



EVALUATION OF WATER CONTAMINATION BY MUNICIPAL SOLID WASTE DUMPING IN SALEM CITY, TAMILNADU, INDIA

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ABSTRACT

The study analyses the impact of dumping municipal solid waste (MSW) in Erumapalayam situated in the heart of Salem city and brings to light the level of health hazards created by water contamination. An area of about 1000m radius was chosen for collecting the water samples. Accordingly, for every 250m radius, four water samples each were collected from all four directions east, west, north and south and totally 16 such samples were taken for the study.

Parameters like pH, turbidity, total dissolved solids (TDS), alkalinity, total hardness (TH), calcium, iron, manganese, nitrate, chloride and fluoride were tested. The test results were analysed and compared with IS: 10500 (1991, 1993) and WHO. The test results of groundwater samples when compared with BIS and WHO Standards, it was found that the parameters like TDS, alkalinity, TH, chloride and nitrate exceeded the desirable limits, which infers that the groundwater up to a radius of 1000m is not suitable for drinking purpose.

INTRODUCTION

The Salem city, located at an elevation of 912 feet above mean sea level between latitude 11.65° and longitude 78.17°, is the headquarters of Salem district. It was upgraded to a Corporation from Municipality in the year 1994. The Corporation covers an area of 91.34 sq. km and an additional command area of about 10 sq. km. It is located at a distance of 340 km from Chennai. The population of the city has grown from 697088 to 851577 during the years 2001 to 2005 and is expected to grow further on account of rapid urbanization.

The solid waste generated in Salem city from various places like marriage halls, hospitals, schools and market areas was collected from four zones viz., Ammapet, Hasthampatti, Suramangalam and Kondalampatti. The MSW, collected from all the zones, was estimated to be 335 MT per day and the same is being dumped at Erumapalayam dumping site for the past four decades. The total extent of the dumping area is about 22 acres. The quantum of MSW collected from each zone is detailed in Table 1. The methodology for the disposal system followed is given in Table 2. The per capita generation, considering the population growth of 2% per annum, was found to be 393 g per day.

MATERIALS AND METHODS

An area of about 1000m radius was chosen for collecting water samples. Accordingly, for every 250m radius, 4 water samples each were collected from all four directions and thus totally 16 samples were collected and tested in the District Water Testing Laboratory, Tamilnadu Water Supply and Drainage Board, Salem. The parameters like pH, turbidity, TDS, total alkalinity, total hardness, calcium, iron, manganese, nitrate, chloride and fluoride were tested. The test results were compared with IS: 10500 (1991, 1993) and WHO (1993) standards.

RESULTS AND DISCUSSION

The results of the physico-chemical analysis of ground water samples collected at Erumapalayam MSW Dumping site from all the four directions are shown in Table 3. Comparison of the test results with drinking water quality standards of BIS and WHO shows that the groundwater quality from the Erumapalayam MSW dumping site is not potable, and hence it should not be used as a primary drinking water source. From the physical examination of the ground water quality of the samples, it was found that the odour level of the water was good for 15 samples except the sample, which was collected at 250m away from the western side of the dumping yard. It is because of the reason that large quantity of market waste is being dumped continuously, which brings the objectionable odour in that particular area. It was found that the turbidity of the all the groundwater samples was within the prescribed limit of the standards. As far as the total dissolved solids (TDS) concentration is concerned, it was found that it is quite high when compared to BIS and WHO standards. The main reason for the increased concentration is the presence of higher concentration of chemical parameters like calcium, magnesium and sodium in the groundwater samples. Since the TDS concentration was ranging from 645 mg/L to 5509 mg/L in and around the Erumapalayam MSW dumping site, the water quality is not all suitable for drinking. If the ground water sources are to be used as the main source of drinking water, the water should be treated for removal of TDS and then can be used as the source.

While performing the chemical analysis of the ground water samples, which were collected in and around the Erumapalayam MSW dumping site, it was found that the pH of the entire water samples were within the limits (6.5 - 8.5) of BIS and WHO standards. The total alkalinity of all the samples exceeds the value (284 mg/L - 832 mg/L), and this is due to presence of all of nitrogenous nutrients, which were mixed from the MSW leachate. While testing for hardness, it was found that the concentration of all the samples exceeded the limit (500 - 2640 mg/L). This higher concentration of hardness in groundwater samples shows that the water is not much suitable for domestic and industrial purposes, which may prevent lathering and creation of scaling. In order to reduce the hardness, the extracted groundwater hardness level has to be brought down by water softening. The chloride level

Table 1: Quantum of MSW collection.

| Classification of Zones | No of wards | Present Population | Average Waste Generation in Tons/Day |
|-------------------------|-------------|--------------------|--------------------------------------|
| Suramangalam-I | 14 | 213288 | 74.56 |
| Hasthampatty-II | 14 | 210046 | 78.06 |
| Ammapet-III | 16 | 227733 | 84.64 |
| Kondalampatty-IV | 16 | 200510 | 97.74 |
| Total | 60 | 851577 | 335 |

Table 2: Methodology for disposal system being adapted.

| | |
|--------------------------------|---|
| Location of the disposal sites | Erumapalayam, Veeranam, Suramangalam (sparingly used) |
| No. of dumping yard | 3 |
| Distance from city centre | 5 to 10 km |
| Method of Disposal | Open Dumping |
| Status of landfill | Presently overflowing |
| Quantity of waste treated | Nil |
| Revenue Generation | Nil |

Table 3: Results of physio-chemical analysis of water samples collected at Erumapalayam dumping site.

