

Introduction

Fibers, yarns, and fabrics made with Acteev® have active zinc ion technology embedded in the polymer matrix which imparts antimicrobial functionality to the finished products. Special care and attention are needed during the dyeing and finishing processes to maintain adequate functionality of the zinc ion technology. This technical guide provides the recommended processing steps to achieve deep colors and uniformity in dyed fabrics/yarns with excellent colorfastness and minimal loss of zinc ion technology, although some is to be expected and built in.

Increased attention to pH during all wet processing steps is required as the zinc ion technology is sensitive to low pH conditions. A verification of each processing step is recommended when first starting to work with Acteev® to make sure each processing step does not remove an excess of the zinc ion technology. To verify each step, a small fabric swatch approximately 5" x 5" or ~2-3 grams is needed for analysis of the Acteev® zinc ion technology content. Ascend analytical labs can quickly verify each step, ensuring the minimum technology content is present for maintaining antimicrobial functionality in the final product(s).

Knitting and Weaving

Acteev® continuous filament yarns can be knitted, woven, textured, and blended/plied with spandex like any other fibers.

Reach out to your Ascend technical representative for fabric constructions and/or blending with non-spandex fibers.

Scouring

Maintaining neutral or basic pH, use non-ionic soap and sodium carbonate with heating as needed up to 80°C. Do not add any acids or scour at low pH.

Dyeing and Fixing

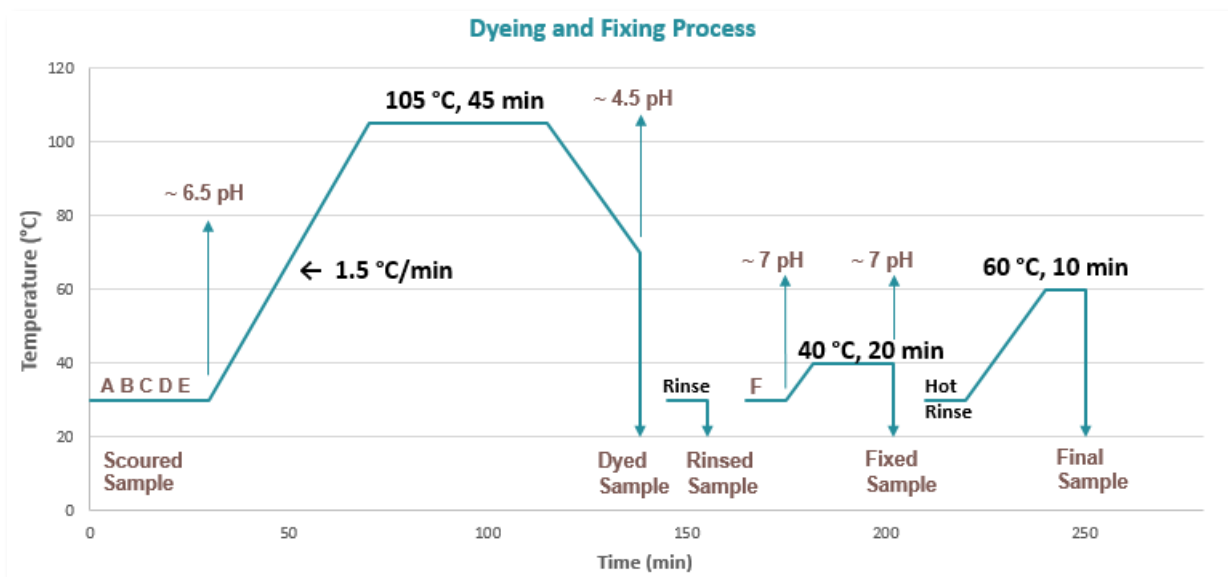
Dyeing is the most critical step for Acteev® yarns and fabrics as precise control of pH is required. The recommended pH control system is a citric acid / acid donor system. Specifically - Opticid® VS liq c is recommended due to its high potency and gradual pH decrease which allows for uniform/level dyeing. The target ending pH is 4.5 - 5.5 to maintain optimal retention of Acteev® zinc ion technology and can be achieved by adjusting the acid donor concentration. As a starting point, 0.7 g/L is recommended but may require adjustment due to specific water quality, dye stuff, color/shade, and/or acid donor batch. In general, retention of Acteev® zinc ion technology will improve with higher ending pH but may come at the expense of dye exhaustion above the upper 6.0 pH range target. The recommended dyeing process for acid and metal complex dyes is shown below using the citric acid / acid donor system.

