المجلة العراقية
لبحوث السوق وحماية المستهلك

المجلد (7) العدد (1)
لسنة 2015

Study the distribution of Fungi and Bacteria in AL-Yusifia River– South of Baghdad City.

Alaa M. Dh. Al-Haidari **Beadae A. Mahdii**
Department of Biology, College of Science
University of Baghdad

تأريخ استلام البحث: 2014/11/18 تأريخ قبول النشر: 2015/5/10

Abstract

Al-Yusifia river was assessed at three sampling stations with study period from Autumn 2010 to the end of Summer 2011. The present investigation was carried out on diversity of fungi and bacteria from Al-Yusifia river, Baghdad city. During the study, a total of 12 fungal genus and 6 bacterial genus were isolated during the year seasons. The dominant fungus at the three stations were *Penicillium sp.*, then *Rhizopus* and *Trichophyton megninii* while the dominant bacteria was *Escherichia coli* and *Klebsiella* sp.

The higher fungi that occurred in station-I and this may be due to unpolluted nature of water and less anthropogenic activities was encountered at this station. Station II and III there were less in number of fungi. This may due to the polluted nature of the water and increased anthropogenic activities at this station, the higher bacterial genus was observed in station- III then station II and station I.

The results showed increased of fungal and bacterial genus during Summer and Spring in compare with other seasons due to convienance of temperature.

Key words: Fungi, Bacteria, Physicochemical parameters, pollution, Four seasons.

المجلة العراقية
لبحوث السوق وحماية المستهلك

المجلد (7) العدد (1)
لسنة 2015

دراسة توزيع الفطريات والبكتريا في نهر اليوسفية- جنوب مدينة بغداد.

الاء محمد ظافر الحيدري بيداء عبد القادر مهدي
قسم علوم الحياة/ كلية العلوم
جامعة بغداد

المستخلص

اجريت هذه الدراسة على ثلاث محطات من نهر اليوسفية في مدينة بغداد لعزل وتشخيص الفطريات والبكتريا خلال الفترة من خريف 2010 الى نهاية صيف 2011. لقد تم عزل وتشخيص 12جنس من الفطريات من تلك المحطات كان معظمها من الفطريات التي قد تكون مرضية او رمية.

اوضحت الدراسة ان الفطريات السائدة كانت *Penicillium, Rhizopus, and Trichophyton megninii,* ان اعلى نسبة ظهور للفطريات كان في محطة 1 وذلك بسبب قلة الملوثات لقلة النشاط البشري لتلك المنطقة ، بينما محطة 2 و3 بلغ اقل عددا للفطريات بسبب زيادة نسبة التلوث و لزيادة النشاط البشري فيها.اوضحت النتائج ايضا زيادة ظهور الفطريات خلال فصلي الصيف والربيع مقارنة مع الشتاء والخريف.

اما بخصوص البكتريا فقد تم عزل وتشخيص 6 اجناس منها وكان النوع السائد طول فترة الدراسة ولجميع المحطات هي بكتريا *Escherichia coli* يليها بكتريا *Klebsiella* sp, *Enterobacter aerogenosa* وكانت المحطة 3 اكثر المحطات تلوثا ولجميع فصول السنة، كما سجلت المحطة 2 و3 ظهورا لبكتريا الكوليرا/ *Vibrio cholerae* خلال فصلي الربيع والصيف، وقد يرجع سبب زيادة نمو الفطريات والبكتريا خلال فصلي الصيف والربيع الى ملائمة درجات الحرارة لنموها.

الكلمات المفتاحية: فطريات، بكتريا، عوامل فيزيائية وكيميائية، تلوث، الفصول الاربعة.

Introduction

Fungi, are directly influenced by environmental factors. Fungi are usually present in natural water in direct proportion to the physicochemical nature of the aquatic environment (24).

Fungi contribute to the energy flow and productivity of ecosystems by their active role in the utilization and biodegredation of organic materials (12; 15).

The main role of the freshwater fungi in freshwater ecosystems are in the degradation of dead organic material (2). Some investigations have been conducted on the occurrence of fungi with special reference to polluted streams (13; 3) that studied streams in Ohio, indicated a correlation between the degree of pollution and occurrence of the fungi. The occurrence of several aquatic hyphomycete species in heavily polluted streams has been reported (22; 23).

