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## EVALUATING THE CHEMICAL AND MICROBIAL QUALITY OF DRINKING WATER IN HARSIN CITY

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### Abstract

Always, water has some mineral, suspended solids and dissolved gases with it. The existence of some minerals in water is necessary for the human health but the excessive amount of them is harmful for human health. Therefore, the aim of this study is evaluating the chemical and microbial quality of drinking water in coverage society by the health center of Harsin city in a research form and in the presenting system of Health services (2006-2010). This is a cross-sectional study and for conducting it, the data, which related to the chemical parameters test (Nitrate, EC, TDS, pH, Fluoride, and residual chlorine) and microbial test have collected from the evidences of Harsin city's health center in a certain period.

The results of this study showed that the fluoride, nitrate, TDS, EC, pH, and residual chlorine level in drinking water resources of Harsincity were in a desirable level. In addition, the best quality of water in microbial evaluation have related to the coverage community by municipal water and wastewater mains network, which more than 96% of the cases in different seasons were potable. In addition, the microbial quality evaluation showed that in 2006 year the (4.36%), 2007 (19.06%), 2008(29.77%), 2009 (23.26%) and 2010 (15.05%) of the samples were undesirable and non-potable in terms of microbial quality. The results of the evaluation showed that all the drinking water resources of Harsin city were in a desirable level in terms of chemical parameter and during the period of the study, any problems in terms of chemical contamination in Harsin and its surrounding villages have not observed. However, in

terms of coliform indicator, there is a need for more attention from the protection system and this subject should have followed by responsible organization.

**Keywords:** Microbial quality, Chemical quality, Drinking water, Harsin, Iran.

## **Introduction**

Always, water have some minerals, suspended solids and dissolved gases with it. This fact caused various region to have different features. The existence of some minerals in water is necessary for human health while the excessive amount of them is harmful for the human health. Therefore, the existence of healthy drinking water is safe for the community and the first step for identifying the water is evaluating the physical, chemical, and biological parameters of drinking water (1-4). The quality and safety of the drinking water is an important public health subject for the human society (5-10). Also the increased of the efficiency and human lifespan is depended on the water safety and high quality (11).

The efficient water with desirable quality is necessary for community, life, and safety (12). Hygiene development and environmental protection always depend on the safety water supply (13). From the human civilization, humans always have settled near the rivers coast, beside the fountains or natural lakes. In preventing many of the disease such as diarrhea, cholera, typhoid and para typhoid, infectious hepatitis, amoebic and bacillary dysentery, a safe and healthy water have a great importance (14, 15).

The surface and ground water exposed to a risk due to the contamination of poisons and pesticides dissemination, which have used in agriculture. In a study which have done on Sefid Rood river from Manjil to Kiashahr, a large amount of pesticides have recognized which in some cases their concentration were 300 time more than the acceptable limit ( 16, 17).

The desirable physical and chemical quality of water from the acceptable point is essential for the consumer, protecting the consumer's health and maintenance of water network system. The Harsin city placed at the communication path of Kermanshah- Lorestan in 45km of south east of Kermanshah which from south reach to the Delfan, from north reach the Sahneh, from west reach Kermanshah and from east reach the Nahavand. The population of this city based on the last census (2006) was 84335 person which 63531 person of them live in city and 20804 person of them were rural. This city formed by two central and bisetoon part and four villages (CheshmehKabood, hoomeh, Cham Chamal and shirz). The main villages of this city are 18 and 66 subsidiary villages. About 47 village provide their required drinking water from the water resources which coverage by health

center. The water resources of this population were 45 fountains, 59 wells, and 1 aqueducts. The tanks type of the villages, which their sources was well, have sanitized and in the villages, which their sources was, fountains 31.11% sanitized have done. this study have done to evaluate the chemical and Microbial quality of drinking water which coverage by health-treatment center of Harsin city with frame routine work of protection system in 2006-2010. This study have done According to the role of water quality in the resident's health and the necessity of continuous measurement of various parameters and because of the fact that the rural supply water resources in Harsin city have not sanitized.

## **Material and Methods**

This study is cross-sectional. In addition, the data, which related to the testing the chemical (nitrate, EC, TDS, pH, fluoride, and residual chlorine) and microbial parameters, have collected from the evidence of Harsin health-treatment center during 2006-2010. In fact, the results have analyzed by SPSS20 software.

