

Formaldehyde residues in olive flounder  
(*Paralichthys olivaceus*) and black rockfish  
(*Sebastes schlegeli*) exposed to formalin, and in  
formalin-treated seawater

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### Introduction

Formalin, 37% formaldehyde, has been employed as a chemical for controlling ectoparasites and aquatic fungi responsible for infectious fish diseases in hatcheries and culture facilities (Roberts, 1978; Schnick, 1991; Rach et al., 1997). Regarding the commercial usage of formaldehyde in the aquaculture industry, the U.S. Food and Drug Administration (FDA) approved three commercial products as parasiticides in a species-specific manner: Paracide-F and Formalin-F for bluegill, catfish, largemouth bass, salmon, and trout and Parasite-S for all finfish (FDA, 1998). Withdrawal time for these products was legally zero when used as permitted under the regulations. With the increased production of cultured fish in Korea, such as olive flounder *Paralichthys olivaceus* and black rockfish *Sebastes schlegeli*, application of formalin to diseased fish has become more frequent. Moreover, there is still some concern about environmental exposures caused by effluents from fish culture facilities. The purpose of the present study was to evaluate residues in fish resulting from therapeutic usage of formalin in the aquaculture industry and to document the rate of disappearance of formaldehyde in seawater treated with formalin.

### Materials and Methods

Formaldehyde residues were analyzed as previously described (Yamagata and Low, 1995). Residual formaldehyde of muscle was determined in cultured olive

flounder weighing 86 to 105 g and black rockfish weighing 80 to 100 g after bath treatment of formalin (37% formaldehyde) at 0 (untreated control), 100, 300 and 500 mg/ℓ for 1 hr and 300 mg/ℓ for 3 hr. Five fish from each tank were sampled daily from the beginning of the recovery period for three days to supply muscle samples for formaldehyde analysis. To minimize the loss of formalin from the solution, neither additional water nor aeration was provided to the tanks during formalin exposure. Data obtained were statistically analyzed by Student's t test with Sigma Plot software and differences giving  $p < 0.05$  were regarded as significant. Disappearance of formaldehyde in filtered seawater treated with formalin at 25, 50, 100, 150, and 200 mg/ℓ was also studied under conditions with (8.2 mg/ℓ ) and without aeration.

## Results and Abstract

Formaldehyde residues in the muscle of those fish treated with 500 mg/ℓ formalin for 1 hr and 300 mg/ℓ formalin for 3 hr were significantly higher ( $p < 0.05$ ) than that of controls when analyzed immediately after bath exposures (0 hr withdrawal). However, there were no significant differences ( $p > 0.05$ ) between control and treated groups when formaldehyde concentrations were determined at 24, 48 and 72 hr of withdrawal. Formaldehyde in seawater treated with formalin ranging from 25 to 200 mg/ℓ was depleted completely within 8 to 19 days, but its degradation was accelerated (within 6 to 10 days) by adding dissolved oxygen (8.2 mg/ℓ ). These findings provide a scientific relevant database suitable for determination of an appropriate withdrawal time and environmental risk assessment for therapeutic use of formalin in the aquaculture industry.

## References

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