The sources of bacteria in waters is differed, some of them from untreated waste waters which contains soluble organic material and harmful bacteria for human and animals(20), also the wastes from animals which contain many harmful bacteria which cause different diseases for human such as intestinal inflammation (29).

The bacterial groups that investigated evaluate the waters include coliform bacteria and fecal coliform bacteria.

The test of fecal coliform bacteria is considered more sensitive for water and used as measurement for activities of water purification and indicator for a health drinking water(21).

The increase in these bacterial numbers and the presence of another bacteria which it not normal bacteria in water are considered indicators for water pollution, especially coliform bacteria (1). The uses of polluted water is considered the causative agent for different disease especially when used these waters in plants irrigation.

The present investigation is an attempt to evaluate the ecological biodiversity of some fungi and bacteria from Al-Yusifia river, Baghdad city.

Materials and Methods

Study area:

Three different stations from Al-Yusifia river south of Baghdad selected for water samples collection for fungal and bacterial diversity analysis. Station I– about 3 Km. before Al-Yusifia region, Station II– about 2 Km. after Al-Yusifia region and Station III- after Al-Rasheed region during Autumn 2010 to the end of Summer 2011.

Collection of water samples:

The water samples from three regions were collected in the morning hours every month by using sterile polyethylene containers. The samples were collected in three different locations from each region.

Isolation and Identification of fungi:

Isolation of fungi was carried out by standard isolation techniques (7): Some drops of water samples was separated by using sepreader on Potato Dextrose agar (PDA), and Sabrouid Dextrose agar (SDA) then incubated at room temperature for one week in a dark place. After one week the fungi appeared on the surface of agar.

Fungi colonies were identified according to the shape of colony and microscopically identification according to their spores and fungal filaments according to fungi manual by(15) with support of various standard references and monographs such as(6).

Isolation and Identification of Bacteria:

Water samples were collected in sterile containers. Bacteria was isolated by using Api-20E and the memberance filtration technique which include: A samples of 100ml water were filtered, the filtration membrane then transferred in to broth media. peptone water [pH=8.8] was used to isolate *Vibrio cholera*, after incubation one ml from the broth cultured on the media TCBS yellow colonies were isolated for biochemical identification(28), isolation of *Pseudomonas* sp. Was carried out by transporting the filtration membrane to nutrient broth, then one ml from nutrient broth was cultured on cetremide agar and brain heart broth, green colonies were isolated for identification test (8; 18), the bacteria *E. coli* and fecal coliform bacteria were identified by using different biochemical tests.

Result and Discussion:

The obtained results revealed that 12 fungal genus and 6 bacterial genus were identified in the 3 stations for all the regions, as explained in (Table 1, 2) and (Figure1, 2).

Water is very inevitable for life subsistence on the earth and its purity and quality is of paramount importance in man daily life(26). In this study 3 stations was used for the isolation and identification of fungi and bacteria being present in water resources.

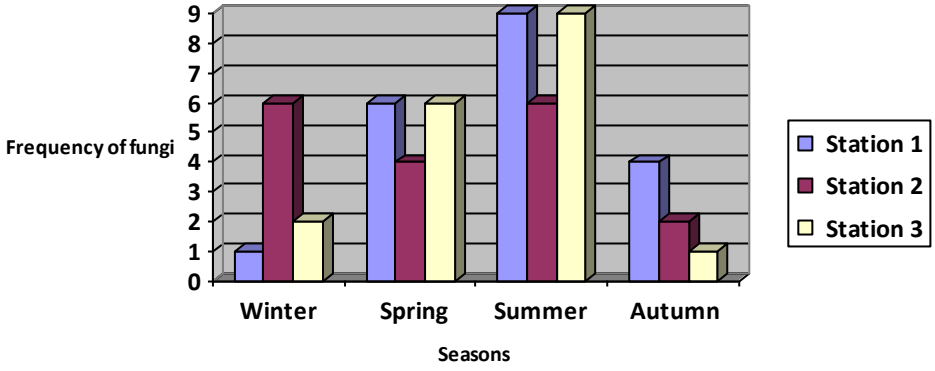

Figure (1): Prevalence of fungal species isolated during 4 seasons from 3 stations.

