

Practical and Effective Test Methods for Managing Anodizing Line Organic Dye Baths

- ❑ Test Methods for real time decisions
- ❑ What do I need to do now to run production?

Christian Ebbrecht
Broadhead Technology
(207) 251-0389
c.ebbrecht@gmail.com



History

- Anodizers of aluminum metals have traditionally relied on the expertise and advise of suppliers to manage organic dye baths.
- These are the organic dyes used to color the anodized aluminum oxide (AAO).
- Samples are mailed to suppliers for analysis, testing is done, corrective action is suggested, replacement chemistry is ordered.
- This process is time consuming and results in production delays and increased turn around times.

The purpose of this presentation is to present **understanding, expertise, and practical test methods** for the anodizer to make real time decisions for less down time.

Traditional Process

- Inquiry
- Collection
- Shipment
- Receipt and analysis
- Results
- Decision for corrective action
- Ship replacement chemistry
- Schedule correction
- Confirmation and production



Where does the time go?



Scenario

Production says the black dyed parts coming off the anodizing line are too light in color.

Parts are not black enough.



SCENARIO: Production says the black dyed parts coming off the anodizing line are too light in color. Parts are not black enough.

Traditional Resolution

1. Engage the supplier and start the conversation
2. Dye sample sent to supplier lab
3. Dye sample tested and results sent to customer
4. Anodizer engages supplier on dye bath fix; pH and dye concentration Dye bath decant or dump
5. Anodizer orders more dye to replenish and replace dye solution
6. Anodizer receives dye and schedules decant or dump and dye bath replacement
7. Corrective action made
8. Confirmation of correction tested

Results

3-8 days with significant production time loss.

Oh No!

The customer wants the
part but you can't meet
their deadline!



SCENARIO: Production says the black dyed parts coming off the anodizing line are too light in color. Parts are not black enough.

Progressive Resolution

- Be the scientist and dig in!
- Use in house expertise:

Understanding



Knowledge



Tools / Test Methods



Results

for real time answers 1-4 business days

Success!
Happy
Customer

Progressive Resolution | Be the scientist and dig in!

Where do you start?

1. **Isolate tank**
2. **Test dye tank pH and buffer** –
reliable and calibrated pH meter
(bench top or hand held)
3. **Test dye concentration** – nominal/total dye strength versus effective strength



Nominal and Effective Strength | What's the difference?

Nominal Strength

- These two tests will provide a relative idea of nominal/total dye strength of the operating bath as compared to the standard concentrations.
- It will be visually clear if you are low, high, or close the total dye strength.

Nominal is the total amount of dye in solution.

Effective Strength

- The next important piece of information is the effective dye strength.
- How much of the total dye strength is available to color the aluminum oxide?

