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CORELATION STUDY AMONG MILK QUALITY PARAMETERS OF CATTLES MILK COLLECTED FROM GIDC SURAT AND ANKLESHWAR

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ABSTRACT

Milk samples of cow and buffalo were collected from near by areas of Sachin GIDC Surat and Piraman gaon near GIDC Ankleshwar at ~ 5.30 a.m. in the month of October, 2002. The milk samples were immediately preserved in a frozen mixture (ice + salt). The concentration of Zn, Cd, Pb, Hg, Mn, Ni, Cr, Fe and I was detected by ICP–AES. Beside the milk samples, ground water and industrial waste water samples have also been analysed. The corelation and regression studies have been carried out among the possible pairs. The corelation and regression provides an excellent tool for the prediction of parameters values within reasonable degree of accuracy.

Key words : Milk samples, GIDC Surat and Ankleshwar, Metals analysis, ICP–AES, Correlation and regression.

INTRODUCTION

Due to the development of urbanisation and industrialisation, the pollution problem has enhanced in the environment. Beside the water pollution also, the pollution in cattles milk, vegetable and crops also been increased[1]. The wastes generated from industrial units are contaminating underground water resources of the area[2]. This industrial waste contains organic and inorganic materials[3]. At present, rains are very less, therefore farmers are utilising this contaminated water for irrigation of crop, vegetable and fodder plants[4–6]. The cattle of highly industrialised areas are utiliseing such contaminated fodder plants for grazing purpose. Because of such contaminated fodder plant and contaminated ground water, the milk of cattles like cow, buffalo, sheep and goats are getting polluted.

Corelation and regression studies among milk and water quality parameters in a specific environmental condition have been shown to be useful[2,7]. When such corelation and regression exist, determination of a few important parameters would suffix to give some idea about the

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overall quality of milk water. Since the other parameters and their function can be explained and accounted for by using these corelation and regression. Utilisation of such methodology will greatly facilitate the task of rapid monitoring of the status of pollution in cattles milk.

In view of the above, the corelation and regression among the milk quality parameters have been studied in the present work.

EXPERIMENTAL

GIDC Surat and Ankleshwar area have been selected for the present investigation. The milk samples were collected in polythene bottles and frozen immediately. The industrial waste water and nearby groundwater samples of the area were also collected for the comparison of the status. The concentration of trace metals have been determined by ICP–AES at RSIC–IIT, Mumbai and chemical oxygen demand of all the samples were determined by dichromate methods[8].

RESULTS AND DISCUSSION

The results obtained during the course of present work are given in Tables 1–8. The concentration of heavy metals like Hg, Mn, As, Ni and Cr were not detected (Table 1 and 2) in all cattle milk samples, which were collected from GIDC Surat and Ankleshwar, respectively. While the concentration of Cu in GIDC Surat was found to be in the range of 0.13–0.78 μ g/mL and concentration of Zn in both GIDC was found in the range 1.24–2.85 μg/mL and 1.24–2.74 μ g/mL. The concentration of Cd was observed in the range 0.01–0.03 μ g/mL and in Ankleshwar cattles milk, it was detected only in Site No. 1 (i.e. 0.022 μ g/mL).

The concentration of Pb was found to be in the range of 0.02–0.05 μ g/mL and 0.012 – 0.44 μ g/mL in Ankleshwar milk. Pb in the sample No. 4 was not detected (Table 2). The concentration of Fe in GIDC Surat milk sample is found to be in the range 10.0–12.4 μ g/mL while the concentration of Fe in Ankleshwar milk sample was found to be detected from 5.8–10.9 μ g/mL. But the concentration of Fe in GIDC Ankleshwar wastewater and ground water samples was found to be 112.0 and 56.02 μ g/mL, respeatively (Table 2).

The concentration of iodine in Surat milk samples was found to be in the range of 0.26–0.44 μ g/mL and its concentration in Ankleshwar milk sample was observed in the range of 0.33–0.43 μ g/mL. Iodine in industrial wastewater and ground water was not detected. Chemical oxygen demand in Surat milk sample was found to be in the range 96.4–146.2 μ g/mL whereas COD values in Ankleshwar milk samples was determined as 114–159 μ g/mL. This is slightly higher. The COD value for Ankleshwar industrial wastewater and ground water was found to be 98.0–38.6 μ g/mL (Table 2).