(Table 1): Prevalence of fungal genus isolated during 4 seasons from 3 stations:

Fungi	Winter			Spring			Summer			Autumn		
	St.1	St.2	St.3	St.1	St.2	St.3	St.1	St.2	St.3	St.1	St.2	St.3
Rhizopus sp.	-	-	-	+	+	+	+	+	+	+	-	-
Epidermophyton	-	-	-	+	-	+	-	-	+	-	-	-
Plasmopara veticola	-	-	-	-	-	-	+	-	-	-	-	-
Alternaria sp.	-	-	-	+	+	-	+	+	+	-	-	-
Trichophyton megninii	-	+	-	-	+	+	+	+	+	-	+	-
Penicillium sp.	+	+	+	+	-	+	+	+	+	+	+	+
Aspergillus niger	-	+	-	+	-	-	+	+	+	+	-	-
A. versicolor	-	-	+	-	-	-	+	+	+	-	-	-
Microsporium ferrugineum	-	+	-	-	-	-	+	-	+	+	-	-
M. nanum	-	-	-	-	-	+	-	-	+	-	-	-
Trichophyton verrucosum	-	+	-	-	-	-	-	-	-	-	-	-
T. vubrum	-	+	-	+	+	+	+	-	-	-	-	-

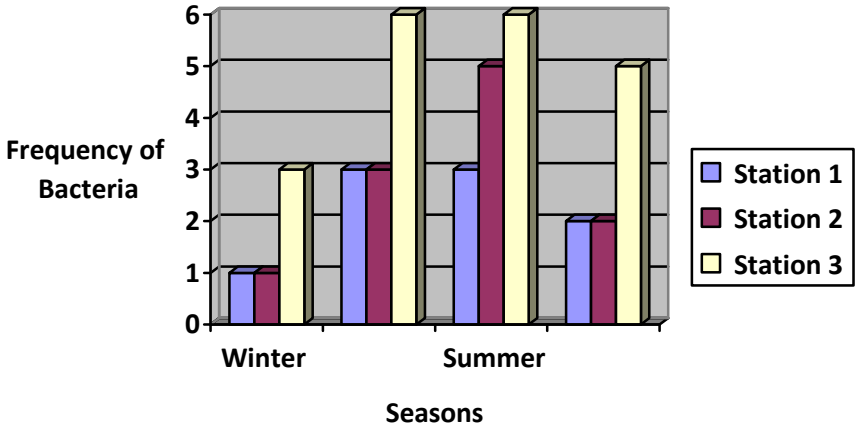

Figure (2): Prevalence of isolated bacterial genus during 4 seasons from 3 stations.

Table (2): Prevalence of isolated bacterial genus during 4 seasons from 3 stations:

Bacteria	Winter			Spring			Summer			Autumn		
	St.1	St.2	St.3	St.1	St.2	St.3	St.1	St.2	St.3	St.1	St.2	St.3
Escherichia coli	+	+	+	+	+	+	+	+	+	+	+	+
Enterobacter aerogenes	–	–	+	+	+	+	+	+	+	–	–	+
Enterobacter vulneris	–	–	–	–	–	+	–	+	+	–	–	–
Pseudomonas aeruginosa	–	–	–	–	–	+	–	–	+	–	–	+
Vibrio cholerae	–	–	–	–	–	+	–	+	+	–	–	+
Hafina sp.	–	–	–	–	–	–	–	–	–	–	–	–
Klebsiella sp.	-	-	+	+	+	+	+	+	+	+	+	+

(Table, 1) showed the fungal species that isolated during four seasons. The more frequently isolated fungi were *Penicillium* sp., *Rhizopus* sp., *Aspergillus niger*, *Trichophyton megninii* and *Alternaria* sp., while the more frequently isolated bacterial species were *E.coli* and *Klebsiella* sp. (Table 2).

The study revealed that the difference in the occurrence, distribution of fungi and bacteria in periodically proved to depend on the physicochemical parameters of the water and also on seasonal variations.

Sampling stations:

During the previous period, illegal industrial and domestic waste input and heavy use of chemical fertilizers and pesticides from areas surrounding the stations has resulted in the stations becoming severely polluted.

As a result, the stations ecosystem has changed into a turbid water body and many species, including water, plants and fish species have disappeared (30). Sampling station I, II and III differ in physicochemical characteristics. The water parameters of these 3 stations were recorded during the study seasons as shown in Table 3, due to these differences the presence of fungi and bacteria were differ from one station to another.

The result showed that increase of fungi and bacteria occure especially during Summer then spring (Table 1, 2 and 3) and this may

due to the increase of water temperature, this result was in agrrement with the result of **(**11), and not with studies (5; 9; 14;16; 19).

