California Fish and Game 99(2):110-112; 2013

Treatment of laboratory waste formalin solutions with Neutralex®

Kathryn A. Hieb* and Linda Warkentin

California Department of Fish and Wildlife, 2109 Arch-Airport Road, Suite 100, Stockton, CA 95206, USA

**Correspondent: Kathy.Hieb@wildlife.ca.gov*

Key words: formaldehyde, formalin, laboratory, Neutralex, neutralization, treatment

---

The California Department of Fish and Wildlife (CDFW) Stockton office has collected several thousand zooplankton, larval fish, fish diets, and other biological samples annually from the San Francisco Estuary that were processed in their laboratories. Most of those samples were fixed and preserved in a 10% formalin (3.7% formaldehyde with 1.0 to 1.5% methanol) solution and many were archived in 5 or 10% formalin solutions. The formalin solutions were often amended with sodium borate to increase the pH or buffered with sodium phosphate monobasic and sodium phosphate dibasic.

The process of rinsing, sorting, processing, and archiving those samples resulted in waste formalin solutions that were successfully treated with Neutralex® (Scigen Scientific, Gardena, CA, USA). An aldehyde neutralization agent, Neutralex® is a noncombustible and stable powder; however, contact with an acid solution of a pH of 4 or less releases sulfur dioxide gas (Scigen 2009). This note documents the procedures used to treat 5 to 10% waste formalin solutions with Neutralex® in the CDFW Stockton laboratories, and the results thereof. Our Neutralex® treatment procedures generally followed the manufacturer's procedures (Sakura 2003, Scigen 2010), adapted for our laboratories and waste formalin solutions.

Each chemical transfer and treatment was conducted in a fume hood. The waste formalin was decanted from the sample through a sieve (43 to 300 microns) to remove debris and organisms, and the waste formalin transferred to a ~10-liter treatment container (American MasterTech, item number FRC-03K). Because the reaction between Neutralex® and formalin was exothermic, treatment containers were frequently inspected and replaced if any evidence of cracking, thinning, or failure was detected. Treatment containers were labeled "Hazardous Waste, Formaldehyde" and stored under the fume hoods located in each of five laboratories until ~7.6 liters of waste formalin had accumulated. There were two treatment containers per laboratory, with one container used for treatment and the other for accumulation.

After ~7.6 liters of waste formalin accumulated in a treatment container, the container was moved to the sink in a fume hood. Using a pH meter (model 85005, Sper

Scientific, Scottsdale, AZ) calibrated daily as necessary, staff tested the pH of the waste formalin. Treatment of solutions with a pH <4.1 did not proceed until the pH was increased to near 7 with sodium borate. The pre-treatment pH of the waste formalin batches ranged from 5.2 to 9.9, with a mean of 7.5 (n=706, SD=0.78).

For treatment of ~7.6 liters of 5% formalin (1.85% formaldehyde), we used one and a half of the 0.75 kg Neutralex® pouches (1.13 kg), while for treatment of the same quantity of 10% formalin (3.7% formaldehyde), we used two Neutralex® pouches (1.50 kg). After the appropriate amount of Neutralex® was added to the treatment container, the container was capped, shaken to mix thoroughly, and placed in a tray under the sink with a "Neutralex Added" sign. The date, volume and percentage of formalin, pre-treatment pH, and employee's initials were recorded on a treatment log next to each hood.

We let the treatment container stand for 30 to 60 minutes during neutralization, and then moved it back to the fume hood, swirled or otherwise mixed the solution, and tested the pH and residual formaldehyde of the treated solution. We used EM Quant® formaldehyde test strips (product number 10036-1; EMD Millipore, Billerica, MA), which were semi-quantitative with a scale of 0 - 10 - 20 - 40 - 60 - 100 ppm; the test strips and reagent were stored in a refrigerator between use, per the manufacturer's instructions. A 5-ml sample of the treated waste was removed with a pipette and placed in the vial supplied with the formaldehyde test kit. Ten drops of the reagent were added to the vial and the vial gently swirled to mix. A test strip was dipped into the vial for one second, removed, and the long edge placed over a paper towel. After exactly one minute**,** the color on the test strip was matched to the color on the label of the test strip container. If the resultant formaldehyde concentration was >100 ppm, the waste solution was retreated. The resultant pH and formaldehyde concentrations were recorded in a log. The pH of treated batches ranged from 4.1 to 10.5, with a mean of 6.3 (n=706, SD=0.85). Residual formaldehyde of all treated batches tested at 0 ppm, although actual values potentially were >0 ppm because the lowest values of the test strips were 0 and 10 ppm.

Finding that waste formalin solutions with pre-treatment pH ranging from 5.2 to 9.9 could be successfully treated with Neutralex® is noteworthy, because California Department of Toxic Substances Control (DTSC) field demonstrations of Neutralex® treatment at several health-care facilities used neutral-buffered 10% formalin with a pre-treatment pH near 7 (DTSC 1997). Our post-treatment pH range of 4.1 to 10.5 was also broader than the post-treatment pH range of 5.5 to 7.75 reported from these demonstrations (DTSC 1997), likely because of how we buffered or otherwise adjusted the pH of our formalin solutions, variations in sample to formalin ratio, and variations in preservative age.

DTSC certified Neutralex® as a hazardous waste treatment technology for use by the health-care industry, in part is based on field demonstrations at several health-care facilities. The CDFW process of waste formalin treatment with Neutralex® resulted in formaldehyde concentrations of <10 ppm, consistent with findings from those field demonstrations (DTSC 1997).

Literature Cited

DTSC (Department of Toxic Substances Control). 1997. [Internet] Final notice of certification**.** Scigen Neutralex technology for treatment of aqueous formaldehyde wastes from the health care industry; [cited 29 March 2013]. Available from: www.dtsc.ca.gov/TechnologyDevelopment/TechCert/scigen-batch-treat-formaldehyde-techcert.cfm

Sakura Finetek USA, Inc. 2003. [Internet] Tissue-Tek® Neutralex™ users' handbook; [cited 29 March 2013]. Available from: www.sakura-americas.com

Scigen, Inc. 2009. [Internet] Material safety data sheet for Neutralex®. Revised 5 December 2009; [cited 29 March 2013]. Available from: www.scigenus.com

Scigen, Inc. 2010. [Internet] Treatment procedure for formalin using the EPA/DTSC certified Neutralex® technology; [cited 29 March 2013]. Available from: www.scigenus.com

Received 31 March 2013
Accepted 11 April 2013
Associate Editor was J. Trumbo

Books Received and Available for Review

The following books have been received, and are available for review. Individuals interested in preparing a review that will be published in *California Fish and Game* should contact the editor (Vern.Bleich@wildlife.ca.gov) with their request to do so.

Gotshall, D. W. 2012. Pacific Coast inshore fishes. Fifth edition. Sea Challengers, Monterey, California, USA. 363 pp. $9.99 (E-Book).

Kirkwood, S., and E. Meyers. 2012. America's national parks: an insider's guide to unforgettable places and experiences. Time Home Entertainment, Inc., New York, New York, USA. 208 pp. $24.95 (hard cover).

Love, M. S. 2011. Certainly more than you want to know about the fishes of the Pacific coast: a postmodern experience. Really Big Press, Santa Barbara, California, USA. 650 pp. $29.95 (soft cover).

Taylor, T. 2013. Fishing the river of time. Greystone Books, Vancouver, British Columbia, Canada. 206 pp. $19.95 (soft cover).