## **Results**

The results of the Chlorimetry in Harsin city by the separation of village and city have recorded based on desirable cases with the residual chlorine of 0.3-0.8 mg/l (table1). The results of the drinking waters chemical quality in Harsin city (Figure1) showed the desirability percentage of drinking water which coverage by municipal water and wastewater in terms of microbial quality during different years.

Figure 2 showed the desirability percentage of drinking water which coverage by rural water and wastewater in terms of microbial quality during different years. Figure 3 showed the desirability percentage of drinking water, which is coverage by health center in terms of microbial quality during different years. Figure 4 showed the desirability percentage of drinking water which coverage by private network in terms of microbial quality during different years.

Figure 5 showed the desirability percentage of the raw water, which supplied the Harsin city in terms of microbial quality during different years.

Figure 6 present the desirability percentage of raw water, which supplied the villages of Harsin city in terms of microbial quality during different years. Figure 7 compared the percentage of drinking water MPN level in Harsin city during different years.

Figure 8 compared the undesirability percentage of water samples in Harsin city during different years. Figure 9 compared the undesirability percentage of drinking water samples in Harsin city during various seasons and different years.

**Table-1: Total measurement of residual chlorine in Harsin city in Urban/Rural and in term of desirable residual chlorine range with 0.3 – 0.8 mg/L ( Mean: 0.5mg/L).**

Year	Urban /Rural	Total measurement	The desirable residual chlorine	
			Number	Percent
2006	Urban	8226	8218	99.9
	Rural	39980	38900	97.3
2007	Urban	8375	8375	100
	Rural	40250	39380	97.8
2008	Urban	15199	15199	100
	Rural	43702	41452	
2009	Urban	15391	15391	100
	Rural	37256	35890	96.33
2010	Urban	15390	15390	100
	Rural	39890	37800	94.76

**Table-2: Results of the chemical quality of drinking water of Harsin city.**

Year		Fluoride (mg /l)		Nitrate (mg /l)		TDS (mg /l)		Electrical conductivity (µ s / cm)		pH	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
2006	Amount	0.54	0	35.64	8.36	350	162	473	254	7.6	7.2
	Sampling location	CheshmehK aboud. *	NO.40 <sup>**</sup>	CheshmehK aboud *	Harsin <sup>***</sup>	Garmianak*	ChamanEsm atej*	Namarg*	Harsin <sup>***</sup>	CheshmehK aboud. *	Harsin <sup>***</sup>
2007	Amount	0.45	0	23.35	10.03	380	173	620	377	7.9	7.3
	Sampling location	CheshmehK aboud. *	Shadabad*	CheshmehK aboud. *	Shadabad*	CheshmehK aboud. *	Sarmaj*	Namarg*	NO.55 <sup>**</sup>	Pariveh Aoulia*	Harsin <sup>***</sup>
2008	Amount	0.6	0.2	28.6	7.48	423	179	802	358	7.8	7.4
	Sampling location	Harsin <sup>***</sup>	Shadabad*	Chehr*	Harsin <sup>***</sup>	Alisavand *	Rayegan*	Alisavand *	Chogha Saied*	Pariveh Aoulia*	Harsin <sup>***</sup>

2009	Amount	0.3	0	22.24	8.8	408	189	638	378	7.6	7.2
	Sampling location	NO.55**	NO.40**	NO.39**	NO.39**	NO.39**	NO.55**	NO.39**	NO.55**	NO.39**	NO.42**
2010	Amount	0.5	0	25.32	7.88	323	178	506	343	7.6	7.4
	Sampling location	CheshmehKa boud.*	ChamanEsm aiei*	CheshmehKa boud.*	Harsin****	Harsin***	Rayegan*	Harsin****	Rayegan*	CheshmehKa boud.*	Harsin****

