SEAWATCH APPLICATION PROGRAM FOR ENVIRONMENTAL MONITORING

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Abstract

Seawatch Indonesia Program as the cooperation program between Indonesia (BPPT) and Norway (Oceanor) in Monitoring on Marine Environmental Pollution, is one of big step on high technology application. Data from buoy which placed in the Indonesian waters given information about waters condition. Monitoring toxicity of heavy metal in waters can be predicted with the situation value of salinity and temperature. Because of salinity, temperature and heavy metals had a correlation in the environment.

I. INTRODUCTION

Indonesian waters as more of 60 % part of Indonesian country with length of coast line reaches 80,791 km (Profil Kelautan Nasional, 1995), is an infinite asset for Indonesian people. In conjunction with the offshore oil exploration and oil tanker routes in Indonesian waters that growth higher, the risk of oil spill will also be higher related to the condition. This condition, of course, needs more monitoring concentration then before relating to the big area of Indonesian waters. In this case, the concrete acts needed to protect Indonesian waters from the impact of oil spill.

Seawatch Indonesia Program as the cooperation program between Indonesia (BPPT) and Norway (Oceanor) in Monitoring on Marine Environmental Pollution, is one of big step on high technology application. With the establishment of this program, all the meteorological & oceanographic data can be covered completely, so the mapping process of physical, chemical, and biological condition of Indonesian waters could be better.

Meteorological & oceanographic data were taken from the buoy that placed in the water. These data are: salinity, current speed and direction, wind speed and direction, temperature, oxygen saturation, attenuation, etc. The data can describe condition and situation of waters. Seawatch Indonesia Program tries to make forecasting from the data.

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II. EFFECTS OF TEMPERATURE AND SALINITY ON THE TOXICITY OF HEAVY METALS

Despite the considerable effort expended on the toxicity testing of potentially harmful substances to aquatic organism by many research organizations, relatively few studies have examined the effects of temperature and salinity. The majority studies have examined the toxicity of substance at one temperature and salinity regime. There have been fewer studies of the toxicity of substances to estuarine animals, and ever fewer cases of temperature and salinity have been included in experimental design.

Property	Effect on Property Increasing		
	Salinity	Temperatur	Pressure
Absorption of light	No effects	No effects	No effects
Boiling point	Increased	*	Increased
Density	Increased	Decreased	Increased
Electrical conductivity	Increased	Increased	Decreased
Freezing point	Decreased	*	*
Latent heat of vaporization	No Change	Decreased	*
Osmotic pressure	Increased	Increased	Increased
Refractive index	Increased	Decreased	Increased
Sound velocity	Increased	Increased	Increased
Specific heat capacity	Decreased	Increased	Decreased
Surface tension	Increased	Decreased	*
Temperature of max density	Decreased		*
Thermal conductivity	Decreased	Increased	Increased
Thermal expansion	Increased	Increased	Increased
Vapor pressure	Decreased	Increased	
Viscosity	Increased	Decreased	No Change

(From Ingmanson, 1989)

Table l. Effects of Environmental Changes on Seawater

This review will show the effects of temperature and salinity on the toxicity of heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) to marine invertebrates.

Arsenic is probably the least studies of the heavy metals with regard to its toxicity, and only the recent study of Bryant, Newbery, McLusky & Campbell (1985 from Barnes, 1986). Founding that toxicity increased as temperature and concentration of arsenic increased, but salinity had no significant effect. Increased temperature enhanced both arsenic uptake and loss. Mussels in seawater at 19%. salinity accumulated approximately three times more than those held at 38%. salinity. Arsenic loss was much less affected by salinity, with only a tendency for greater arsenic retention noted at lower salinities. There are few studies on the acute toxicity of arsenic to marine invertebrates. Nelson et aL (1 976) report a 96 h LCgo of 3.49 mgl-l arsenic as As"' to Argopecton irradians at 20 OC and 25%. salinity and noted that arsenic was less toxic than mercury, silver or cadmium. Calabrese, Collier,

Nelson & Macinnes (1 973) reported a 48 h LC50 value of 7.5 mgl-l arsenic to embryos of Crassostrea virginica at 26 OC and 25%..

