produce a random creasing pattern, folded to produce linear folds or wrung by rotation one part relative to another,

(xx) the fabric may be rinsed after subjection to one or more applications of microwave radiation.

According to preferred aspects of the invention:-

(a) the process comprises first creasing the fabric, secondly subjecting the fabric to water-borne dye and subsequently subjecting the fabric to microwave radiation;

(b) the process comprises first subjecting the fabric to a water-borne dye, secondly creasing the fabric, and subsequently subjecting the fabric to microwave radiation;

(c) the process comprises first creasing the fabric, wetting the fabric, and thirdly subjecting the fabric to water-borne dye whilst subjecting the fabric to microwave radiation;

(d) the process comprises subjecting the fabric to the water-borne dye prior to application of microwave radiation to it; or

(e) the process comprises subjection of the fabric to the water-borne dye after the application of microwave radiation to the fabric.

Any combination of the above methods and other methods of creasing the fabric may be used.

Subjecting the fabric to water-borne dye may comprise soaking the fabric, either before or after creasing, in water to which has previously been added the water-borne dye.

Alternatively, the fabric may be soaked in water to which is subsequently added the water-borne dye.

Preferably, the soaking of the fabric and the subjection to microwave radiation are conducted within the same vessel containing the fabric, so that there is no need to transfer the fabric between vessels. It is therefore desirable that the vessel used is suitable for use in a microwave oven and is heat proof since the water and fabric may become hot

when subjected to treatment by microwave radiation.

Optionally, the fabric is subjected to microwave radiation while soaking in excess water-borne dye.

Excess water may be removed from the fabric prior to its subjection to microwave radiation, for example, by wringing the fabric, allowing the excess water to drip from the fabric or by application of heat to the fabric.

Alternatively, the method of subjecting the fabric to water-borne dye instead comprises partial wetting of the fabric, for example, by sprinkling or spraying the fabric with the water-borne dye, or pre-wetting the fabric and spreading or sprinkling dry or semi-dry dye thereon.

An important aspect of the invention is to utilise microwave radiation at a low power level which does not cause the complete migration of dye throughout the fabric in the time taken to achieve the required maximum depth of colour, i.e. to inhibit the uniformity of migration of the dye through the fabric giving a more graded dyeing effect.

A convenient way of achieving this is to use a microwave oven, such as a standard domestic microwave oven. Typically, the output of the microwave oven will be in the range from 100 to 1,500 watts, preferably 200 to 1,000 watts. A more preferred range is 500 to 700 watts.

The frequency of the microwave radiation is broadly in the range 0.3×10^{12} to 10^{9}Hz. Thus the frequency of the microwave radiation in a domestic appliance will usually be in the range of 5×10^{10} to 10^{8} Hz. The most preferred microwave radiation frequency range is from 5×10^{9} to 10^{9} to 10^{9} Hz.

The fabric may either be stationary relative to the microwave source while being subjected to microwave radiation or alternatively may be relatively rotated, for example by rotating it on a rotating plate. Alternatively a rotating microwave source may be used. This will depend upon the pattern of dyeing which is desired. A more uneven pattern will be obtained if the fabric is stationary.

In addition, if an uneven distribution of microwave radiation is used a more uneven pattern will be obtained in the dyed fabric. If such is desired microwave radiation of an uneven distribution may be used. The microwave radiation may be emitted from the top of a microwave oven, from the side of a microwave oven, or from the bottom of a microwave oven, or any combination of these. Some domestic microwave ovens emit microwaves in a fashion which is other than in parallel lines. Such ovens may be used to give differing patterns from those obtained with microwave ovens that emit microwave radiation in parallel lines.

Microwave ovens usually have several output power control options. For example these control options may be "low, warm, defrost, simmer, medium, bake, roast, re-heat or high". Any of these control options may be selected to give the most appropriate effect.

The microwave oven may be provided with a fan to provide convection of the heat generated by the microwave radiation. This fan may be a cooling fan.

Whether the fan is cooling fan or not, it may be particularly advantageous to use a microwave oven with a fan so that a relatively uniform temperature is achieved in the soaked garment. A cooling fan may be used particularly where it is desired to use cool water dyes to prevent excessive increase in the water temperature.

The microwave oven may be provided with a thermometer which is microwave resistant and the thermometer may be placed into the region of the fabric. Thus excessive increases or decreases in temperature of the fabric may be avoided. Provided the fabric does not heat excessively, it may be subjected to microwaves for between 30 seconds and 20 minutes. More usually the time for which the fabric is subjected to microwaves is from 1 minutes to 5 minutes, most usually from 3 minutes to 4 minutes. This will vary depending on the concentration of dye(s), the microwave power output used, and the colour effects required. The microwave oven may be stopped during the cycle and for example the fabric may be examined to see if the dye is being taken up by the fabric.

Preferably, the fabric is subjected to microwave radiation in close proximity to an apparatus for drying the fabric, for example a tumble dryer, a radiator, or a flat headed drying surface.

It is desirable that the dyes used in the process according to the present invention are dyes which are operational at temperatures below 95 degrees centigrade, more preferably below 80 degrees centigrade. In order to economise on energy expended on heating the water, it is even more desirable to use water soluble dyes which are operational at temperatures below 40 degrees centigrade. Cool water dyes are preferred, as this reduces the amount of time that the soaked fabric is to be subjected to microwave radiation. Preferably the temperature of the water is in the range recommended by the manufacturer for the particular dye used. The concentration of the dye in the water may be in the range of 1:000,000, to 1:10 by volume. More preferably in the range of 1:10,000 to 1:10 and more desirably in the range 1:1,000 to 1:100 by volume. The most preferred concentrations of dye are in the range recommended by the manufacturer for the particular dye used.