\*Village\*\*Well\*\*\*Mirage \*\*\*\*City

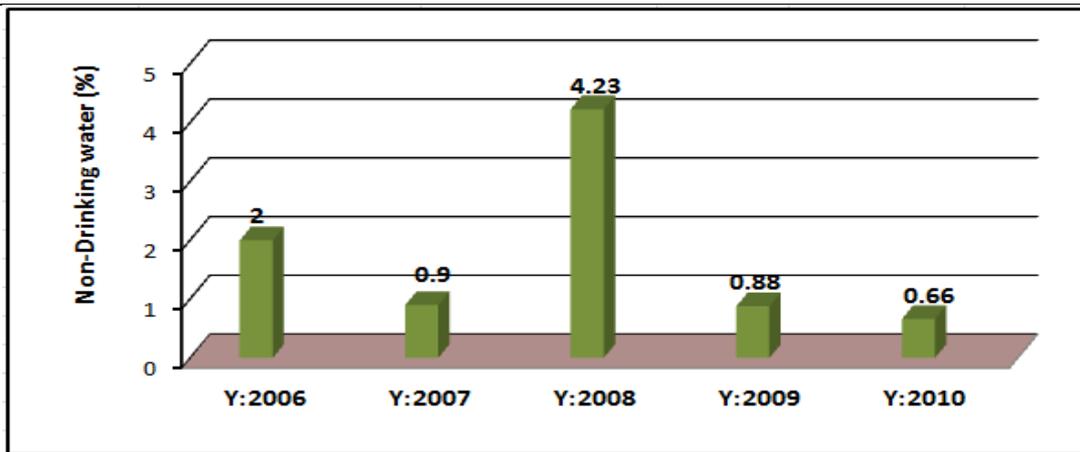


Figure-1. Frequency of non-drinking water samples (under coverage the municipal water and wastewater company) in five-year period (2006-2010).

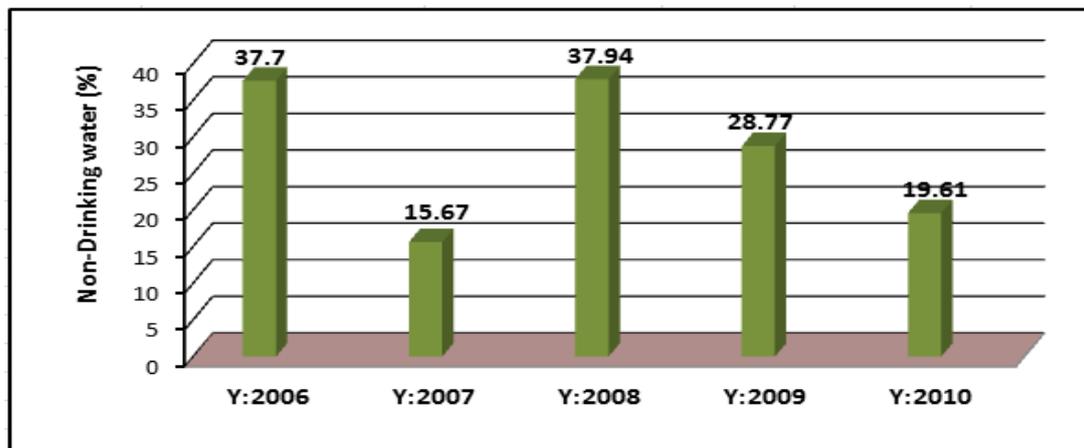


Figure-2. Frequency of non-drinking water samples (under coverage the rural water and wastewater company) in five-year period (2006-2010).

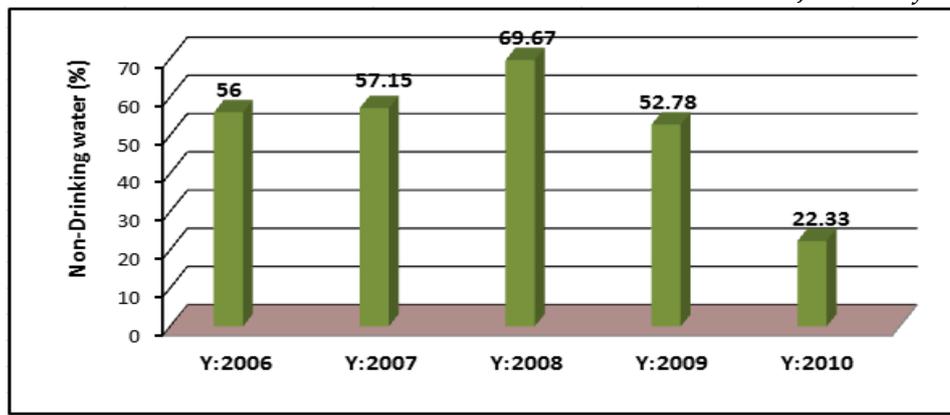


Figure-3. Frequency of non-drinking water samples (under coverage the home health) in five-year period (2006-2010).

