

**Table 4b. Toxicity of Copper to Saltwater Plants**

Species	Method <sup>a</sup>	Chemical	Salinity (g/kg)	Duration	Effect	Result <sup>b</sup> (total µg/L)	Reference
Dinoflagellate, <i>Amphidinium carteri</i>	S,U	Copper chloride	21	14 days	83% reduction in growth	<50	Erickson et al. 1970
Dinoflagellate, <i>Gymnodinium splendens</i>	S,U	Copper sulfate	31.6-33.3	5 days	EC50 (growth)	20	Saifullah 1978
Dinoflagellate, <i>Prorocentrum micans</i>	S,U	Copper sulfate	31.6-33.3	8 days	EC50 (growth)	5	Saifullah 1978
Dinoflagellate, <i>Scrippsiella faeroense</i>	S,U	Copper sulfate	31.6-33.3	5 days	EC50 (growth)	5	Saifullah 1978
Dinoflagellate, <i>Scrippsiella faeroense</i>	R,U	Copper sulfate	31.6-33.3	8 days	EC50 (growth)	<1	Saifullah 1978
Dinoflagellate, <i>Simbiodinium microadriaticum</i>	S,M,T	Copper sulfate	FSW	23 days	46% reduction in growth (significant)	40	Goh and Chou 1997
Dinoflagellate, <i>Simbiodinium microadriaticum</i>	S,M,T	Copper sulfate	FSW	23 days	26% reduction in growth (not significant)	42	Goh and Chou 1997
Green alga, <i>Chlorella stigmatophora</i>	S,M,T	Copper chloride	35	21 days	EC50 (cell volume)	70	Christensen et al. 1979
Green alga (zoospores), <i>Enteromorpha intestinalis</i>	S,U	-	-	5 days	EC50 (development to 2+ cell stage)	10	Fletcher 1989
Green alga, <i>Olisthodiscus luteus</i>	S,U	Copper chloride	21	14 days	74% reduction in growth	<50	Erickson et al. 1970
Diatom, <i>Nitzschia closterium</i>	-	-	-	96 hr	EC50 (growth)	33	Rosko and Rachlin 1975
Diatom, <i>Nitzschia thermalis</i>	S,U	Copper sulfate	35.7	Several days	No growth	38.1	Metaxas and Lewis 1991
Diatom, <i>Skeletonema costatum</i>	S,U	Copper chloride	21	14 days	58% reduction in growth	50	Erickson et al. 1970
Diatom, <i>Skeletonema costatum</i>	S,U	Copper sulfate	35.7	Several days	LOEC (no growth)	31.8	Metaxas and Lewis 1991
Diatom, <i>Skeletonema costatum</i>	S,U	Copper chloride	-	96 hr	EC50 (growth)	45	Nassiri et al. 1997
Diatom, <i>Thalassiosira aestevallis</i>	S,U	Copper chloride	-	3-4 days	Reduced growth	19	Hollibaugh et al. 1980
Red alga (tetrasporophyte), <i>Champia parvula</i>	R,M,T	Copper chloride	30	11 days	Reduced growth	4.6	Steele and Thursby 1983
Red alga (tetrasporophyte), <i>Champia parvula</i>	R,M,T	Copper chloride	30	11 days	Reduced production	13.3	Steele and Thursby 1983
Red alga (mature), <i>Champia parvula</i>	R,M,T	Copper chloride	30	7 days	Reduced female growth	4.7	Steele and Thursby 1983
Red alga (mature), <i>Champia parvula</i>	R,M,T	Copper chloride	30	7 days	Stopped sexual reproduction	7.3	Steele and Thursby 1983

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Species	Method <sup>a</sup>	Chemical	Salinity (g/kg)	Duration	Effect	Result <sup>b</sup> (total µg/L)	Reference
Kelp (meiospore), <i>Laminaria saccharina</i>	R,U	Copper sulfate	-	21 days	Reduced gametophyte development rate	5	Chung and Brinkhuis 1986
Kelp (1-3 cm sporophyte), <i>Laminaria saccharina</i>	S,U	Copper sulfate	-	9 days	LOEC (100% mortality)	100	Chung and Brinkhuis 1986
Kelp (8-10 cm sporophyte), <i>Laminaria saccharina</i>	S,U	Copper sulfate	-	-	23% decrease in blade growth	10	Chung and Brinkhuis 1986
Giant kelp, <i>Macrocystis pyrifera</i>	S,U	-	SW	96-hr	EC50 (photosynthesis)	60	Clendenning and North 1959
Giant kelp, <i>Macrocystis pyrifera</i>	R,M,T	Copper chloride	33	19-20 days	NOEC (sporophyte production)	<10.2	Anderson et al. 1990
Giant kelp, <i>Macrocystis pyrifera</i>	R,M,T	Copper chloride	33	19-20 days	NOEC (sporophyte production)	10.2	Anderson et al. 1990

<sup>a</sup> S=Static; R=Renewal; F=Flow-through; M=Measured; U=Unmeasured; T=Total metal conc. measured; D=dissolved metal conc. measured.

<sup>b</sup> Results are expressed as copper, not as the chemical.