(Table 3): Water parameters during tha study seasons:

Temperature C°	**Station 1**	**Station 2**	**Station 3**
Autumn 2010	24	24	25
Winter 2010-2011	16	16	16
Spring 2011	24	24	25
Summer 2011	29	29	30
pH	**Station 1**	**Station 2**	**Station 3**
Autumn 2010	7.25	7.55	7.25
Winter 2010-2011	7.35	7.85	7.7
Spring 2011	8.15	7.85	7.85
Summer 2011	8.01	7.9	8.01

(Table, 3) showed the higher temperature during summer has been found favorable for most of the fungi and bacteria, while low temperature during winter unfavorable for most fungi and bacteria.

Fungi were generally associated with clean and well- aerated freshwaters and believed to be sensitive to pollution (4).

Water polluted with organic material was seen to affect not only the abundance of species, but also species distribution (25).

At station I- 20 of fungal genus were recorded, while the number of bacterial genus recorded were 9 which is less polluted station as showed in table5 and figure 4. Whereas at station II-18 and at station III– 17 fungal species recorded station II-11, station III-20 bacterial genus which is highly organically polluted stations (16), due to these fungi was decade the organic matters, as shown in Table 4 and Figure 3.

The dominant fungi recorded from station -I and II were *Aspergillus niger*, *Aspergillus versicolor*, *Rhizopus* sp., and *Penicillium* sp. which can be used as pollution indicators of water (16).
Rhizopus sp., *Aspergillus niger*, *Alternaris* sp., and *Penicillium* sp. were found to be the common species at all stations associated with polluted water.

Results also observed that the *Rhizopus*, *Aspergillus*, and *Penicillium* although found commonly as terrestrial fungi but frequently were isolated from sewage waters (23).

(Table, 2) showed that the dominant bacteria in all the study stations was *E.coli* because the water of Al-Yusifia river is polluted with sewage water and animal wastes as this region is agricultural place and known with animals breeding (27). These results are in agreement with (17) whom showed the presence of pathogenic bacteria such as *Vibrio cholerae*, *Enterobacter sp.*, and *E. coli* which is use as pollution indicator of water.

The results showed the presence of *V. cholera* especially in the 3rd station in all study period during seasons Summer, Spring and Autumn because heavly polluted water in this region. The presence of bacteria generally during spring and summer may due to the suitable temperature for bacterial growth, these results are in agreement with (10; 17; 18).

The 3rd station is considered more polluted station while 1st station is less polluted with bacteria among the 3 study stations, while 1st station was more polluted with fungi among the 3 stations, as showed in table 6 and figure 5.

Table (4): Frequency of fungal genus in 3 stations during the study year:

Fungal isolates	Station 1	Station 2	Station 3
Rhizopus sp.	3	2	1
Epidermophyton	1	-	2
Plasmopara veticola	1	-	-
Alternaria sp.	2	2	1
Trichophyton megninii	1	4	2
Penicillium sp.	4	3	4
Aspergillus niger	3	2	1
A. versicolor	1	1	2
Microsporium ferrugineum	2	1	1
M. nanum	-	-	2
Trichophyton verrucosum	-	1	-
T. rubrum	2	2	1
Total frequency of stations	20	18	17

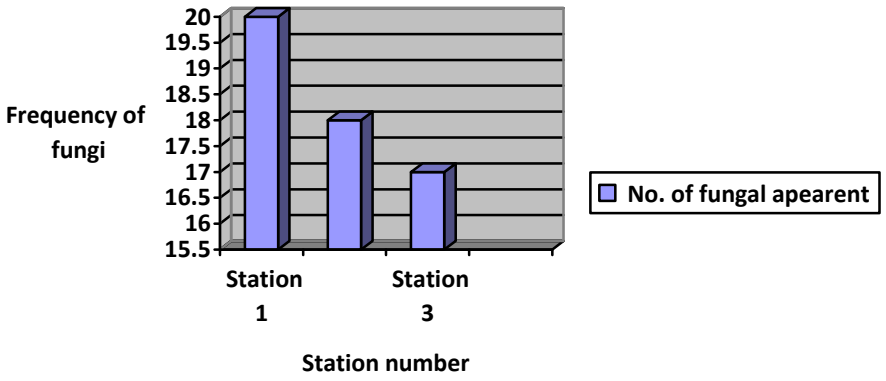

Figure (3): Frequency of fungal genus in 3 stations during the study year.