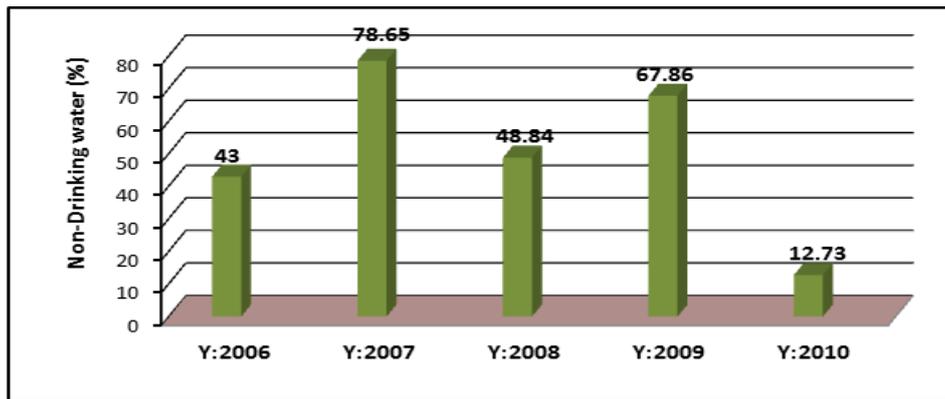


Figure-4. Frequency of non-drinking water samples (under coverage the private network in Harsin) in five-year period (2006-2010).

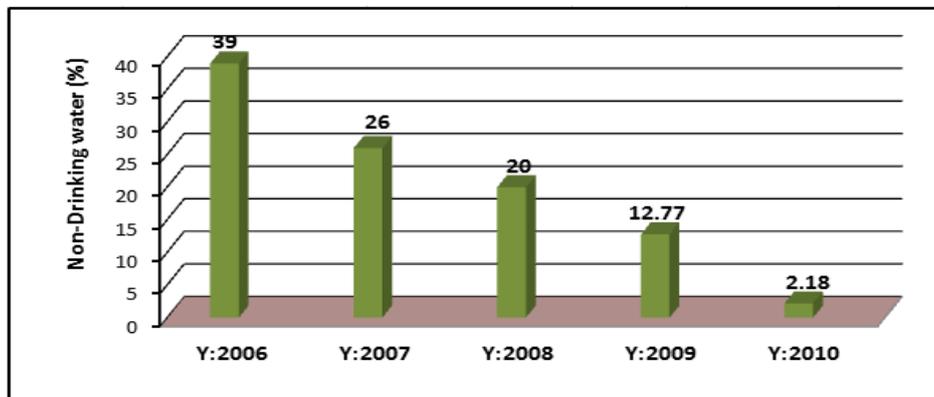


Figure-5. Samples frequency of Harsin city's raw water supply in five-year period (2006-2010).

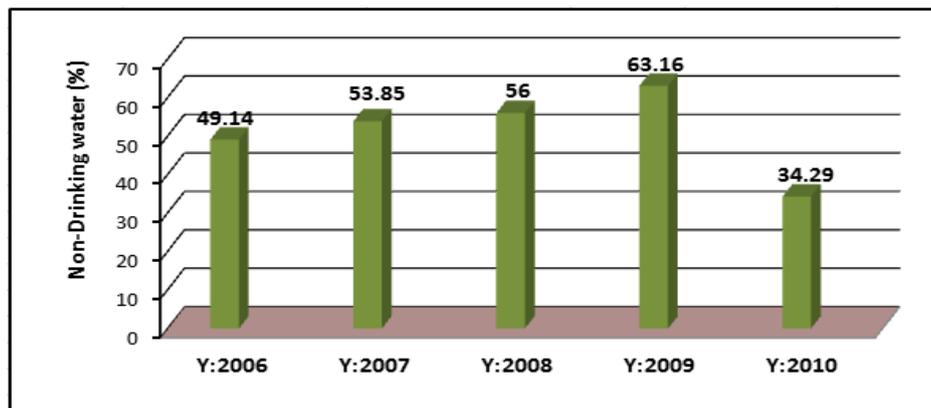


Figure-6. Samples frequency of Harsin Rural raw water supply in five-year period (2006-2010).

