

Technical Information



Nippon Kayaku (Thailand) CO., LTD.
Technical Service Center

(vol.17)

[Kayacion E-CG series for vivid green dyeing]

- The Kayacion E-CG series are a reactive dye series developed for vivid green color dyeing with excellent dyeing reproducibility.
- This document will explain and show the levelling properties of the E-CG series in producing vivid green shades.

Kayacion E-CG: Liquor ratio dependency and dyeing temperature dependency

Lemon Yellow + Turquoise

	Liquor ratio dependency		Dyeing temperature dependency		
	1:12	1:30	60℃	70℃	80℃
Kayacion E-CG (80℃ dyeing) Lemon E-CG 1.0 Turquoise E-CG 1.0					
Other company (70℃ dyeing) Yellow F-4G 1.05 React. Turq. G 1.10					
Other company (80℃ dyeing) Yellow H-E4G 2.0 Turquoise H-A 1.7					

Liquor Ratio 1:30 Dyeing concentration (Recipe % x 1.14)



Our E-CG trichromatic colors, Lemon E-CG, Turquoise E-CG, and Blue E-CG, have matched affinity which enables for excellent reproducibility.

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Kayacion E-CG: Affinity and Reactivity (In comparison with Kayacion E-LE conc)

Kayacion E-CG Recipe

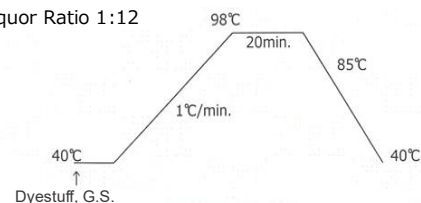
Kayacion Lemon E-CG	2.0 %o.w.f.
Kayacion Turquoise E-CG	1.0 %o.w.f.
G.S./Na ₂ CO ₃	42/20 (g/L)
Kayatector E	1 g/L

Kayacion E-LE conc Recipe

Kayacion Yellow E-LE conc	0.141 %o.w.f.
Kayacion Magenta E-LE conc	0.139 %o.w.f.
Kayacion Marine E-LE conc	0.485 %o.w.f.
G.S./Na ₂ CO ₃	22/20 (g/L)
Kayatector E	1 g/L

Glauber's salt Absorption (Na₂CO₃ not added)

Liquor Ratio 1:12

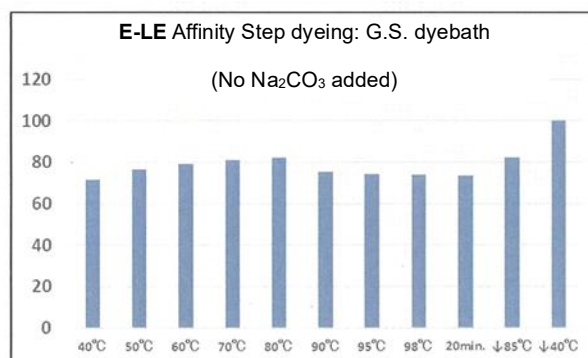
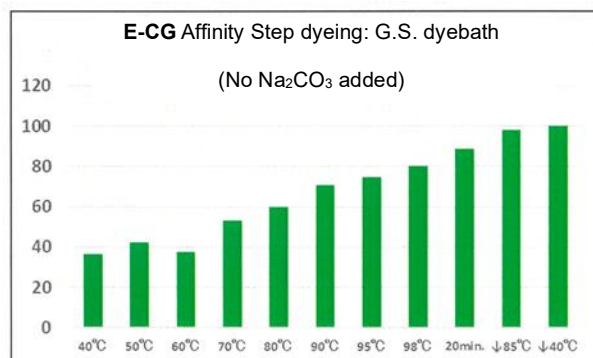


Kayacion E-CG

40°C	50°C	60°C	70°C	80°C	90°C	95°C	98°C	×20min.	↓85°C	↓40°C
36.4	42.3	37.5 ?	53.8	60.0	70.7	74.6	80.0	88.6	98.0	100