Table 1. The metal and COD in cattles milk from GIDC Surat

S. No.	Sample Type	Site of Sample collection	Cu	Zn	Cd	Pb	Hg	Mn	As	Ni	Fe	Cr	I	COD µg/mL
1.	Cow milk	R.K. Rayon Silk Mill	0.78	1.24	0.01	0.02	ND	ND	ND	ND	12.2	ND	0.42	122.4
2.	Buffalo milk	R.K. Rayon Silk Mill	0.13	2.83	0.03	0.05	ND	ND	ND	ND	10.0	ND	0.26	135.0
3.	Cow milk	Sachin (Mullaji Mill)	0.79	1.25	0.01	0.02	ND	ND	ND	ND	12.1	ND	0.42	146.2
4.	Buffalo milk	Sachin (Mullaji Mill)	0.132	2.85	0.033	0.04	ND	ND	ND	ND	10.2	ND	0.27	96.4
5.	Cow milk	Arun Mill (Near Hajira road)	0.79	1.26	0.01	0.02	ND	ND	ND	ND	12.4	ND	0.44	112.8
6.	Buffalo milk	Arun mill	0.14	2.84	0.03	0.05	ND	ND	ND	ND	11.0	ND	0.38	139.0

Table 2. The metal and COD concentration in cattles milk, industrial waste water, GIDC, Ankleshwar

S. No.	Sample Type	Site of Sample collection	Cu	Zn	Cd	Pb	Hg	Mn	As	Ni	Fe	Cr	I	COD µg/mL
1.	Buffalo milk	Piramangam near UPL–1	0.14	2.73	0.022	0.44	ND	ND	ND	ND	5.8	ND	0.40	132.0
2.	Cow milk	Piramangam near UPL–1	0.82	1.23	ND	0.22	ND	ND	ND	NNDD	11.2	ND	0.36	159.0
3.	Buffalo milk	Binnaca cloth mill	0.89	2.73	ND	0.014	ND	ND	ND	ND	5.82	ND	0.43	128.0
4.	Cow milk	Rabadivas ONGC Colony	0.81	1.24	ND	ND	ND	ND	ND	ND	10.9	ND	0.33	114.0
5.	Buffalo milk	Panoli, UPL–2, UPL–3	0.91	2.74	ND	0.012	ND	ND	ND	ND	5.96	ND	0.39	118.6
6.	Cow milk	Piramangam (village)	1.33	0.66	0.004	0.16	ND	0.001	ND	ND	56.2	0.06	ND	38.6
7.	Buffalo milk	Khadi canal near Piramangam	6.37	2.42	0.014	5.21	ND	ND	0.014	0.42	112.0	0.122	ND	98.0

The concentration of detected metals in the cattles milk of both the areas are slightly higher. This is because of the industrial pollution, which is coming through the fodder plants grown on industrial waste amended soils and drinking of contaminated water by cattles milk samples[6].

The modelling of the collected results in the form of corelation and regression analysis are being tabulated in Tables 3–8. The corelation coefficient 'r' among all the detected metal is calculated. As some of the metals were not detected, therefore, Corelation of some detected metals and COD are given here. In some samples (Table 3 and 5) corelation between Cu and

Table 3. Correlation coefficient between metals and COD from milk sample, GIDC Surat

S.No	Metals	Cu	Zn	Cd	Pb	Fe	I	COD
1	Cu	1						
2	Zn	–0.999	1					
3	Cd	1.065	0.862	1				
4	Pb	6.245	0.446	3.811	1			
5	Fe	1.037	–0.248	0.256	55.67	1		
6	I	0.817	0.838	0.271	–0.10	0.135	1	
7	COD	0.1085	0.00017	0.0602	0.09416	0.158	0.2630	1

Table 4. Values of regression coefficient for milk sample, GIDC Surat

S.No.	Parameters pair	a	b
1	Cu; Zn	3.1661	–2.436
2	Cu; COD	122.64	5.6434
3	Cu; Cd	0.3796	–0.0898
4	Zn; COD	130.03	–2.35014
5	Zn; Pb	–0.000909	0.01674
6	Cd; CID	109.66	2234.18
7	Cd; Pb	–0.0098	1.274
8	Pb; COD	124.85	11.625
9	Fe; I	–0.4615	0.0730
10	Fe; COD	95.190	2.6548
11	Pb; Fe	–119.62	–3928.7
12	I; COD	102.899	61.189

COD, Fe and COD and Zn and COD were calculated. Iodine is well corelated, while high positive corelation is observed in Cu and COD[10].