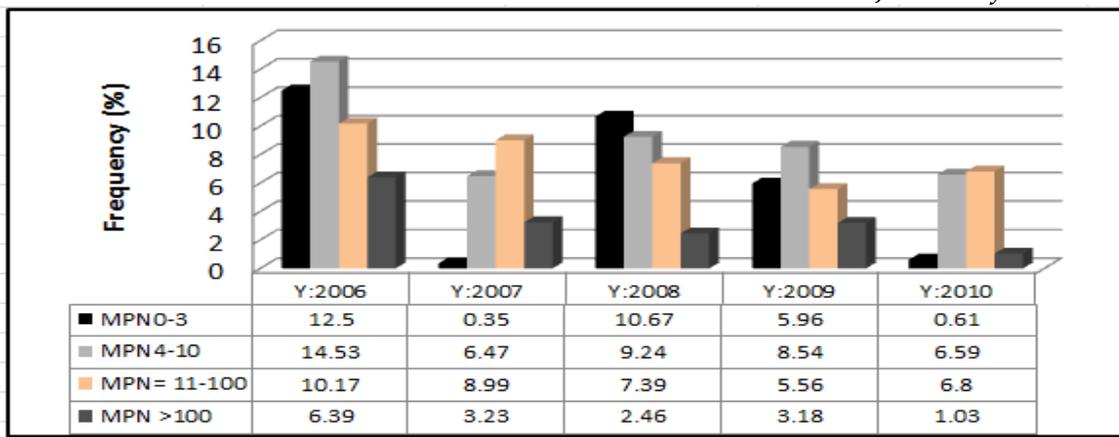


Figure-7. Microbial quality of Harsin drinking water in five-year period (2006-2010) based on MPN ranges.

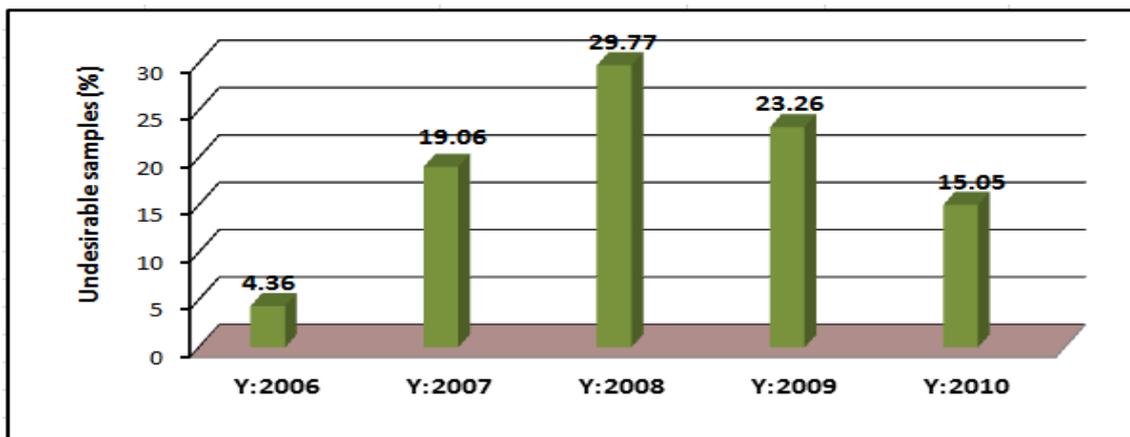


Figure-8. Total frequency of undesirable samples of drinking water in five-year period (2006-2010).