Kayacion E-LE conc

40°C	50°C	60°C	70°C	80°C	90°C	95°C	98°C	×20min.	↓85°C	↓40°C
71.6	76.7	79.4	81.0	82.2	75.5	74.5	73.9	74.0	82.4	100



- The graph above shows the absorption behavior at each temperature when Na₂CO₃ is not added (only dye and G.S. is added).
- For Kayacion E-LE conc (Right graph), there is small absorption difference from 40°C to 98°C and the absorption drops from 82.2% at 80°C to around 75% at 90°C to 98°C.
- By contrast, for Kayacion E-CG (Left graph), the absorption at 40°C to 60°C is about 40%, and the absorption amount increases towards 98°C. Kayacion E-CG does not show the same decrease in absorption at 90°C to 98°C.
- The cool-down dyeing method is a method of migrating the dye at condition where the absorption is reduced to obtain more uniform dyeing. Therefore, for Kayacion E-CG, if absorption spots/unlevel dyeing occur during the temperature rise process, dye transfer (migration) cannot be expected even if migration process is performed at 95°C to 98°C.
- To achieve uniform dyeing and prevent dyeing spots/unlevel dyeing with Kayacion E-CG, it is recommended to consider the absorption amount in the temperature rise process and slow down the temperature increase rate.

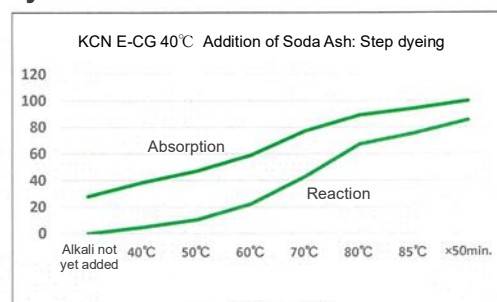
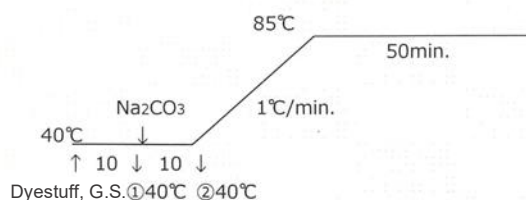
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KCN E-CG 40°C addition of Na₂CO₃: Affinity and Reactivity

Liquor Ratio 1:12



	① 40°C	② 40°C	50°C	60°C	70°C	80°C	85°C	×50min.
Absorption	27.9	38.6	47.2	59.4	77.0	88.8	94.1	100
Reaction	0	4.9	10.1	22.4	43.0	67.2	75.6	100

- The data above shows the absorption and reaction of E-CG with the addition of Na₂CO₃ at 40°C.
- The absorption difference before the addition and after the addition of Na₂CO₃ at 40°C is about 10% (38.6-27.9).
- In contrast, the absorption difference from 40°C to 80°C is approximately 50% (88.8-38.6) and during that time, fixation is progressing by approximately 60% (67.2-4.9).
- Therefore, even if there are no absorption spots/unlevel dyeing at the stage after alkali is added at 40°C, unlevel dyeing can still occur during the temperature rise process.

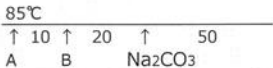
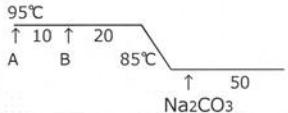
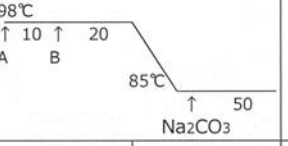
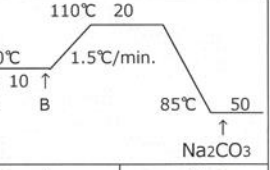
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Kayacion E-CG: Levelling properties in Glauber's salt dyebath

- Relationship of top temperature and cool down temperature on levelling properties. Liquor ratio is 1:12. Add undyed fabric A in the dye/G.S. bath and let the dye absorb for 10 minutes → Add undyed fabric B and allow dye absorption for 20 minutes → Add Na_2CO_3 for fixation.

