

Study of Physicochemical Properties of Commercial Drinking Bottled Water Brands

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Abstract—Drinking water quality is being affected by industrial effluents, pesticides and fertilizers, poor sanitation services and unhygienic practices. Thus, upper and middle-class people used to prefer bottled water for drinking instead of tap water. Increasing demand for bottled water leads to the presence of low quality branded waters in the market due to the high demand and improper quality checks. In this regard, this study is carried out to assess the physicochemical properties of various branded bottled waters. For that, ten different water brand samples, coded from S1 to S10, were collected from Safoora Goth, Karachi. Various physicochemical quality parameters of branded water samples were analyzed according to the set procedures of American Society for Testing and Materials. It was discovered that the pH levels of S9 and S8 bottled water brands were slightly less than World Health Organization guideline values. The physical and chemical quality parameters of S1, S2, S4, S5, S7, and S10 branded bottled water samples were found within standards.

Keywords—drinking water; bottled water; physicochemical properties; contamination

I. INTRODUCTION

Sufficient quantity of clean and safe water is crucial to human health [1-3]. Population growth, rapid urbanization, industrialization, changing lifestyles and economic development cause severe stress not only on the quantity of available water resources but also on its quality [4, 5]. Water resources are being contaminated by different physical, chemical and biological agents. Its quality control is essential for environment preservation and for public health protection [6]. Increasing rate of pollution in fresh water resources amplified the demand for bottled water [7]. Bottled water consumption has significantly increased the last three decades, particularly in food and beverage industries with an annual average of 12% in spite of its high cost [8]. Its annual average

consumption is more than 100 liters per person in fifteen countries, and over 200 liters per person in Mexico, Italy, and the United Arab Emirates [7].

It is reported that bottle water utilization has been increased enormously in Pakistan, approximately from 6% to 10% from 2003 to 2007 [9-12]. Karachi is the biggest urban center and city of Pakistan having population of more than 16 million [13, 14]. Upper and middle class people use to prefer bottled water for drinking purpose instead of using tap water as it is considered to be free from contaminants [1, 11, 12, 15, 16]. Although it is prerequisite for bottled water brands to register for quality production in Pakistan, nevertheless replicas and inferior brands are posing serious threat to the public health. Its high demand leads to the existence of low quality brands in the market [17]. The present study is an attempt to investigate on the physicochemical quality parameters of different branded bottled waters, commonly consumed by the people of Karachi.

II. MATERIALS AND METHODS

Samples from ten local bottled water brands were taken from different shops and supermarkets of Safoora Goth during the September to October time period. Five samples of each brand were examined in the laboratory. The sample brands were assigned codes from S1 to S10. These codes were assigned for recognition of water samples during and after analysis. Thermo-set containers were used to preserve the samples at 25°C [18-20]. The drinking quality parameters examined in the laboratory were pH, TDS, EC, salinity, alkalinity, chlorides, hardness, turbidity, color, nitrates and fluorides. PH meter, gravimetric method, floating glass hydrometer and HI98302 meter were used to analyze pH, TDS, salinity and EC respectively. Titration method was employed for alkalinity, total hardness and chloride measurements. Turbidity was measured with the use of a nephelometer

(turbidimeter), color by Platinum-Cobalt method and nitrates with phenol disulphuric acid method. Fluoride content in was tested with spectrometer.

III. RESULTS AND DISCUSSION

All samples were examined according to defined procedures of ASTM and were compared with WHO standards.

A. Turbidity, Colour and pH

Turbidity level and color of all examined samples were found within permissible limits. The level of pH in examined water samples is shown in Figure 1. Maximum pH value of 8.21 was found in S3 and minimum in S9 with 6.1.

B. TDS and EC

The values of total dissolved solids (TDS) samples are given in Figure 2. Maximum TDS of 383mg/l was found in S9 and minimum 156mg/l in S1 and S2. Besides TDS, the results of electrical conductivity (EC) are given in Figure 3. The maximum electrical conductivity value was found in S5 with 490 μ S/cm and minimum from S1 with 333 μ S/cm. The EC of all samples was found within WHO allowable limit of 2500 μ S/cm.

0.3%. The minimum concentrations of salinity were found in S1, S2, S3, S4, S8, S9 and S10 with 0.2%. Moreover, maximum alkalinity of 120mg/l was found in S2 and minimum 53mg/l in S8 as shown in Figure 5. Similarly, the maximum level of hardness with 103mg/l was found in S8 and minimum 33.25mg/l in S1 as shown in Figure 6. The results of hardness in all water samples were within WHO guideline value of <500mg/l.

