INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530/2001/03–1–155–156
http://www.ijab.org

Continuing Education Article

Econtrol – A New Process for Dyeing

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ABSTRACT

The "Econtrol" process was jointly developed by BASF (GB) (previously Zeneca) and Monforts. In contrast to the process already described, Econtrol is characterized by the fact that no ancillary substances such as urea, water glass, soda, sodium hydroxide solution or salt are required. Reactive dyestuffs with high reactivity can be used for the Econtrol process. Dichlorotriazine (Procion MX) dyestuffs were employed in the development of this process and are used in practice.

Key Words: Econtrol; Dyeing

Economy and ecology are among the most used catchwords of our time, and their significance is of the greatest possible importance for the survival of our industry. Where continuous dyeing with reactive dyes is concerned, economic efficiency means employing dyeing process and techniques, which help to withstand international price cut and stay competitive. Simplified or reliable processes with greater color yields yet with a smaller usage of auxiliaries and energy must be the aim.

In the coming century, the forecast of cotton fabrics persistence in the world market is evident from the rapid growth in the popularity of woven leisurewear. The restrictions imposed by environmental legislation, growing competition in the world market, increased costs of resources and rapidly changing fashion demands, have put the pressure on the continuous dyes to compete with the present and future requirements. To survive in the market, necessary modifications in the machinery are essential along with the optimization in the process.

For this purpose, an evaluation was made of Econtrol method, a new dyeing technique with some modifications. The necessary economical and environmental benefits, which could be achieved with respect to the other conventional processes for continuous dyeing were assessed. The main priority was to assess the color yield achieved by different processes and to point out fastness requirement level.

Modification of Econtrol process for laboratory experimentation. The basic requirement for Econtrol drying process is hot air and 25% steam content. Keeping in view, the laboratory steamer was used. The steamer gives saturated steam (100% humidity) at 100-105°C. The temperature of the steamer was raised such that the humidity level fell to 25% in the steamer. The 25% humidity corresponds to 122.5°C. So temperature was maintained at 122.5°C. The other factors were kept as: Pick up = 80%, Shade = 2%, Total liquor = 250 ml, Amount of dye required = 2 x 250/80 = 6.25 g, Dye = Procion MX, Common salt = 5 g, Soda ash = 5g, Caustic soda (36°Be) = 1.75 ml, High temperature steaming (25% humidity, for 2 min).

The sample dyed by different processes like pad dry pad steam, pad dry thermofix, pad steam were compared with samples those dyed with Econtrol method.

Assessment of fastness to colour. The dyed samples were subjected to the color fastness tests i.e. washing fastness, light fastness and rubbing fastness, according to the description of International Standards Organization (ISO).

Colour strength percentage. The sample dyed with Econtrol method showed highest color strength using same dye bath concentration. The presence of 25% steam content at 120°C results in effective dissociation of cellulosic hydroxyl groups in the presence of alkali, and the preferential reaction of the dye with the cellulose with minimal hydrolysis of the dye.

Fixation level. The sample dyed with Econtrol method achieved the higher fixation level than other dyeing processes. This depends upon number of bonds the dye has made with fiber. Lower water costs result from higher degree of fixation and lower hydrolysis.

Chemical consumption. With a production speed of approximately 40 m/min and three-shift operation the following points emerged: 1. Pad-dry-pad-steam process approximately 520 tons of salt per annum, 2. Pad-dry thermofix process approximately 310 tons urea per annum, 3. Pad-batch process approximately 150 tons of alkali per annum, and 4. Econtrol process approximately 33 tons of soda ash per annum.

All these chemicals are washed out of the fabric and these pollute the environment through effluents.

Fastness

1. Washing fastness. The color of the washed fabric sample was compared with the original fabric sample and the color changed rating was noted by comparing with Grey

scale. It is clear from the following table that the sample dyed by Econtrol process gave highest fastness (Table I).

Table I. Washing fastness

Process	Rating (ISO a03)
Pad-steam	3-4
Pad-dry-thermofix	4
Pad-dry-pad-steam	4
Econtrol	4-5

2. Light fastness. The color of the exposed fabric sample was compared with the original fabric sample and the color change was noted by comparing with Grey scale. It is clear from the following table that the sample dyed by Econtrol process gave highest fastness (Table II).

Table II. Light fastness

Process	Rating (ISO) 105/B01
Pad-steam	5
Pad-dry-thermofix	5
Pad-dry-pad-steam	5-6
Econtrol	5-6

3. Rubbing fastness. The color stain on the white rubbed fabric (both dry and wet) was compared with the original white fabric sample and the color staining was noted by comparing with Grey scale. It is clear from the following table that the sample dyed by Pad-dry-thermofix process gave poor fastness (Table III).

Table III. Rubbing fastness

Process	Dry	Wet
Pad-steam	4-5	4
Pad-dry-thermofix	4	3-4
Pad-dry-pad-steam	5	4-5
Econtrol	5	4-5

CONCLUSIONS AND ADVANTAGES

To dye cotton by Econtrol method is a new step, which complies with the requirements, demanded by the continuous dyer. The advantages of the process can be summarized as:

1. Lower auxiliary costs. Highly reactive dyes (Procion MX) are used. Therefore, the process require just 10 g/L sodium carbonate.
2. Lower dye costs. Less dyestuff costs result from the greater fixation yield, i.e. less dyestuff is necessary to achieve the same shade. The process gives highly color intensity with the same dye concentration in the bath.
3. Lower water costs. Lower water costs resulted from the higher degree of fixation and lower hydrolysis per kilogram of fabric.
4. Lower steam and energy costs
5. Less effluent pollution. The higher degree of fixation and the absence of auxiliaries leads to a lower effluent pollution.
6. Softer handle
7. No dyestuff migration
8. Ideal for shot batches and large batches
9. The most economical process

(Received 20 November 2000; Accepted 11 December 2000)