							
A	B	A	B	A	B	A	B
							
ref.	$\Delta E=1.74$	ref.	$\Delta E=1.99$	ref.	$\Delta E=2.08$	ref.	$\Delta E=0.46$

- When the top temperature is below 98°C, there are larger differences in the shade of Fabric A and Fabric B.
- Fabric A and Fabric B is closest in shade at top temperature of 110°C.

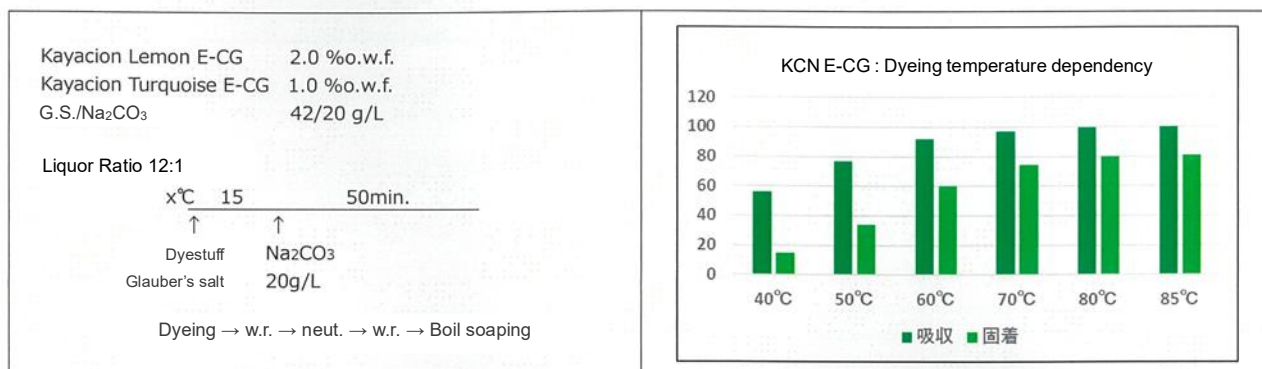
Reference

Material	85°C Isothermal	98°C Cool down	110°C Cool down	130°C Cool down	Material	85°C Isothermal	98°C Cool down	110°C Cool down	130°C Cool down
Cotton					Tencel G.S. 28g/L				

- In case of dyeing at above 110°C with cool down, the produced hue of both cotton and Tencel will be bluish

Kayacion E-CG: Levelling properties with Na₂CO₃ addition

Kayacion E-CG: Affinity step dyeing (No Na₂CO₃ added)