A short fixing step at neutral pH is recommended to improve colorfastness. A specific fixative - Hydrocol APR is recommended due to its ability to be used effectively at neutral pH.

Post-Fix Hot Rinse

A short hot water rinse at 60°C for 10 minutes is required at the end to clean the fabric of any impurities left behind during any of the dyeing process.

Dyeing and fixing process using acid donor and buffer system

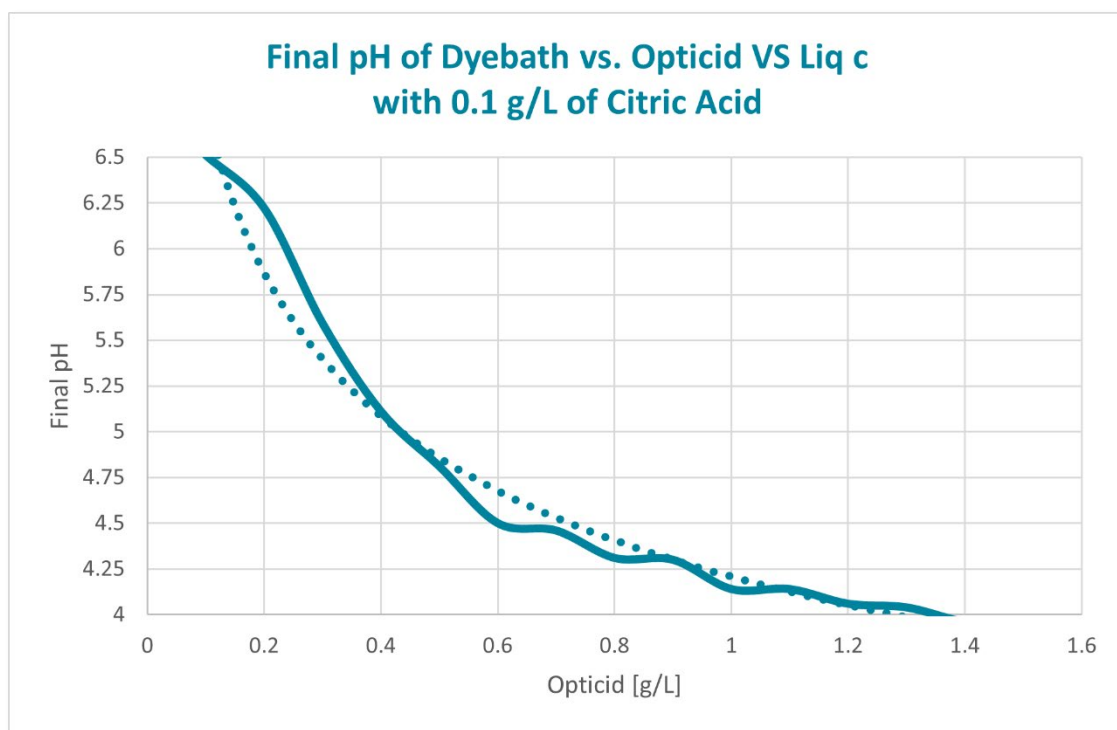


- A 0.1 g/L Citric Acid
- B ~ 0.4 g/L Opticid® VS liq c (acid donor product from Archroma) - *adjusted to meet target ≥ 4.5 ending pH or higher based on required shade/color (lighter colors and shades will require less acid donor for complete exhaustion) see chart below for guidance*
- C x% owf Acid and Metal Complex dyes - *preferred dye stuff being Nylon® or Lanasyne® products from Archroma*
- D 1.5 g/L Leonil EHC Liq - Wetting Agent product from Archroma
- E 0.375 g/L Lyogen CN Liq - Levelling Agent product from Archroma (*Optional-Use as Needed*)
- F 2% owf Hydrocol APR (fixative product from Rudolf)

Actions - pH Measurements and Sample Collection points for process verification

Notes:

- Acid donor concentration may need to be adjusted based on liquor ratio.
- Measure pH within 5-10 minutes of adding all auxiliaries and dyes but before starting heating as the acid donor will start to hydrolyze as soon as it is introduced to water, beginning to lower the pH.
- Other pH control systems may be used in place of the citric acid / acid donor system but may require additional verification and determination of pH/concentration/capacity.
- Different fixative products can be trialed and verified by collecting the samples before and after fixing, the neutral pH guidelines still apply.
- Different dye classes may require different rates, temperatures, times, and pH requirements - the general principals of pH control over 4.5 and verification after every step can be applied to verify the process suitability for Acteev®.
- Different facilities have different water pH and this value should be understood prior to dyeing to help improve the accuracy of the starting and ending pH for this dyeing process.