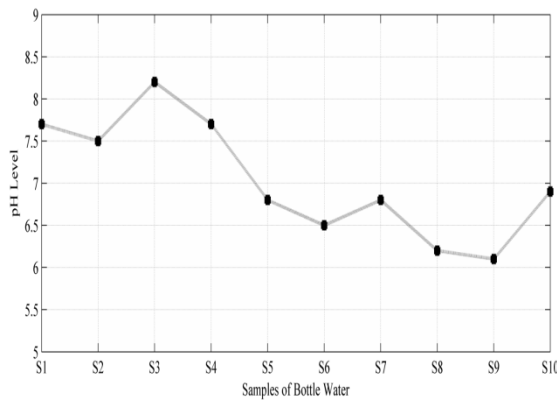


Fig. 1 Level of pH in local brand bottled water samples

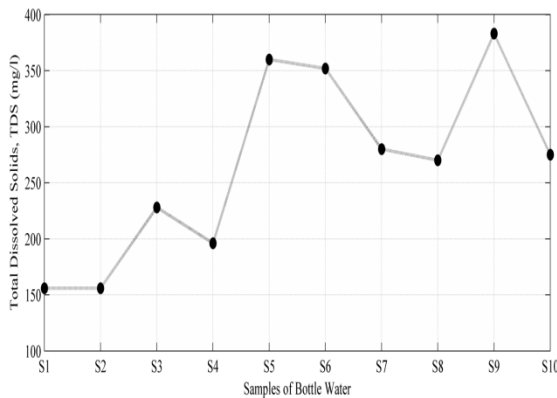


Fig. 2 Level of total dissolved solids in local brand bottled water samples

C. Salinity, Alkalinity and Hardness

Figure 4 displays the analyzed values of salinity. Three brands, namely S5, S6 and S7 displayed maximum salinity of

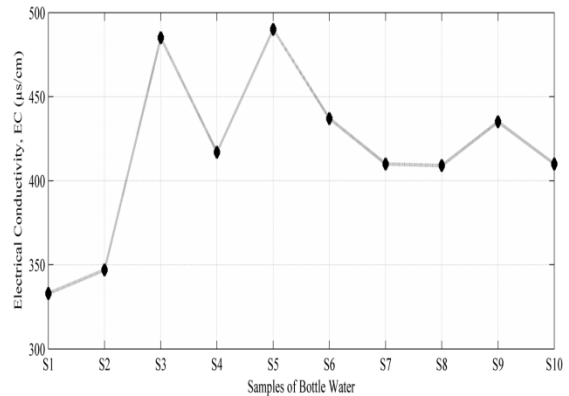


Fig. 3 Level of electrical conductivity in local brand samples

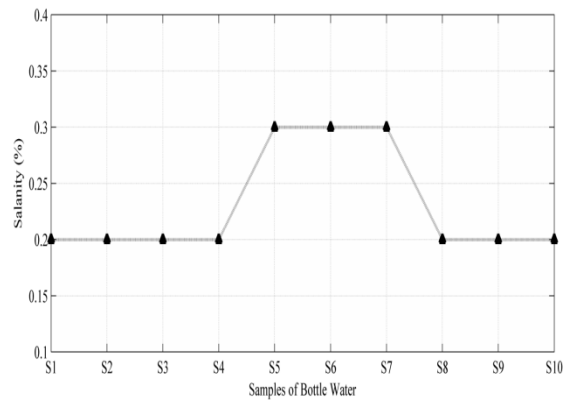


Fig. 4 Level of salinity in local brand bottled water samples

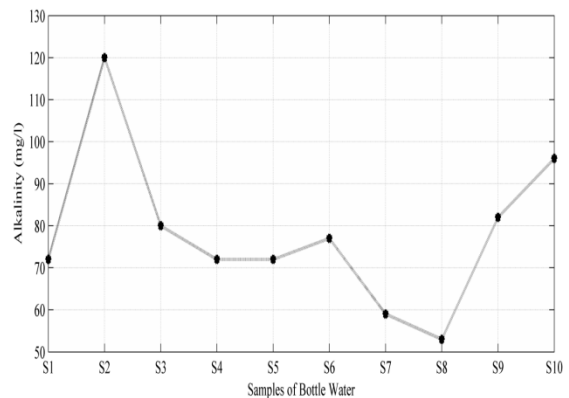


Fig. 5 Level of alkalinity in local brand bottled water samples

D. Chloride, Fluoride and Nitrates

The Chloride results are displayed in Figure 7. Maximum chloride value of 130mg/l was found in S5 and minimum of

