THE COMPARISON OF BACTERIAL LEVEL IN THE GOLDEN HORN (ISTANBUL, TURKEY) BY USING MICROSCOPIC AND CULTURAL METHODS

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Abstract

Surface water taken from four different areas in the Golden Horn (Istanbul, Turkey) was analyzed in order to detect levels of bacterial contamination. Bacterial densities enumerated by direct microscopic counts were 2 orders of magnitude higher than plate counts.

Key words: Microscopic Count, Viable Count, Bacterial Contamination

Introduction

Bacteria play a central role in the bio-cycles in aquatic environments (1). Under anthropogenically induced eutrophication, bacterial abundance might increase and pathogenic bacteria might be present as well (2) influencing human health (3).

Instead of conducting separate tests for pathogen bacteria, like *Salmonella, Esherichia coli* 0157, *Vibrio cholera,* determination of indicator bacteria using ordinary analytical methods is a classic approach in aquatic microbiology (4, 5). When we count marine bacteria using either microscopic or ordinary viable counting methods, great differences often occur between direct counts (DC), and viable counts on nutrient rich media such as ZoBell 2216E and VNSS (6).

Golden Horn has been one of the important recreation areas of Istanbul (Turkey) but became heavily polluted in the last half of the 20th century.

Materials and methods

A total of 44 samples of surface water was collected from the coastal area of Alibeykoy, Eyup, Balat and Fener (Golden Horn, Istanbul) and transported to the laboratory between November 2002 and September 2003.

Bacterial counts were made using direct microscopic counting techniques (DC) and the Most Probable Number (MPN) Technique with different media. VNSS agar plates (800 mg C/l), Plate Count Agar (PCA), 0.22 µm Filtered Natural Seawater (FSW), Filtered Seawater with 0.05 µg/l vitamin B_{12} (FSW+B_{12}) were used for viable counts (6; 4). After 24 hours of incubation at 37°C colonies on agar plates were counted.

Results

The results of bacterial counts using DC and cultural methods on surface water samples collected from Golden Horn during the investigation period are given in Tables 1-3. Total Coliform and *E. coli* were highest in samples taken at Alibeykoy (Tables 1, 2). Maximum bacterial abundance was detected by direct microscopic counting. Minimum bacterial numbers were detected using Filtered Seawater as the medium.

Table 1. Analysis for Total Coliforms, *Esherichia coli*, and *Salmonella* spp. in surface waters from Golden Horn, Istanbul, Turkey (MPN/100 mL)

Study Area	Number of the Samples	Total Coliform Max-Min	*Esherichia coli* Max-Min	*Salmonella* spp.
Alibeykoy	11	$11x10^2$-≥$24x10^3$	95x10 -$11x10^2$	One Sample +
Eyup	11	$23x10^2$ -$95x10^2$	24x10-95x10	-
Balat	11	95x10-23x10	9.5x10-2.4x10	-
Fener	11	50	<10	-

Discussion

Microscopic counting of bacteria in samples from Alibeykoy yielded $3x10^5$ cells/ml, values of the same samples on Plate Count Agar were $2x10^5$ CFU/ml. Variances in bacterial counts in samples from Alibeykoy were found to be lower as compared to samples collected from Fener (Table 3). Samples from Fener showed that differences between microscopic counts and cultural counts are greater in oligotrophic environments. As can be seen in this study, both the trophic level of the aquatic environment and the different enumeration methods used affect the results of the counts. Thus, studies on transforming unculturable bacteria to culturable forms are important (6; 7; 8). It is assumed that bacteria undergoing sudden exposure to nutrient rich media cannot utilize the substrates (9).

Table 2. Bacterial counts by microscopic and viable counting methods in surface water collected from Alibeykoy (Golden Horn, Istanbul)

Direct Count Cells/ml	*Viable Counting Methods CFU/ ml*			
	Plate Count Agar (PCA)	*Nutrient Rich Media (VNSS)*	*Filtered Seawater (FSW)*	*Filtered Seawater with Vitamin B_{12} (FSW+B_{12})*
$3x10^5$	$2x10^5$	10^5	10^2	10^4

Table 3. Bacterial counts (cells/ml) by microscopic (MC) and viable counting methods in surface water collected from Fener (Golden Horn, Istanbul)

Direct Count cells/ml	*Viable Counting Methods CFU/ ml*			
	Plate Count Agar (PCA)	*Nutrient Rich Media (VNSS)*	*Filtered Seawater (FSW)*	*Filtered Seawater with Vitamin B_{12} (FSW+ B_{12})*
$6x10^2$	50	2.6	4X10	4.5X10

References

1 - Heissenberger A., Leppard G.G., Herndl J.G., 1996. Relationship between the intracellular integrity and the morphology of the capsular envelope in attached and free-living marine bacteria. *Appl. Environ. Microbiol.,* 62: 4521-4528.

2 - Jacob J.M., 1989. Safe Food Handling World Health Organization Genava 142.

3 - Ducklow H.W., Carlson C.A., 1992. Oceanic bacterial production. *Adv. Microb. Ecol.,* 12: 113-181.

4 - APHA, American Public Health Association, American Water Work Association,Water Environment Federation, 1998. Standard Methods for the examination of water and waste water (20th ed) Clesceri, LS., Greenberg, A.E., Eaton, AD, EDS. Washington.

5 - Bordner R., Winter J., Scarpino P., 1978. Microbiological methods for monitoring the environment: water and wastes. Environmental Monitoring and Support Laborotory, Office of Research and Development. EPA-600/8-78/017

6 - Eguchi M., 1999. The nonculturable state of marine bacteria. 8th International Symposium on Microbial Ecology, Bell CR, Brylinski M, Johnson-Green P (Eds) Canada.

7 - Pinhassi J., Zweifel UL., Hangström A., 1997, Dominant marine bacterioplankton species found among colony-forming bacteria. *Appl. Environ. Microbiol.,* 63: 3359-3366.

8 - Schut F., Prins R.A., Gottschal J.C., 1997. Oligotrophy and pelagic marine bacteria: facts and fiction. *Aquat. Microb. Ecol.,* 12: 177-202.

9 - Bloomfield S.F., Steward G.S., Dodd C.E.R., Bototh I.R., Power E.G.M., 1998. The viable but non-culturable phenomenon explained? *Microbiology*, 144: 1-3.