Any colour of dye may be used. Alternatively, the fabric may be subjected to the process using one particular dye, and subsequently subjected to the process again using the same or a different dye to attain a more complex pattern achieved by the sequential processes using the one or more dyes.

The fabric may be a natural fabric or may be a synthetic fabric. Suitable natural fabrics include cotton, wool, linen, and fabrics of animal skins including leather and suede.

It is generally undesirable to operate a microwave appliance with metallic articles or material in the chamber of the appliance. Small amounts of e.g. aluminium foil may though be added to the fabric, e.g. in strips or squares prior to creasing further to vary the effect of the microwave radiation on the dye and fabric.

EXAMPLES

Example One

The manufacturer's recommended amount of pink cold water dye was dissolved in a pint of cold water in a microwave radiation resistant bowl. A white cotton shirt was crumpled and placed into the bowl of cold water containing dye and the bowl was placed in the microwave oven. The microwave oven was operated on full power (ie.e. 600 watts) for four minutes. The microwave oven used did not rotate the soaking fabric. The temperature of the water in the bowl at no time exceeded 80 degrees centigrade. The frequency of the microwave output was 2.4×10^9 Hz. After four minutes the fabric was removed from the microwave oven, rinsed in cool water and flat dryed on a warm drying surface. The shirt was found to have been dyed pink and have the desired graded colouring effect.

Example Two

The manufacturer's recommended amount of green warm water dye was placed in a pint of warm water in a microwave resistant bowl. A piece of cream nylon fabric was crumpled and placed in the water containing the dye and the bowl was placed in the microwave oven for three minutes. The nylon fabric was then removed from the bowl, rinsed in cool water and was placed in a tumble dryer where it was dryed. The nylon fabric had become dyed green and exhibited the desired grading colouring effect.

Example Three

The green dyed nylon of Example Two was crumpled and placed in a bowl containing a pint of warm water in which had previously been dissolved the manufacturers' recommended amount of blue dye.

The bowl was placed in the microwave oven for four minutes and the piece of nylon was subsequently rinsed in cool water and dried. A more complex graded colouring effect was achieved by this manner, using the two sequential drying processes.

Example Four

The manufacturers' recommended amount of yellow cold water dye was dissolved in a pint of water in a bowl and a piece of white cotton fabric was soaked in the bowl. The fabric was removed from the bowl, and wrung. The fabric was placed in the microwave oven. The power of the microwave oven was 650 watts and the frequency of the microwaves used was 2.4×10^9Hz. The microwave oven was set on medium power for 3 minutes and was started. After 3 minutes the fabric was removed, rinsed and dried and exhibited the desired graded colouring effect.

Example Five

A piece of white linen fabric was crumpled in the hand and placed in a bowl of water. Water-borne dye was gently added to the top surface of the water in the bowl and the bowl was placed in a microwave oven. The microwave oven was operated on medium power for 4 minutes. After 4 minutes, the fabric was removed, rinsed and dried on a flat drying surface, and exhibited the desired colouring effect which was more uneven than that of the fabrics obtained in Examples one to four.

Claims

1. A process for dyeing fabric, in which the migration of the dye is uneven, comprising subjecting at least a part of the fabric to creasing, subjecting at least a portion of the part of the fabric to wetting and a least one water-soluble dye and subjecting the fabric to microwave radiation.

2. A process as claimed in claim 1, in which the water-soluble dye is at least partially dissolved in water.

3. A process as claimed in claim 2, in which the dye is applied to the surface of the water, without agitation.

4. A process as claimed in claim 2, or 3, in which the fabric is completely or partially immersed in the water bearing the dye.

5. A process as claimed in claim 1, 2, 3 or 4, in which the fabric is partially wetted with water-borne dye.

6. A process as claimed in claim 1, 2, 3, or 4, in which the fabric is wetted and sprinkled with dry or semi-dry water-soluble dye.

7. A process as claimed in any of claims 2 to 4, in which the microwave radiation is applied after adding the dye to the water.

8. A process as claimed in any of which 1 to 4 and 7, in which the dye is added to the water before or after immersion of the fabric in it.

9. A process as claimed in any of the preceding claims, in which the fabric is creased prior to subjection to the dye.

10. A process as claimed in any of the preceding claims in which the fabric is recreased between applications of microwave radiation.

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EUROPEAN SEARCH REPORT

Application Number

EP 89 30 0489

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y	US-A-4576611 (MILLIKEN RESEARCH CORPORATION) * the whole document *	1	D06B11/00 D06B19/00
X		9	
Y	EP-A-63203 (THE ICHIKIN) * the whole document *	1	
A	US-A-3102771 (SOUTHERN BLEACHERY AND PRINT WORKS INC.) * the whole document *	1	
A	US-A-1846845 (SANFORD MILLS) * the whole document *	2-5	
A	US-A-4108595 (UNITED MERCHANTS AND MANUFACTURERS INC.)		
A	WO-A-8705343 (BROOKE)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

D06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	02 MAY 89	PETIT J.P.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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