

Soil and Groundwater Contamination By Leachate on Cemetery in Botucatu - Brazil.

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Introduction

Urban sprawl leads to the need for environmental mitigations, and with that studying the planning of the soil use and its occupation process is imperative in order to enable such actions. With urban sprawl, more attention is needed towards cemeteries as contamination in soil and underground sources of water nearby have surfaced. Currently, the Brazilian National Environmental Council (CONAMA) has two resolutions about constructive aspects to the purpose of controlling existing waste, such as leachate from cemeteries (*necrochorume*). Considering those issues, this paper presents a preliminary study in the Jardim Municipal Cemetery in the city of Botucatu, in the state of São Paulo, Brazil.

Materials and Methods

The Jardim Cemetery of Botucatu is located in the city of Botucatu, state of São Paulo, Brazil. The city is located on the water catchment area of the Tietê river Médio Superior which is drained in the North by the water catchment area of the river Tietê and in the south by the river Pardo. The Cemetery has an area of 72.710 m² and an average altitude of 825 m, under the coordinates 22° 55' 54" south latitude and 48° 28' 54,7" west longitude.

There were 3 surveys conducted in the area, each in a different location: the first one being a “virgin” site (P 1) with no burial activity, the second an “active” site (P 2) with burial activity and lastly a third site (P 3) close to a dumpster where the remaining of the burial material is discarded.



After the samples were collected on different depths of soil cuts (0 – 50 cm, 50 – 100 cm and 100 to 150 cm), the material was homogenized and separated further into samples in volumes from 1 to 5 cm³. These were then mixed with different kinds of culture media to identify the different types of microorganisms. Based on the guidelines of CONAMA 420/2009 resolutions and on the Management of Contaminated Areas Manual – CETESB, the soil monitoring through the surveys conducted sought to verify the possible occurrence of leaks of product colligation (leachate) or other substances in the soil, derived from the cemetery-related activity. The soil sample collection followed the methodology of manual auger using a liner, thereby reducing contamination by collapse of the side walls and minimizing contact between soil and air, as well as reducing possible contamination.

Samples collected in the field were stored in appropriate, identified disposable bottles (labelled with location and depth of the survey, and the parameter to be analyzed), stored in a cooler with ice for storage at temperature of 4 C.

Results

Microbiological analysis of a total of 9 samples collected revealed an average amount of micro-organisms for both the virgin sites and for the sites with human remains buried as follows: a total of 19 different micro-organisms found in the virgin sites, 23 in the samples from location with burial activity and 28 for the sites next to the dumpster. Overall, 70 microorganisms were identified, among them there was: 3 (33%) Gram-Positive Bacilli, 20 (28.5%) Fungi, 15 (21.5%) Enterobacteria, 5 (7%) Anaerobe Micro-organisms and 7 (10%) Gram-Negative Bacilli.

Microorganisms	“Virgin” Site	Site Close to the Dumpster	“Active” Site
Fungi			
Trichophyton spp.	4	10	6
Gram-Negative Bacilli			
Acinetobacter Iwoffii	3	2	2
Gram-Positive Bacilli			
Bacillus subtilis	5	12	6
Anaerobe Microorganisms			
Clostridium sp.	3	0	2
Enterobacteria			
Citrobacter sp.	4	3	7
E. coli	0	1	0
Total	19	28	23

The microorganisms found conducting this study are not exclusively associated with cemetery soil, as they are also present in other types of soil as well as being found in animal, human, food and water samples, however they serve as guidelines for indices of soil quality and levels of contamination.

Conclusion

All the other kinds of microorganisms were excluded from the results because they are commonly found in the environment. The collection of samples was performed at different depths, which allowed to evaluate the possible contamination of different layers of soil.

Consistent with findings of Ueda (2011, p 78), this study did not determine a significant difference between the microbiota of lands considered virgins and lands with burial activity, possibly due to the ground next to the dumpster highlighting major indices of microorganisms. This conclusion agrees with the Technical Standard of L1.040 Cetesb (1999), which describes the need for proper disposal of waste arising after exhumation thus avoiding contamination of the site.

Norms and rules of hygiene and cleanliness about the contact with earth and with the corpses must be observed in order to avoid unnecessary risks to worker health.

Bibliography

- UEDA, Suely MitoiYkko et al. Comparação entre a microbiota da terra nos cemitérios: locais virgens e locais onde são enterrados corpos. “Arquivos Médicos” 2011 – pg 74 -9.
- _____. Implantação e operação de cemitérios: procedimento. São Paulo: CETESB, 1999. Gp (L1040).