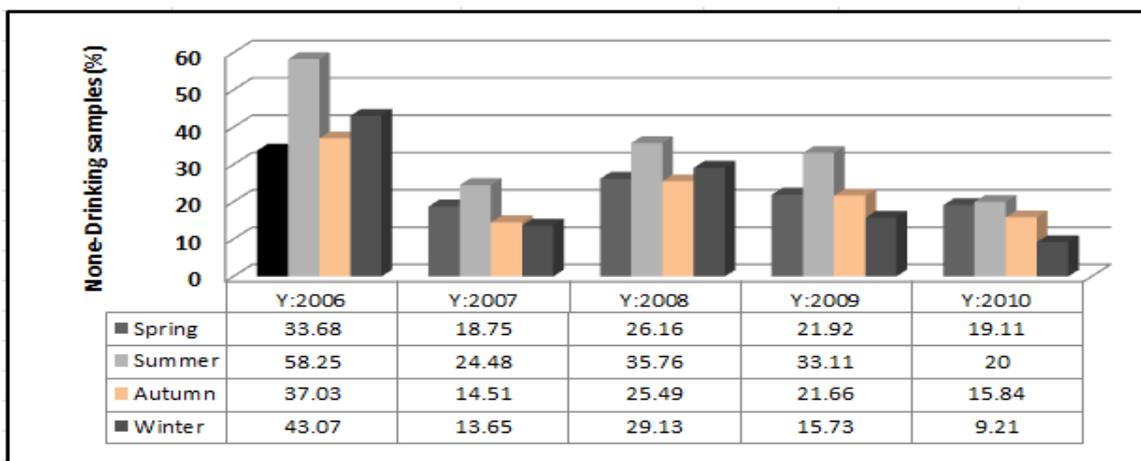


Figure-9. Total frequency of undesirable samples of drinking water in five-year period (2006-2010) based on different seasons.

### Discussion

The results of the evaluating the chlorine management is consistent with EdrisBazrAfshan et al. study and showed that from 46344 Chlorimetry test of rural water network, which have coverage by health center, 95.16% of Chlorimetry tests were undesirable (18). The MohammadianFazli (2002) study showed that from all the Chlorimetry

cases in 85.8% of them the residual chlorine concentration were about 0.5-0.8 mg/l (the range of standard and national suggestion). In 1.9% of them, the residual chlorine concentration was zero and in the rest of them, the concentration was less or more than the standard (19).

Although in rural region of the country most of the water quality problems have related to the bacteriological and other biological concentration, but there are some important cases of chemical contamination of water resources too, which may have very serious problems. These contaminations may enter the water through various industries or by agricultural activities or improper use of them such as improper use of nitrate as a fertilizer or through resources such as fluoride. Global standard recorded the maximum desirable level of fluoride, nitrate, TDS, EC, pH in drinking water resources 1.5mgNO<sub>2</sub> /l, 10mg/l, 500mg/l, 1500µs/cm, 7-8.5 respectively. The maximum acceptable limit of them were 1.7mg/l, 45mgNO<sub>2</sub>/l, 1500mg/l, 2000µs/cm, and 6.5-9 respectively (20). Based on the comparison of the results with the standard data in 2006-2010 years, drinking water of Harsin city was desirable in terms of chemical parameters. Some study have done in this field in some part of the country. In Safari, and. Vaezi (2002) study which have done on the water resources of Mianeh city, it have revealed that the main problem of this water were total hardness, TDS and bicarbonate ion, and the other parameters were in good and acceptable limit (21). Farshad et al. (2001) in their study, which was about evaluation of nitrate and nitrite ion in the industrial unit of Tehran-Karaj region in 1998 showed that, the nitrate and nitrite ions level, were 51.96mg/l and 16.8mg/l respectively (22). Based on the study which have done on drinking waters physical and chemical quality of Zabol in 2005, the pH level in all samples were more than 8.2 and the average of the EC and total residual chlorine and total dissolved solid parameters were 1589µs/cm, 1.6mg/l and 831mg/l (23). Also a study which have done in 2007 for evaluating the chemical quality of ground water in Sanandaj city, the pH, EC, TDS and total hardness parameters level were 6.65, 991.5µs/cm, 615.25mg/l, 312.5mg/l respectively (24). Karamati, and Mahvi (2007) study showed that the average of the pH, residual chlorine, EC, TDS parameters for drinking water of Gonabad were 7.56, 0.57ppm, 1840.36µs/cm and 901.65mg/l (25).

According to the fact that the drinking water should be free of the indicator bacteria of fecal coliform contamination, MohammadianFazli (2002) study showed that in microbial test at possibility and verification stage, 95 and 98% of the samples have desirable safety condition respectively (19). The best condition of drinking water in microbial evaluation have related to the coverage community by municipal water and wastewater main network in Harsin city, which in more than 96% of cases and various season is potable. The drinking water desirability trend from 2006 to

2010 have not a regulate trend and the reason of this is the utilization management type, maintenance of transmission and distribution system or at least enough necessary measurement should have taken. Also in the evaluation, which have done, based on various seasons of the year, the results showed that most of the samples contamination was in summer which the reason of it is the effect of the summer heat on the water temperature increase and indicator microorganism growth and doubling their proliferation.

## Conclusion

The results of the evaluation showed that all the drinking water resources of Harsin city were desirable in terms of chemical parameters and there was no chemical contamination in Harsin city and subsidiary villages during the study. However, in terms of the coliform indicator, there is a need for more attention of protection agencies and it should followed by the responsible organization.

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