| Parameters | DL-as per IS:10500 (1991& 1993) | WHO | East side | | | West side | | | North side | | | South side | | | | | | | |
|-----------------------|---------------------------------|----------------|-----------|------|------|-----------|------|------|------------|-------|------|------------|------|-------|------|------|------|------|------|
| | | | 250m | 500m | 750m | 1000m | 250m | 500m | 750m | 1000m | 250m | 500m | 750m | 1000m | | | | | |
| Physical Exams | | | | | | | | | | | | | | | | | | | |
| Odour | Unobjec- tionable | Unobjec- odour | None | None | None | None | None | None | None | None | None | None | None | None | None | None | None | None | None |
| Turbidity NT units | 5 | 5 | 3 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 2 | 4 | 1 | 0 | 0 |
| TDS | 500 | 1000 | 3262 | 2562 | 2156 | 2079 | 5509 | 2289 | 2142 | 1449 | 645 | 1484 | 1589 | 3654 | 3920 | 1946 | 2023 | 3003 | 3003 |
| EC | - | - | 4660 | 3660 | 3080 | 2970 | 7870 | 3270 | 3060 | 2070 | 921 | 2120 | 2270 | 5220 | 5600 | 2780 | 2890 | 4290 | 4290 |
| Chemical Exams | | | | | | | | | | | | | | | | | | | |
| pH | 6.5 - 8.5 | 6.5 - 8.5 | 7.08 | 6.72 | 6.92 | 6.85 | 6.4 | 6.93 | 6.75 | 7.11 | 6.87 | 6.78 | 6.98 | 7.01 | 6.53 | 7.1 | 6.77 | 6.71 | 6.71 |
| Alkalinity | 200 | - | 436 | 496 | 488 | 496 | 832 | 428 | 440 | 460 | 284 | 416 | 416 | 508 | 424 | 400 | 456 | 544 | 544 |
| Hardness | 300 | 500 | 1230 | 740 | 730 | 550 | 2640 | 690 | 890 | 440 | 228 | 500 | 590 | 1320 | 1880 | 620 | 750 | 1050 | 1050 |
| Calcium | 75 | 75 | 280 | 172 | 168 | 132 | 608 | 160 | 212 | 108 | 54 | 120 | 140 | 324 | 440 | 140 | 172 | 240 | 240 |
| Magnesium | 30 | 50 | 127 | 74 | 74 | 53 | 269 | 116 | 86 | 41 | 22 | 48 | 58 | 122 | 187 | 65 | 77 | 108 | 108 |
| Sodium | - | 200 | 480 | 445 | 350 | 420 | 540 | 310 | 260 | 248 | 98 | 235 | 240 | 558 | 395 | 297 | 291 | 460 | 460 |
| Potassium | - | 55 | 50 | 40 | 35 | 96 | 40 | 35 | 27 | 12 | 25 | 28 | 72 | 65 | 36 | 39 | 50 | 50 | 50 |
| Iron | 0.3 | 0.3 | 0.2 | 0.2 | 0 | 0 | 0.6 | 0.4 | 0 | 0 | 0 | 0.1 | 0 | 0 | 0.1 | 0.3 | 0 | 0 | 0 |
| Manganese | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nitrate | 45 | 45 | 105 | 80 | 80 | 73 | 168 | 74 | 63 | 50 | 15 | 57 | 69 | 126 | 126 | 69 | 76 | 92 | 92 |
| Chloride | 250 | 250 | 1180 | 850 | 700 | 620 | 2050 | 740 | 600 | 330 | 104 | 420 | 440 | 1400 | 1420 | 640 | 560 | 980 | 980 |
| Fluoride | 1 | 1.5 | 1 | 0.7 | 0.6 | 0.8 | 0.4 | 1 | 1.6 | 2 | 0.6 | 0.6 | 0.8 | 1 | 0.2 | 1.6 | 1.8 | 2.2 | 2.2 |
| Sulphate | 200 | 400 | 110 | 95 | 78 | 110 | 320 | 110 | 120 | 90 | 30 | 70 | 76 | 100 | 270 | 85 | 110 | 140 | 140 |

DL = Desirable Limit; All units are in mg/L except pH and Conductivity (micromho/cm); IS: 10500: 1991 and subsequent amendment 1993 has been referred.

of all the sixteen groundwater samples showed that the value exceeded (330 - 2050 mg/L) the limit of BIS and WHO standards. This is mainly due to intrusion of domestic sewage in soil and contamination of the groundwater by MSW leachate. Similarly, the presence of nitrate is also high in all the water samples (50 - 168 mg/L) which should not exceed the maximum limit of 45mg/L. If the groundwater is used regularly for drinking purpose, it may cause unhealthy state to the livestock and human beings, and particularly infants will be affected by the blue-baby disease or methemoglobinemia. Hence, before using the ground water as the main source of drinking water, the nitrate level has to be brought to the desired level by adopting suitable treatment methods.

CONCLUSION

While examining the ground water samples, collected near Erumapalayam MSW dumping site from all the four directions, and comparing the test results with the standards of BIS and WHO, it is found that the concentrations of TDS, hardness, chloride and nitrate exceed the standard limits. Hence, it is recommended that the groundwater source of the area should not be used as the main source of drinking water supply. On acute shortages of drinking water supply in the area, the groundwater can be used as the source of drinking water after proper treatment, subjected to test for water quality standards and by reducing the concentrations of TDS, hardness, chloride and nitrate to the desirable limits.

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