APPENDIX A

ABSORBANCE CURVES FOR COTTON

Cotton red

\[ y = 19.26x \]
\[ R^2 = 0.997 \]

Cotton blue

\[ y = 22.96x \]
\[ R^2 = 0.997 \]

Cotton yellow

\[ y = 15.68x \]
\[ R^2 = 0.997 \]
APPENDIX B

B.1 DYEING CYCLE OF COTTON

Salt

- dye
- disp.seq
- anti-crease

30°C

10%

30%

60%

soda ash

15'

30-60'

80°C

soaping and rinsing

B.2 CARRIER DYEING OF POLYESTER

disperse dye

70°C

10'

10'

2°C/min

95°C

30-60'

Reduction clearing and rinsing

- acetic acid
- dispersing agent
- carrier agent
- anti-crease mark
APPENDIX C

ABSORBANCE CURVE FOR POLYESTER

- Polyester red: \( y = 17.86x \), \( R^2 = 0.966 \)
- Polyester blue: \( y = 8.8x \), \( R^2 = 0.997 \)
- Polyester yellow: \( y = 26.35x \), \( R^2 = 0.964 \)
APPENDIX D

Figure D.1 Experimental setup of conventional heater

Figure D.2 Experimental setup of ultrasonic cleaner
APPENDIX E

Figure E.1 Experimental setup of microwave oven

Figure E.2 Experimental setup of magnetic stirrer
APPENDIX F

Figure F.1 Experimental setup of infrared dyeing machine

Figure F.2 Spectrophotometer
APPENDIX G

MICROWAVE DYEING MACHINE

Outline

The machine to realize rapid dyeing treatment. The cloth, saturated by dyestuff or other chemicals, is guided into an autoclave which is filled with saturated steam and allows the rapid diffusion of dyestuff into the inner part of the cloth by micro-wave heating.

1) Electro-magnetic wave (micro wave) can penetrate into the cloth instantaneously, and heat it up in a very short time.
2) Heat is generated by dielectric loss and absorbed proportionally to an amount of the loss. Therefore, the microwave heats up just the required portion.
3) As the material to be heated generates heat, there is no loss to heat ambient air or the equipment. Therefore, high heating efficiency is obtainable.
4) As every portion of the cloth is heated simultaneously, the cloth is dried up uniformly without temperature difference between its surface and inside.

[Description]

Structure explanation, Shape, and/or System diagram

Micro-wave dyeing machine

Since this is newly developed machine, comparison with conventional ones is not possible. Therefore, following table is a comparison with beam dyeing machine, that has much similarity with micro-wave dyeing.

<table>
<thead>
<tr>
<th>Energy saving effects</th>
<th>Beam dyeing</th>
<th>Micro-wave dyeing</th>
<th>Effect s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific power consumption</td>
<td>50 kWh/h</td>
<td>5 kWh/h</td>
<td>45 kWh</td>
</tr>
<tr>
<td>Steam consumption</td>
<td>360 kg/h</td>
<td>150 kg/h</td>
<td>3450 kWh/y</td>
</tr>
<tr>
<td>Reduction in crude oil equivalent *</td>
<td></td>
<td></td>
<td>1.109 IL/y reduce d</td>
</tr>
</tbody>
</table>

(*Note: assumed working hour is 4,000 h/oy)

<table>
<thead>
<tr>
<th>Economics</th>
<th>Equipment cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment amount(A): million yen</td>
<td>Improvement effect(B): million yen/year</td>
</tr>
<tr>
<td>Investment payback (A/B): years</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Remarks</th>
</tr>
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<tbody>
<tr>
<td>Applied at many sites. Technical report of a synthetic fiber manufacturer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inquiry</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEDO/ECC/JIEC</td>
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