The regression studies (Table 4 and 6) have also been carried out on possible parameter pairs. Values of regression coefficient have been calculated, which interprets the regression efficiency.

Table 5. Correlation coefficient between metals and COD from milk sample, GIDC Surat

S.No.	Metals	Cu	Zn	Cd	Pb	Fe	I	COD
1	Cu	1.00						
2	Zn	–0.28	1.00					
3	Cd	–0.012*	0.031	1.00	1			
4	Pb	–1.033	0.258	0.0	1.00			
5	Fe	0.298	–0.019	0.0	–0.90	1.00		
6	I	–1.94	0.879	0.0	–4.31	–0.381	1.00	
7	COD	0.984	–0.012	–2.903	–0.0720	0.042	26.86	1.00

Table 6. Values of regression coefficient for milk sample, GIDC Ankleshwar

S.No.	Parameters pair	a	b
1	Cu; Zn	1.62304	0.7156
2	Cu; COD	–175.85	428.8
3	Cu; Cd	0.000489	–0.03011
4	Zn; COD	145.228	–6.9858
5	Zn; Pb	–0.0824	0.09958
6	Cd; COD	146.66	–666.5
7	Cd; Pb	0.122	0.0
8	Pb; COD	135.118	–5.887
9	Fe; I	0.1123	0.00125
10	Fe; COD	113.24	2.15289
11	Pb; Fe	9.645	–14.00
12	I; COD	–5043.75	13544.6

Table 7. Correlation coefficient between metals and COD from groundwater and industrial wastewater, GIDC, Ankleshwar

S.No.	Metal	Cu	Zn	Cd	Pb	Mn	As	Ni	Fe	Cr	COD
1.	Cu	1.00									
2.	Zn	1.04	1.00								
3.	Cd	1.00	1.00	1.00							
4.	Pb	1.00	0.87	0.821	1.00						
5.	Mn	–0.037	–0.014	–0.00055	0.00055	1.00					
6.	As	0.035	0.0215	0.00012	0.038	0.0	1.00				
7.	Ni	1.61	0.646	0.000378	1.128	–0.168	0.0	1.00			
8.	Fe	1.00	1.00	3.169	–2.198	–14142.5	1.174	0.0	1.00		
9.	Cr	–17.58	0.999	1.566	0.6853	0.0	0.0	0.0	0.0019	1.00	
10.	COD	1.00	1.00	1.00	0.999	0.0	0.348	0.0	1.00	1.00	1.00

Table 8. Correlation coefficient between metals and COD from ground water and industrial waste water GIDC Ankleshwar

S.No.	Parameters pair	a	b
1	Cu; Zn	0.1346	0.3642
2	Cu; COD	22.92	11.786
3	Cu; Cd	0.0009324	0.002096
4	Zn; COD	16.32	33.75
5	Zn; Pb	–1.16122	2.4976
6	Pb; CID	36.72	11.78
7	Cd; Mn	0.001	–1.0
8	Mn; COD	38.6	0.0
9	As; Ni	0.42	0.0
10	Ni; COD	98.0	0.0
11	Fe; Cr	0.0853	0.0000648
12	Cr; COD	–18.88	958.064
13	Ni; Fe	84.1	0.0
14	Cd; COD	14.84	5940
15	Pb; Mn	0.000945	0.0000203
16	As; COD	97.995	0.348
17	As; Fe	84.116	1.1749
18	Fe; COD	–21.224	1.0645

The corelation and regression study (Table 7 and 8) of industrial wastewater and ground water of Ankleshwar GIDC have also been undertaken for the sake of comparison and evaluation.

The heavy metal concentration in all the milk samples, industrial waste and ground water samples of both the study areas and corelation regression between them has been observed. Due to rapid industrialization and urbanization, the cattles milk of the study areas are being contaminated by different means. Heavy metals concentration and COD clearly indicate that these are variable from site to site depending upon environmental conditions. The high concentration of metals in industrial waste and groundwater samples are definitely harmful to the cattles and their milk. Because such cattles are eating polluted fodder plants as well as drinking polluted ground water. Such polluted milk ultimately affects adversely the human health. This contaminated milk also affects the health of infants and small children. The detection and control of such indiscriminate metallic contamination in cattles milk needs further exhaustive investigations.

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