Performance Finishes (i.e. moisture wicking, softeners, DWR)

Acteev[®] yarns and fabrics can be combined with most topical finishes for added functionality. To ensure the effectiveness of the Acteev[®] zinc ion technology, consult with your Ascend technical representative before applying these types of treatments.

Heat Setting

Typical nylon hot air heat setting conditions can be used. Do not apply any acidic additives in the pre-heat setting.

Verification of Processing Steps

After every processing step, a small fabric swatch approximately 5" x 5" or ~2-3 grams are needed for analysis of the Acteev[®] zinc ion technology content. Ascend analytical labs can quickly verify each step, ensuring the minimum technology content is present for maintaining antimicrobial functionality in the final product(s). For troubleshooting any issues related to excess loss of Acteev[®] technology, pH measurements during the dyeing, fixing, and other process steps is essential. The minimum samples and pH measurements needed are highlighted in green in the dyeing process outline.

Sample Collection and pH Measurement Checklist:

Dyeing Trial: _____

Date: _____

Fabric Composition: _____

Processing Step	Sample to be Collected	Target pH	Sample Labeled	Measured pH	Notes
Knitting/Weaving	Greige fabric	n/a			
Scouring	Scoured fabric	7.0 – 10.5			
Dyeing	Dyed fabric	Start >6.0 Ending 4.5 – 5.5			
Rinsing	Rinsed fabric	~7.0			
Fixing	Fixed fabric	~5.5 - 7.0			
Rinsing	Post Fix Rinsed fabric	~7.0			
Topical Finish	Fixed + Topical fabric	~5.5 - 7.0			
Heat Setting	Heat set fabric	n/a			
Final fabric	Finished fabric	n/a			

Notes:

- Collect 5" x 5" or ~2-3 grams swatches, send samples as directed by your Ascend technical representative for analysis.
- Minimal losses are expected during scouring, rinsing, fixing, and heat setting if pH is properly controlled.
- Significant losses can occur during processing steps if pH less than 6 is experienced by the fabrics/yarns.
- Significant losses can occur during the dyeing step if pH less than 4.5 is experienced by the fabrics/yarns.
- Heat set step can be before or after dyeing depending on the end use requirements.

Colorfastness Results

Fabric:	100% Acteev Knit Jersey
Weight:	140gsm
Color spectrophotometer values:	L*: 17.04 A*: 0.1537 B*: -4.3637

When following the Acteev Dyeing and Finishing Technical Guidelines, the user should expect similar results to the colorfastness testing that can be seen below.

Colorfastness to Laundering: Accelerated (AATCC Test Method 61 – 2A)



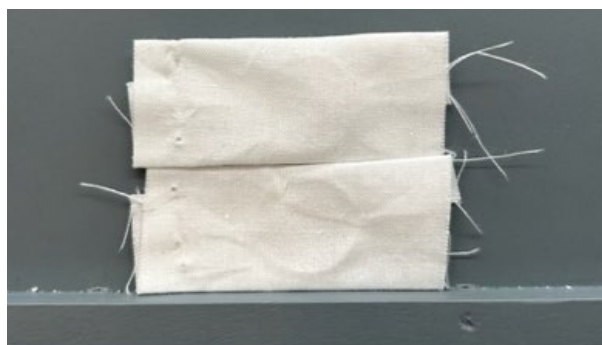
Material	Grade
Acetate	5
Cotton	4.5
Nylon	4.5
Polyester	5
Acrylic	5
Wool	5

Colorfastness to Water (AATCC Test Method 107)



Material	Grade
Acetate	5
Cotton	5
Nylon	5
Polyester	5
Acrylic	5
Wool	5

Colorfastness to Crocking: Crockmeter Method (AATCC Test Method 8)



Method	Grade
Dry Crocking (Top)	5
Wet Crocking (Bottom)	4.5