WET DEPOSITION EFFECTS ON IRON AND NUTRIENT DISTRIBUTIONS IN IZMIR BAY, EASTERN AEGEAN SEA

Ugur Sunlu [1]*, Ethem Maniga [2], Mine Dumanogullari [2] and Meral Ozsuer [1]
[1] Ege University , Faculty of Fisheries Dept. of Hydrobiology - ugur.sunlu@ege.edu.tr
[2] Ege University, Center for Environmental Studies

Abstract
The aim of this study was to determine the impacts of wet atmospheric deposition on nutrients and iron levels in Izmir Bay (Turkey). Rain water and marine water were collected monthly between 2012-2013 from the selected three stations. At the and of the research we found that nutrients and iron contents of rain water effected the quality of coastal marine water.

Keywords: Atmospheric input, Coastal waters, Nutrients, Eutrophication, Aegean Sea

Iron is an element essential for the biochemical and physiological activity of marine phytoplankton due to its role in many metabolic processes, i.e. photosynthesis, nitrate reduction, nitrogen assimilation, nitrogen fixation and oxidation reactions. In the aquatic environment iron and nutrients deficiency are responsible for the growth restriction of phytoplankton. Wet and dry deposition of iron molecules from the atmosphere is an important source for both HNLC (high nutrient low chlorophyll) and coastal marine waters. Particle iron (Fe^{+3}) transport over long distance by adsorbing onto particles in the air. In the meanwhile, reduced to Fe^{+2}, the bioavailable form to the marine phytoplankton (1).

The main purpose of this study primarily determination of particulate and dissolved (Fe^{+2} and Fe^{+3}) iron and nutrients (such as, nitrite, nitrate, ammonium, phosphorus and silicate) concentrations in rain water at the selected three stations (Homa Lagoon: Station1; Ege University: Station 2; Urla: Station 3). The sampling stations designated by the degree of rurality. St 1 is an rural area with no settlement, St 2 is an built up area with an high pressure of urbanization and St 3 is a semi urban area. Simultaneously, samples from the coastal marine waters were taken from the selected stations and analyzed on a regular basis for 12 months.

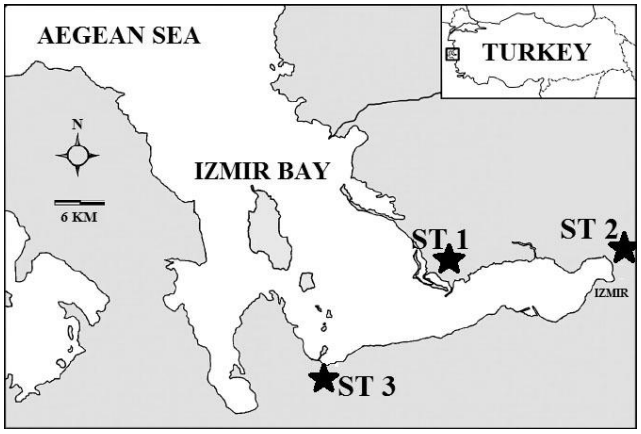

Fig. 1. Sampling stations for rain and marine water along the Izmir Bay

Izmir Bay is a part of the eastern coast of the Aegean Sea (Figure 1). Rain and marine water were collected with dark PE bottles from three stations (figure 1) (St.1, St. 2, St.3) on a monthly basis during a year. Since the summer is dry season in the area, rain water can't be collected in that period. Spectrophotometric analysis applied for nitrite, nitrate, ammonium, phosphate, silicate, particulate (Fe^{+3}) and dissolved iron (Fe^{+2}) concentrations (2, 3). Hatch Lange Dr 4000 model spectrophotometer is utilised for the determination of concentrations. Levels of nutrients and iron are shown in Table 1.

Tab. 1. Minimum–maksimum (average) nutrient and iron concentrations of coastal marine and rain waters (µg M/L)

	ST1 Rain Water	ST 1 Sea Water	ST 2 Rain Water	ST 2 Sea Water	ST 3Rain Water	ST 3 Sea Water
NO_2	0.46-2.52 (1.44)	0.01-6.28 (0.93)	0.03-1.04 (0.27)	0.08-4.67 (0.77)	0.59-2.19 (1.41)	0.01-0.88 (0.21)
NO_3	2.08-12.82 (8.50)	1.51-9.56 (3.29)	0.84-21.95 (13.99)	1.13-25.62 (9.67)	1.65-19.48 (10.75)	1.08-8.17 (2.97)
NH_4	2.63-15.03 (9.48)	1.49-19.93 (5.39)	3.24-29.01 (12.79)	0.93-29.87 (13.28)	3.49-17.10 (10.35)	0.29-7.83 (3.47)
PO_4	0.10-0.99 (0.41)	0.14-1.36 (0.35)	0.22-2.61 (0.71)	0.80-5.08 (1.99)	0.09-0.37 (0.24)	0.02-1.15 (0.30)
SiO_2	9.89-13.27 (11.66)	6.01-17.69 (8.52)	9.38-17.18 (13.82)	3.93-25.41 (14.68)	5.68-32.38 (18.54)	3.65-23.60 (9.77)
Fe^{+2}	0.10-0.32 (0.24)	0.02-0.04 (0.02)	0.07-0.14 (0.10)	0.01-0.05 (0.03)	0.05-0.19 (0.15)	0.03-0.07 (0.05)
Fe^{+3}	0.90-1.54 (1.25)	0.38-0.69 (0.56)	0.13-0.32 (0.24)	0.16-0.55 (0.37)	0.56-0.72 (0.65)	0.01-0.05 (0.02)

The most abundant nutrients were silicate, nitrate and ammonium both in sea and rain water from the all stations. Iron levels were more in the rain water than the marine water. While the order of total N was St 1<St 3< St 2 in rain water, it was St 3< St 1< St 2 in marine waters. Both Fe(II) and Fe(III) has the highest levels in St 3 during the year. The order of particulate iron levels in rain water were ST 2 < ST 3 < ST 1, which can be explained by the direction of the predominant wind. The dominant wind direction of Izmir Bay is N and NE (4). These winds are coming from the northerly agricultural land, Menemen lowland, where the fertilizers are intensively used. We assume that the iron–steel plants of the area is also contribute to the iron load of the air.

The high amount of nutrients and iron in rain water has contribution to marine waters and in certain months there is a eutrophication in Izmir Bay, even tough there is a treatment facilities.

At the end of the research, we found that nutrient and total iron concentrations in rain water affectted the coastal sea water quality directly. In addition, nutrient and total iron contents of rain water showed significant variations depending on the seasons and the sampling locations.

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