42.54mg/l in S1. The level of fluoride in water samples is shown in Figure 8. Maximum fluoride value was 0.9mg/l in S3 and minimum in S1, S7 and S8 brands with 0.2mg/l. Figure 9 demonstrates the values of nitrates in the samples. Maximum of 21mg/l was found in S6 and minimum 0.6mg/l in S1.

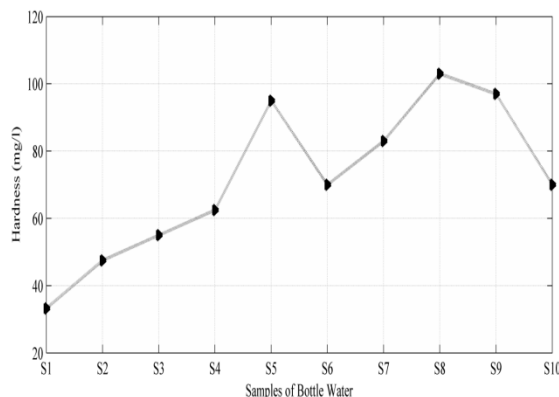


Fig. 6 Level of hardness in local brand bottled water samples

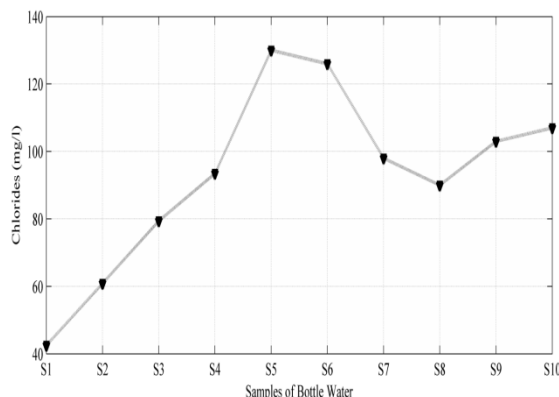


Fig. 7 Level of chlorides in local brand bottled water samples

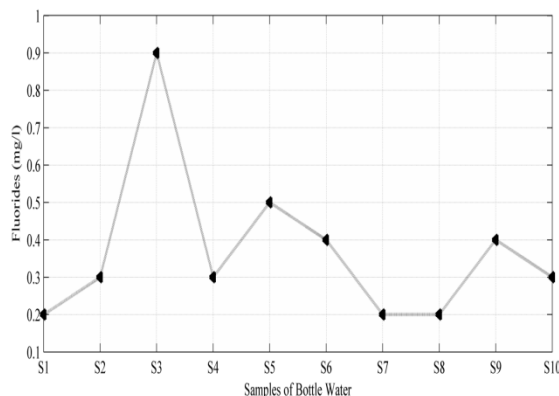


Fig. 8 Level of fluoride in bottled water samples

IV. CONCLUSION

In this study, water samples of bottled water from 10 local brands were assessed for physicochemical properties. It was found that the pH value of S9 and S8 bottled water samples were slightly less than WHO guideline values. The results of S1, S2, S4, S5, S7 and S10 water brands were found within

guideline values. It is strongly recommended that environmental protection agencies organize seminars, workshops and training programs to create awareness about the adverse impacts of polluted water.

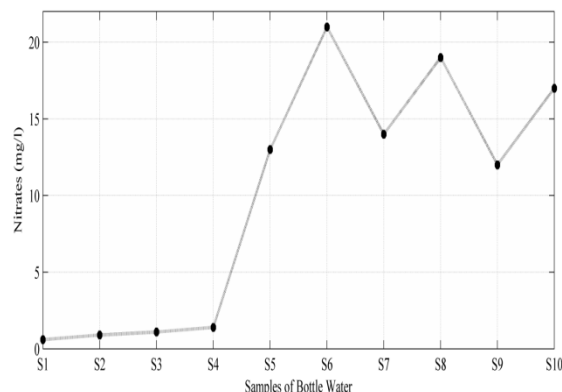


Fig. 9 Level of nitrates in local brand bottled water samples

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