Table (5): Frequency of bacterial genus in 3 stations during the study year:

Bacterial isolates	Station 1	Station 2	Station 3
Escherichia coli	4	4	4
Enterobacter aerogenes	2	2	4
Enterobacter vulneris	_	1	2
Pseudomonas aeruginosa	_	_	3
Vibrio cholerae	_	1	3
Hafina sp.	_	_	_
Klebsiella sp.	3	3	4
Total frequency of stations	9	11	20

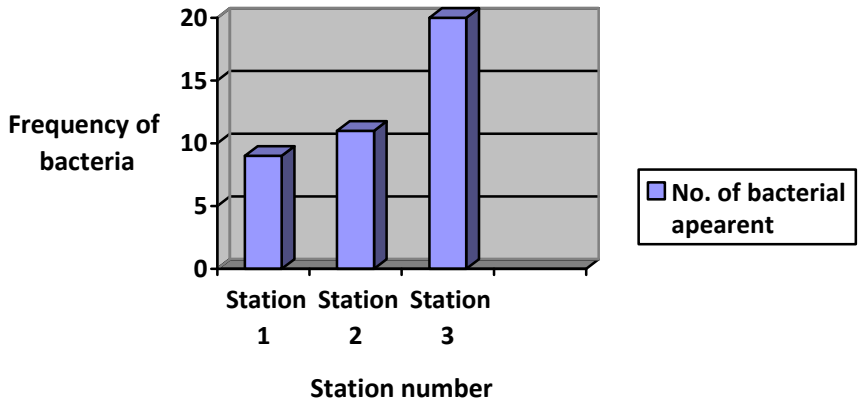

Figure (4): Frequency of bacterial genus in 3 stations during the study year.

Table (6): Total number of fungal and bacterial genus in 3 stations during 4 seasons:

Study Stations	Fungi	Bacteria
Station 1	20	9
Station 2	18	11
Station 3	18	20
Total No. of isolates	56	40

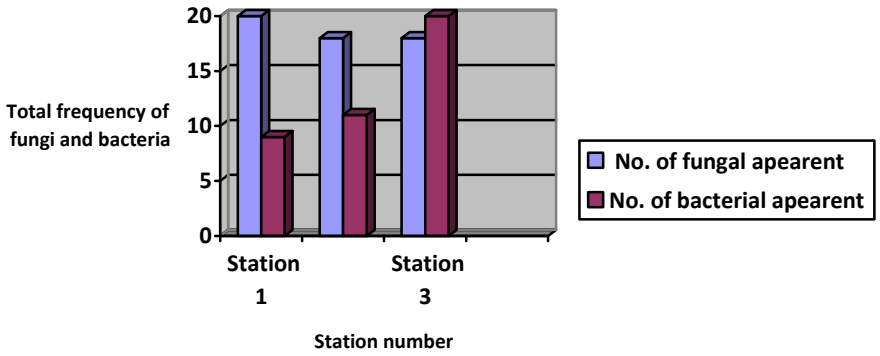

Figure (5): Total No. of fungi and bacterial genus in 3 Stations during 4 Seasons.

References

1. التميمي، عبدالفتاح شراد خضير. (2004). دراسة بيئية وبكتيرية لمياه نهري دجلة وديالى جنوبي بغداد. رسالة ماجستير، قسم علوم الحياة –كلية العلوم. جامعة بغداد.

2. حميد رنا هادي. (2006). دراسة بيئية للفطريات البيضية في نهر دجلة (بغداد) وامراضيتها لبعض الاسماك. رسالة ماجستير، كلية العلوم، الجامعة المستنصرية.

3. خيمي، محمد بن احمد. (2007). دراسة بيئية وفسيولوجية للفطريات المتحملة للملوحة المتوسطة في سبخة العوشزية بمنطقة القصيم بالمملكة العربية السعودية. المجلة السعودية للعلوم البايولوجية. 14(2): 115–123.

4. Barlocher, F. (1992). The ecology of aquatic Hyphomycetes. Springer, Berli Heidelberg New York.

5. Barlocher, F., Seena, S., Wilson, K. P., Williams, D. D. (2008). Raised Water Temperature Lowers Diversity of Hyporheic Aquatic Hyphomycetes. Freshw. Biol. 53: 368-379.