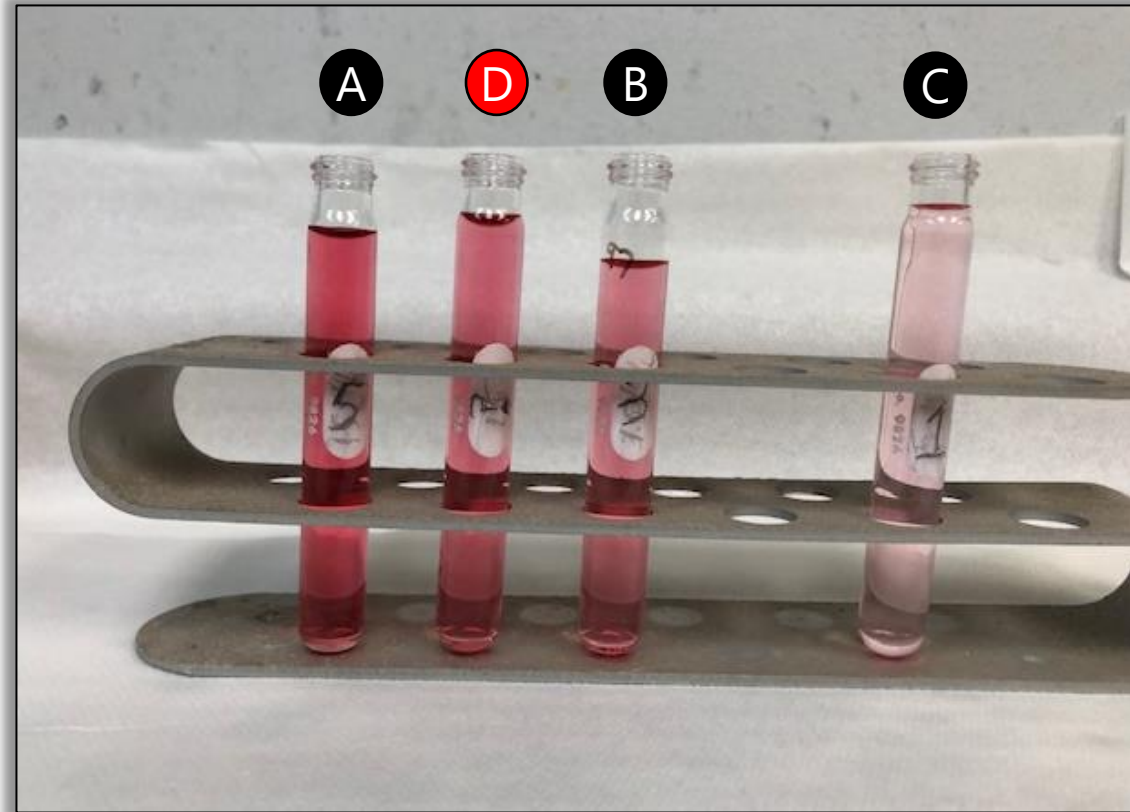
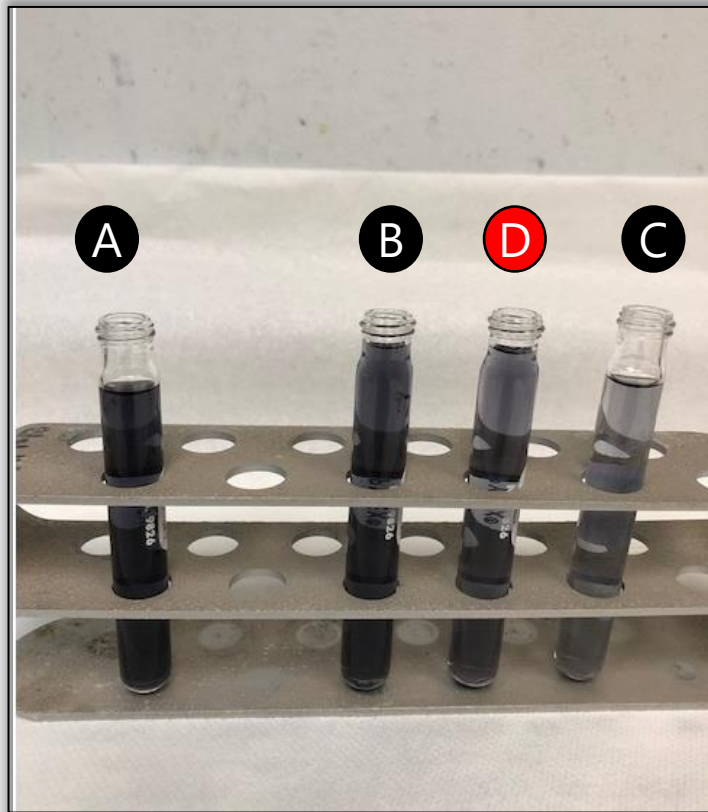
Effective is the amount of total dye that is active and able to dye the oxide.