Sainity	Na^{+}	Mg^{2+}	Ca^{2+}	K^{+}	B^{2+}	Sr^{2+}	Cl^{-}	SO_4^{2-}	Br^{-}	F^{-}	HCO^{3-}
5	1.539	0.185	0.058	0.057	0.001	0.001	2.763	0.387	0.010	0.0002	0.020
10	3.078	0.370	0.118	0.114	0.002	0.002	5.527	0.775	0.019	0.0004	0.040
15	4.617	0.555	0.177	0.171	0.003	0.003	9.290	1.162	0.029	0.0005	0.061
20	6.156	0.739	0.235	0.228	0.003	0.005	11.054	1.550	0.038	0.0007	0.081
25	7.695	0.924	0.294	0.285	0.004	0.006	13.817	1.937	0.048	0.0009	0.101
30	9.234	1.109	0.353	0.392	0.004	0.007	16.581	2.325	0.058	0.0011	0.122
31	9.542	1.146	0.365	0.353	0.004	0.007	17.133	2.402	0.059	0.0011	0.126
32	9.850	1.183	0.377	0.365	0.004	0.007	17.685	2.480	0.062	0.0012	0.130
33	10.157	1.220	0.388	0.376	0.004	0.007	18.239	2.557	0.063	0.0012	0.134
34	10.465	1.257	0.400	0.388	0.004	0.008	18.791	2.635	0.065	0.0012	0.137
35	10.773	1.294	0.412	0.399	0.005	0.008	19.344	2.712	0.067	0.0013	0.142
36	11.081	1.331	0.424	0.410	0.005	0.008	19.897	2.789	0.060	0.0013	0.146
37	11.389	0.368	0.435	0.422	0.005	0.008	20.449	2.867	0.071	0.0013	0.150
38	11.696	1.405	0.447	0.433	0.005	0.009	21.002	2.944	0.073	0.0014	0.154
39	12.004	1.442	0.459	0.445	0.005	0.009	21.555	3.022	0.075	0.0014	0.158
40	12.312	1.479	0.471	0.456	0.005	0.009	22.107	3.099	0.077	0.0015	0.162
41	12.620	1.516	0.482	0.456	0.005	0.009	22.660	3.117	0.079	0.0015	0.166
42	12.928	1.553	0.494	0.467	0.005	0.009	23.213	3.254	0.081	0.0015	0.170

Caution Concentration: Average result of Cox and Culkin (1 967) Sulphate and Bromide concentration based on mean value from Moris and Killey (1 966).

Table 2. Concentration of mayor ions in sea water of various salinity (gkg-1) (Riley & Skirrow, 1975)

Acute cadmium toxicity is strongly modified by abiotic factors, mainly temperature and salinity. Polyps more tolerant to cadmium low temperature (7.5 OC) and high salinity (25%.), with maximum toxicity at 17.5 (C and 10%. S. Rank order of toxicity at one salinity (20%.) and one temperature (20 OC) from six species of estuarine animals are: H g2,) Cd 2+) Zn 2+) Cr 6+) Ni2+. Cadmium and mercury together and separately had an increased effect as salinity decreased. Cadmium and salinity were fatal in the combination of 0.4 mgl-l and 20%. for 30 days, and 4 mgl-l at all salinities if a 48-h LC50 for annelids (Dinophilus gryciliatus)(Roed, 1979 from Barnes, 1980).

The influence of temperature and salinity, dissolved oxygen concentration and population density on the toxicity of cadmium to the copepod Tisbe holothuarie show that toxicity of cadmium was significantly affected by the dissolved oxygen concentration, the population density and the interaction between salinity (from 33 to 46%o) and temperature higher than 1 1 OC (up to 26 OC) the combined effects of temperature and cadmium cause a heavy metal stress to Tisbe so that the salinity effect is masked.

Cooper toxicity has been shown to be influenced by both temperature and salinity; the shrimp, Pandalus done, was found to be more sensitive to cooper at 20 ('C than at 10 OC. The combined effects of salinity, temperature, and cooper on two life stage of the American oyster, Crassostrea virginica.

Lead as a pollutant has assumed particular importance due to relative toxicity and increased environmental contamination via car exhaust and highway run-off. Effects of lead in estuarine environment with the combined effects of fluctuating

salinity and temperature, however, have not been widely studied and relevant literature is scarce. Salinity has more effect on development Mytilus edualis embryos than temperature. Optimum condition existed at 34.8%. and 15.6 OC, under which lead had a minimal effect.

Mercury is considered a non-essential but highly toxic element for living organism; consequently mercury and its compounds are included in the "black list" of all international convention. Research has shown that the toxicity of heavy metals generally increase with decreasing salinity and increasing temperature, this may not always be the case with mercury; changes in temperature and salinity from the optimum condition required by a particular animal are, likely to lead to an increase in sensitive to mercury.

III. CONCLUSION

Buoy Seawatch Indonesia can give oceanography data and meteorology. Salinity and temperature are sample of data. From the salinity and temperature, if being combined with toxicity of heavy metal could give an early warning about environment condition. Because of relation between salinity, temperature and heavy metals, so the environment condition can be predicted when it is harmful.

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