6. Barnett, H. L. and Hunter, B. B. (1972). Illustrated Genera of Imperfect Fungi, 3rd Eds. Burgess Publish Co, Minneapolis, Minnesota. pp. 1- 300.

7. Baron, E. J.; L. R. Peterson; and fine Gold, S. M. (1994). Diagnostic Microbiology 9th (ed). Mosby. Boston.

8. Cornelis, P. (2008). Pseudomonas: Genomics and Molecular Biology, 1st ed. Caister Academic press USA.

9. Dayal, R. and Tandon, R. N. (1962). Ecological studies of some aquatic Phycomycetes. Hydrobiologia., 20: 121– 127.
10. Goel, P. K. (2006). Water pollution, Causes, Effects and Control. 2nd .14.1 new age international publishers.
11. Hughes, G. C. (1962). Seasonal periodicity of Saprolegniaceae in the Southeastern United States. Trans. Brit. Mycol. Soc. 45: 519-531.
12. Hunter, R. E. (1975).Water moulds of the River Great Ouse and its tributaries. Transactions of the British Mycological Society. 65: 101- 108.
13. Khalil, M. T. (1985). The effect of sewage and pollution wastes upon Bahr El- Baqar Drain and the southern area of Lake Manzala, Egypt. Egyptian Journal of Wildlife and Natural Resources., 6: 162– 171.
14. Khulbe, R. D. (1991). An ecological study of water molds of some rivers of Kumaun Himalayas, Indian Tropical Ecology. 32: 127-135.
15. Khulbe, R. D. (2001). A manual of aquatic fungi (Chytridiomycetes and Oomycetes) Delhi, Daya, p. 255.
16. Kshirsagar, A. D. and Gunale, V. R. (2013). Diversity of Aquatic fungi from Mula River at Pune city, IJALS, vol: 6, issue: 3.
17. Leclerc, H., Mossel, D. A. A., Edbery, S. C., and Struijk, C. B. (2001) Advances in the bacteriology of the coliform group: their stability as Markers of Microbial water safety. Annu. Rev. Microbial. 55, 201- 234.
18. Leclerc, H., Schwartzbord, L., and Dei Cas, E. (2002). Microbial agents associated with water born diseaces Accpted for publication in crit. Rev, Microbial.
19. Luo, J., Yin, J. F., Cai, L., Zhang, K. O. and Hyde, K. D. (2004). Freshwater fungi in Lake Dianchi, a heahily polluted in Yunnan, China. Fungal Diversity 16: 93- 112.
20. Mcfeters, G. A., and Sing, A. (1991). Effect of aquatic environmental stress on enteric bacterial pathogens. J. Appl. Bact.,70: 1155-1205.
21. Murth, T. R. K. (1984). Relative numbers of coliform. J. Food production 47(2):142-144.
22. Pascoal, C., Pinho, M., Cassio, F., Gomes, P. (2003). Assessing structural and functional ecosystem condition using leaf

breakdown, studies on a polluted river. Freshwater Biology, 48: 2033- 2044.

23. Pascoal, C., Marvanova, L. and Cassio, F. (2005). Aquatic hyphomycete diversity in streams of Northwest, Portugal. Fungal Diversity., 19 : 109 -128.

24. Prasad, D., Rajanaika, J.H. and Krishna, V. (2009). Diversity of Aquatic Fungi in Relation to Environmental Conditions in Tunga River (South India). Researcher., 1(6) : 54 – 62.

25. Tan, T. K. and Lim, G. (1984). A comparison of fungi from polluted water. Environmental Pollution Series A., 35 : 57 – 65.

26. Tebbutt, T. H. Y., (1998). Principles of water quality control, 5th edition. Pp.1- 45. (http://www.amazon.com/PrinciplesWater-Quality- control-Fifth/ dp/ 0750636580).

27. The microbiology of Drinking Water. (2002).-part 4- Methods For Isolation and Enumeration of Coliform bacteria and Escherichia coli (including E. coli 0157:H7).

28. The microbiology of drinking water (2002). -part10- Methods and enumeration of Yersinia, Vibrio, and Compylobacter by selective enrichment membrane.

29. Usera, M., Echeita, A., and Aladuena, A. (1995). Investigation of an outbreak of water borne typhoid fever in California in 1994. Appl. Environ. Microbial, 13(8):450-454.

30. Zhao, S., Wu, X. and Xia, F. (1999). On aquatic plant in Dianchi Lake, Yunnan Environmental Science 18: 4-8.