Nominal Dye Testing | Test Tube Dilution

Test Tube Dilution – Comparison against standard solution

1. Prepare three standard dye solutions – target, above, and below
2. Make dilutions of 5 ml per 1,000 ml water in each standard solution
3. Make dilution of 5 ml per 1,000 ml water of operating dye bath
4. Compare operating bath against the standard solutions for relative idea of nominal bath concentration

Nominal Dye Testing | Test Tube Dilution



Dilution Key

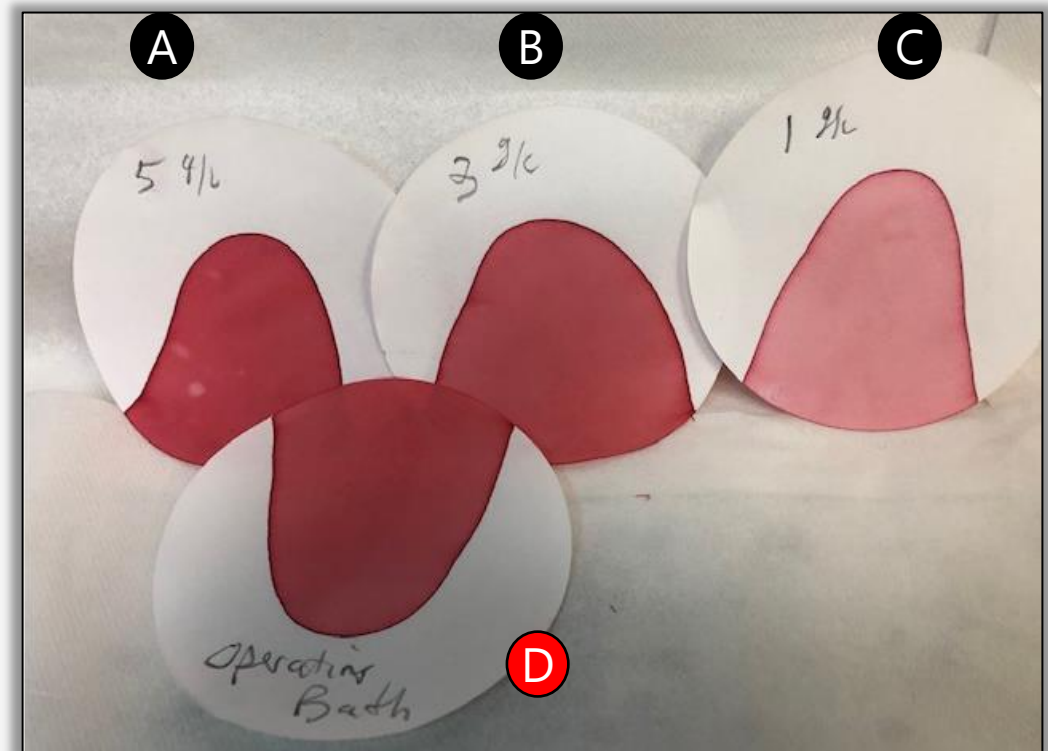
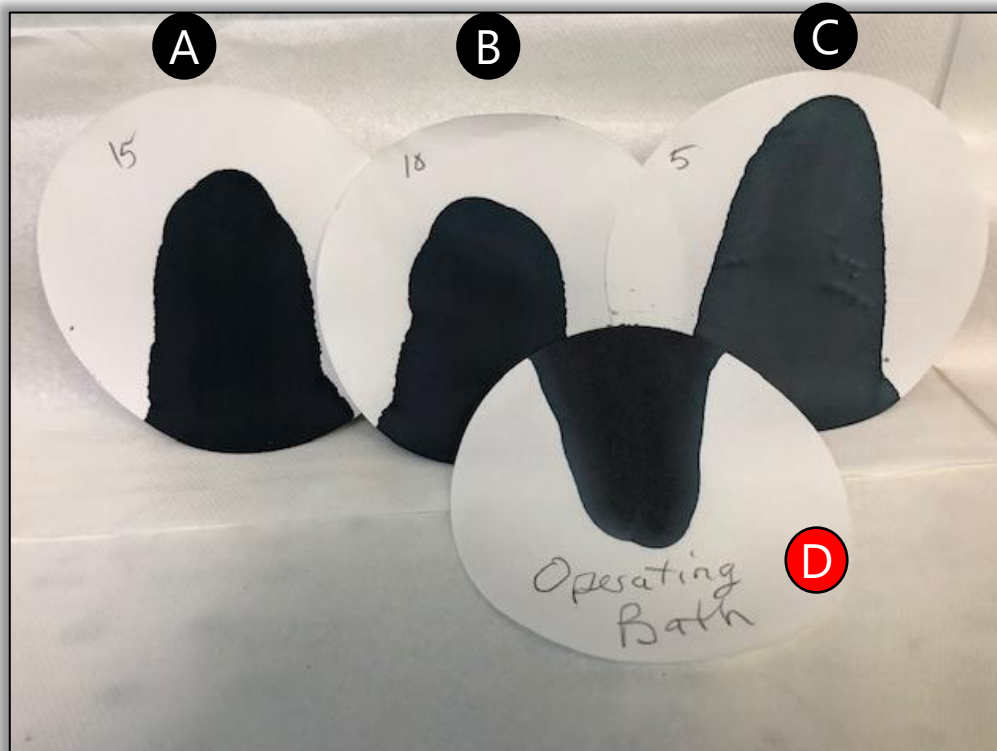
- A: High
- B: Target
- C: Low
- D: Operating Bath