x°C	40	50	60	70	80	85
Absorption						
Reaction						

Conclusion

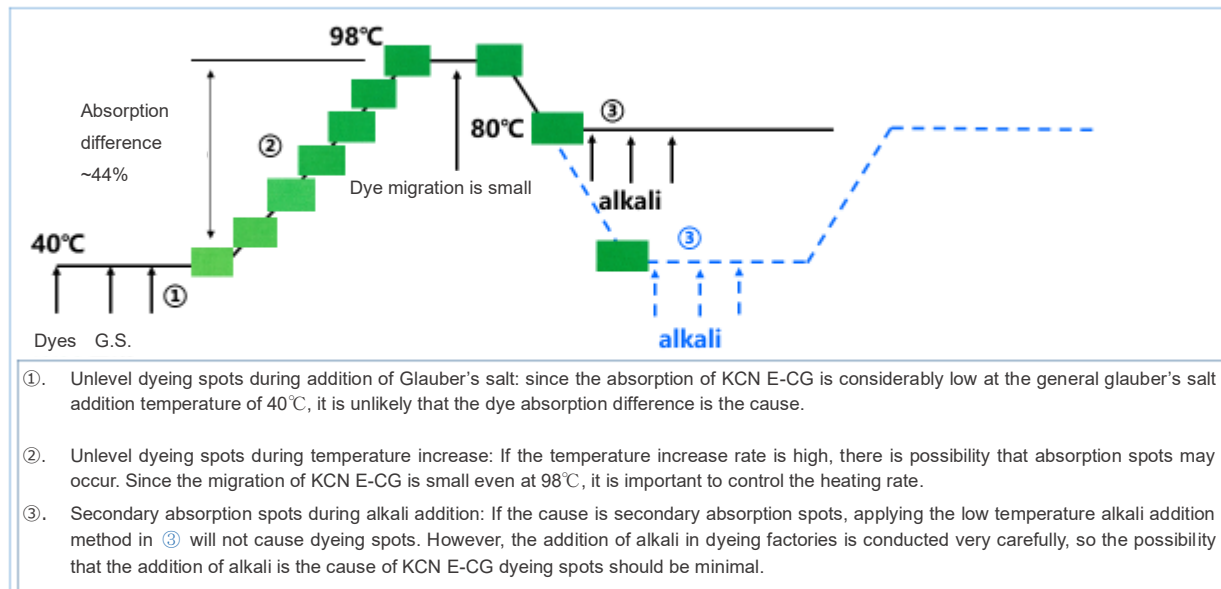
Factors that may result in dyeing spots/absorption spots:

1. Absorption spots when adding Glauber's salt
 - Usually at dyeing factories, Glauber's salt is added in parts, so absorption spots are unlikely to occur.
 - Glauber's salt is recommended to be added at 30-40°C for Kayacion E-CG, and due to the low affinity, absorption spots are unlikely to occur at this temperature.
2. Absorption spots during temperature increase
 - Unlike ordinary reactive dyes, absorption of Kayacion E-CG increases as temperature increases, similar to that of disperse dyes in polyester dyeing. Also, dye migration cannot be expected even if treated at a top temperature of 95°C-98°C. Therefore, if absorption spots occur during the increase in temperature, it is likely that they will become dyeing spots.
3. Absorption spots during addition of alkali
 - The general alkali addition temperature of Kayacion E-CG is 80°C, but Kayacion E-CG will have secondary absorption after alkali addition. Thus, if absorption spots occur during secondary absorption after the addition of alkali at this temperature, fixation progresses with the absorption spots remaining, resulting in dyeing spots.
 - Although the dyeing method seems to differ depending on the dyeing factory, it is speculated that the alkali is added at 80°C after processing for about 20 minutes at a temperature of 80°C or 90°C-95°C. A dyeing method in which the temperature of the dyebath is lowered to 40°C to 60°C for alkali addition, and the temperature is raised again to 80°C may be able to prevent dyeing spots due to alkali addition.

Factors other than dyes are also conceivable for dyeing spots, but this time, we confirmed dyeing factors specific to Kayacion E-CG. We hope that it will be of some help to solve the dye spots of our customers.

Combining the results aforementioned, the following dyeing recommendation can be created:

Absorption spots when dyeing with KCN E-CG



「Comment」

- We recognize that KCN Turquoise E-CG has a low affinity. Actual test results show that KCN Turquoise E-CG does not easily absorb to the cotton, and once it is absorbed in the cotton, it does not migrate easily.
- Regarding the causes of unlevel dyeing, there are various factors such as the type of material, the effect of scouring, and the effect of water quality. Therefore, the test results introduced this time cannot determine all the causes of unlevel dyeing, but we wish it would be of reference.
- We have received reports of uneven dyeing that occurred at a Chinese customer and was resolved through joint work between the customer and our Chinese Technical staff. The heating speed was changed and set to 1° C/min. After cooling down (90°C x 20 min.) → 80°C, the initial addition amount of soda ash was also changed and set to 0.5 g/L. Both these changes can reduce the absorption spots, so the factor that led to the resolution of the dye spots cannot be identified, but considering the test results this time, it is likely that changing the temperature increase speed was effective.