A COMPARATIVE STUDY OF ANTIOXIDANTS IN COLOR PRESERVATION OF FISH[1]

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ABSTRACT

Fifteen commercial antioxidants were evaluated as color preserving agents in fish. Erythorbic acid (Miles Lab.) at a concentration of 1% in 10% formalin proved to maintain all colors studied in near natural conditions for more than two years. Ionol CP-40 (Shell Chemical Company) 1% was successful for red-color preservation for two years. Limited success in preserving red was also experienced with Antioxidant 221 (Greef Company) 0.1%, Antioxidant 703 (Ethyl Corporation) 1%, and Dillydap (Carlisle) 0.1%. All other agents failed to maintain color beyond that of formalin controls, failure in most cases being attributed to antioxidant insolubility. Isopropyl alcohol was ineffective as a vehicle for antioxidants used in biological color preservation.

Recent interest has been shown toward the use of antioxidants in preserving natural coloration of biological specimens (Yoshida, 1962; Toyama and Miyoshi, 1963; and Weller and Eschmeyer, 1965). This study evaluates commercially available antioxidants as color preservatives in freshwater fishes.

METHODS AND MATERIALS

Samples of fifteen antioxidants were secured from manufacturers and prepared at 0.01, 0.1, and 1.0% concentrations in 10% formalin and 40% isopropyl alcohol. Those agents insoluble in both preservatives were emulsified with Tween 80 and the subsequent emulsion dispersed in 10% formalin.

Four species of fish in breeding coloration were collected during the spring of 1964 from the Black River, Lorain County, Ohio. Each species was chosen to test a given color. Species selected and color represented were rainbow darter. *Etheostoma caeruleum* (orange), greenside darter. *Etheostoma blenniodes* (green), common shiner. *Notropis cornutus* (red), and yellow perch *Perca flavescens* (yellow).

Immediately after capture, a single individual of each species was placed in a pint glass jar containing a given concentration of the antioxidant. Specimens

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were stored in daylight and examined for color change and distortion at three-month intervals for a period of two years.

RESULTS

The results of color retention tests in the antioxidants evaluated are reported in table 1. Of these only two were of particular success in preserving all colors studied. Erythorbic acid (1%) in 10% formalin maintained natural color of specimens intact for more than two years. All colors remained, with only slight fading of the greens in *Etheostoma blenniodes*.

Ionol CP–40 (0.1%), previously reported as effective in maintaining red and orange colors at concentrations of 1, 10, and 20 cc. per 4500 cc. of 10% formalin (Waller and Eschmeyer, 1965), was found to preserve all colors for only six months. Complete fading of all colors except red was apparent within a year.

TABLE 1

Color-retaining properties of antioxidants in 10% formalin after 2 years

	Species	Rainbow Darter			Greensided Darter			Common Shiner			Yellow Perch		
	Color	Orange			Green			Red			Yellow		
	Concentration	.01	0.1	1.0	.01	0.1	1.0	.01	0.1	1.0	.01	0.1	1.0
Name													
Antioxidant 221	(Greef Chemical)	−	−	−	−	−	−	−	−	+	−	−	−
Antioxidant 703	(Ethyl Corp.)	−	−	+	−	−	−	−	−	+	−	−	−
Dillydap	(Carlisle Chemical)	−	−	−	−	−	−	−	+	+	−	−	−
Erythorbic Acid	(Miles Chemical)	−	−	+	−	−	+	+	+	+	−	−	+
Ionol CP-40	(Shell Chemical)	−	−	−	−	−	−	−	−	+	−	−	−

Partial color preservation was experienced through the greater part of the two-year period with Antioxidant 703 (1%) in keeping red and orange colors, while Antioxidant 221 (1%) and Dillydap (0.1 and 1%) proved successful for red.

All other agents failed to maintain natural coloration beyond that of a formalin control. Antioxidants which were dispersed with Tween 80 emulsifying agent included Antioxidant 703, BHA, BHT, Dillydap, Disterdap, Ethoxyquin, Irganox 1076, and Santoquin. None of these emulsions remained stable for more than two months. Isopropyl alcohol, while an excellent solvent for antioxidants, was ineffective as a color-preserving fluid, because animal pigments were highly soluble in it.

Those agents in which totally negative results were obtained included Butylated Hydroxyanisole (Koppers), Butylated Hydroxytoluene (Koppers), Disterdap (Carlisle), Ethoxyquin (Monsanto), Ionol CP–40 (Shell), Irganox 1076, Melilotin (Greef), Propyl Gallate (Heyden), Santoquin (Monsanto), Tenox 4 (Eastman), Tenox 5 (Eastman), and a formalin control (Matheson).

LITERATURE CITED

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