Nominal Dye Testing | Paper Pour Out

Paper Pour Out – Comparison against standard solution

1. Prepare three test solutions – target, above, and below
2. Using an eye dropper, run solution down the center of the filter paper
3. Visually compare the strength of the operating bath against the standards

Nominal Dye Testing | Paper Pour Out



Paper Pour Out Key

A: High

B: Target

C: Low

D: Operating Bath

Effective Strength Test | Coupon Dyeing

- Use pre anodized sheet stock sold in 12-inch by 12-inch sheets.
 - *The sheet stock is thinner gauge material easily cut by a larger paper cutter.*
 - *The stock is available in 5005 alloy.*
- Cut the sheet material to fit into test beakers or test tubes to dye the coupons.
- A simple chemical activation step is used to make the AAO receptive to the dye.
- Coupons are dyed in standard solutions and compared to the operating bath to visually determine the effective dye bath strength.

Materials Required

- ✓ Pre-anodize sheet stock – purchased from Lawrence and Frederick, Streamwood IL (630) 289-8300
- ✓ Paper shear - larger size for heavier materials works well
- ✓ Nitric acid – 2-3% solution of nitric acid at ambient temperature to activate the pore structure
- ✓ Dye solutions – both standard and operating bath at correct pH and temperature

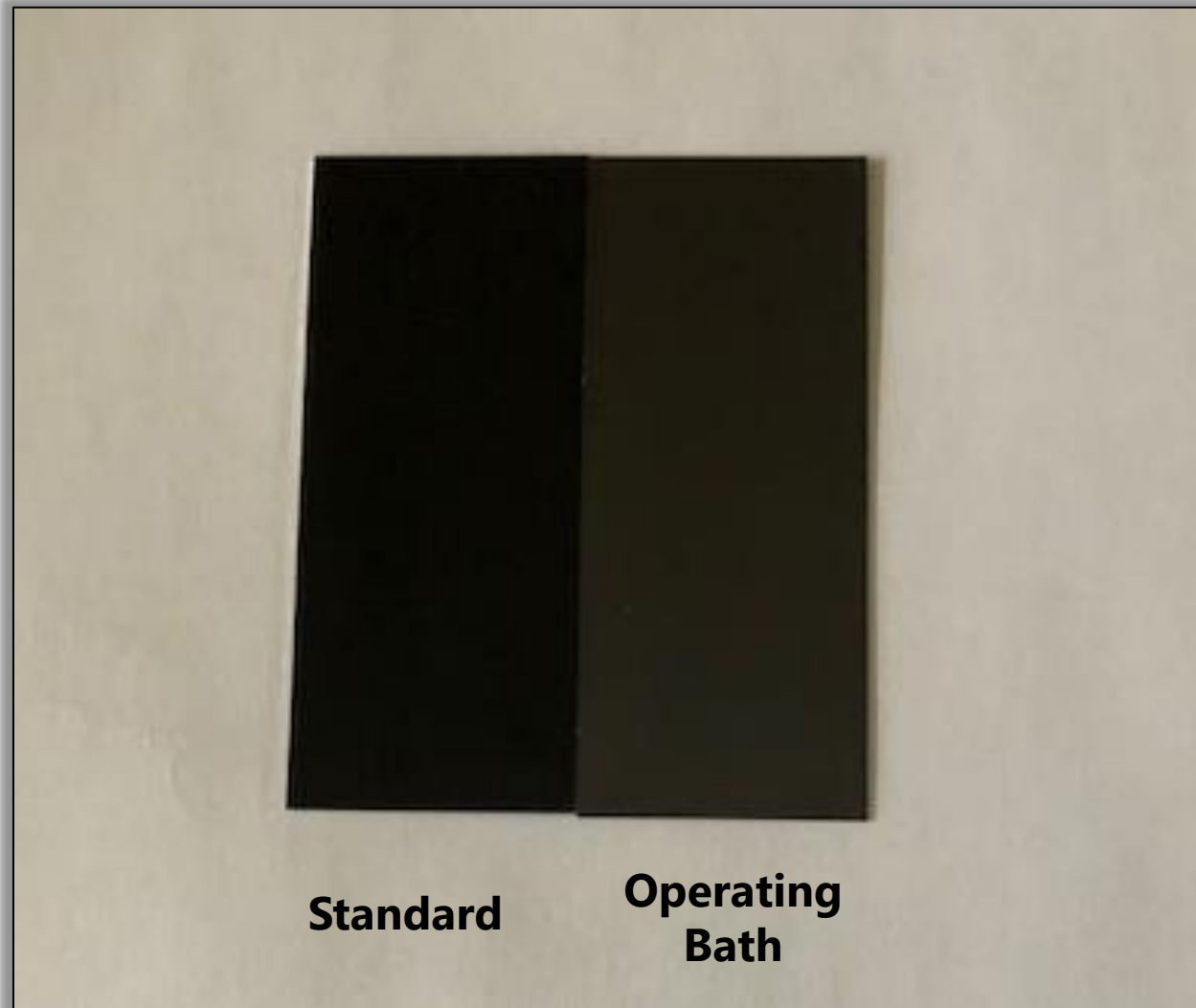
Effective Strength Test | Test Method

1. Prepare coupons, cut to width and length
2. Prepare 2-3% nitric acid solution at ambient temperature
3. Prepare standard test solution at correct dye concentration, buffer, pH, and temperature
4. Obtain operating dye bath and confirm pH, and temperature
5. Activate test coupons with 15-30 second nitric acid dip
6. Dye test coupons in dye solutions and compare depth of color of operating bath to standard bath
7. Test operating dye bath for buffer solution, make correction if required
8. Re-test coupon dyeing in the buffer corrected bath
9. Make visual assessment of dye bath operating efficiency for color against standard

Effective Strength Test | Coupon Dyeing Preparation



Effective Strength Test | Coupons



Summary

- Simple visual testing of operating dye baths can provide usable and accurate information to quickly provide corrective action to struggling dye baths.
- These tests when used together can significantly reduce **down time** by providing **real time answers** for production efficiency.

Stayed Tuned ...

Next Evolution ~ adding test equipment for scientific accuracy.

- **Spectrophotometer** techniques are used to measure the concentration of solutes in solution by measuring the amount of the light that is absorbed by the solution in a cuvette placed in the spectrophotometer. The spectrophotometer technique is to measure light intensity as a function of wavelength.
 - *ebay – Spectronic 20D*
 - *Hach - Colorimeter*



Thank You!

Questions?

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