Ecological burial proposal for the city of Curitiba (PR)

Proposta de enterro ecológico para a cidade de Curitiba (PR)

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ABSTRACT

In this present work, the current issue of crowding of the public cemeteries, mainly the municipal ones, of the city of Curitiba was discussed. Given the above, the immediate counterpoint is the proposal of the cremation process. However, it believes that there exists a model that uses the positive parts of both processes, being the same alternative, harmonic and environmental with implantation of trees in their internal areas (but extended to the external areas, as an act of continuity). From the environmental point of view, the cremation does not contaminate the soil and the water table with the necrochorume and to put trees in the place of the mausoleums, taking that somber air of conventional cemeteries, is the proposal presented without hurting existing customs and traditions by peoples and religions.

Keywords: Cemetery; Trees; Cremation; Necrochorume

RESUMO

Neste presente trabalho, discutiu-se a atual questão de lotação dos cemitérios públicos, principalmente os municipais, da cidade de Curitiba. Diante do exposto, o contraponto imediato existente é a proposta do processo de cremação. Contudo, crer-se existir um modelo que utilize as partes positivas de ambos os processos, sendo o mesmo alternativo, harmônico e ambiental com implantação de árvores nas suas áreas internas (porém estendidas às áreas externas, como um ato de continuidade). Como é melhor, sob a ótica ambiental, a cremação, em curto prazo e os seus efeitos secundários para o meio ambiente a fim de não contaminar o solo e o lençol freático com o necrochorume e colocar árvores no lugar dos mausoléus, tirando aquele ar sombrio dos cemitérios convencionais, é a proposta apresentada sem ferir costumes e tradições existentes por povos e religiões.

Palavras-chave: Cemitério; Árvores; Cremação; Necrochorume

1 INTRODUCTION

The cemetery is the place to bury the corpses. In most cases, cemeteries are places of religious practice. By analogy, a cemetery is a place where products are buried or accumulated, typically waste and debris (e.g., nuclear waste cemetery). It is

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the same as necropolis or sepulchral when referring to living beings (CEMETERY AND ENVIRONMENT, 2018).

The cemeteries were generally far from the churches outside the city walls: the practice of burial in churches and church buildings was unknown in the early centuries of the Christian era. From the eighteenth century, a serious problem was created with the lack of space for the burials in the churches of the churches or even in the limits of the city; the skiffs were accumulating, causing pollution and mortal diseases, which made the vicinity of the temples highly unhealthy. The English law of 1855 came to regulate the burials, passing these to be made outside the urban center. The practice of cremation, increasingly frequent, has allowed destining the bodies in a way more compatible with sanitary norms (GUEDES, 2015).

Over time, the cemeteries became overcrowded and, for that matter, the idea of the designers Anna Citelli and Raoul Bretzel, where they created *Capsula Mundi* in Italy in 2003 (CITELLI and BRETZEL, 2003) inspired this study.

Based on the stocking of the urban cemeteries of the city of Curitiba (PR), the objective of the present work, based on the Public Management approach, was to present an alternative, harmonic and environmental model with implantation of trees in its external areas, planted in a conventional way and complying with technical recommendations (as a form of environmental harmonization in the urban structure) but mainly in the internal areas (as a form and control of minimization of environmental impact) taking advantage of the benefits provided by them. Leaving them more comfortable and presentable for loved ones and friends to visit, minimizing that somber air and giving the name to "Valley of Paradise". Also, to rewrite the landscape of the cemeteries with the substitution, also, for trees in place of the catacombs.

In the cities, the implantation and the maintenance of public squares wooded and of other green areas, like parks and public gardens, is a device used to soften the urban problems. Urban afforestation provides, for example, thermal comfort and the reduction of atmospheric and visual pollution, favoring the well-being of the

population (GOMES and AMORIM, 2003; COLTRO and MIRANDA, 2007; FARIA *et al*., 2013).

Thus, the objective was to study the traditional tombs of conventional tombs and the use of graves in the cemeteries, that is, instead of burying the body, there would be the intermediate option of cremating and with the ashes buried together with a specific tree sapling.

2 THEORETICAL FRAMEWORK

2.1 Cemetery

The word cemetery, originally from the Greek *Koumeterian* and from the Latin *Coemeteriun*, means a dormitory, a place where one sleeps, an enclosure where the dead are buried or kept and the words necropolis, ram, sepulchral, holy field, foot city together and the last dwelling (CAMPOS, 2007).

For Bayard (1993), the cemetery is understood as *Beth Olam* (house of eternity) and *Beth ha'hayim* (house of life). The cemeteries are monuments, to the memory of those who died, that the living makes a point of perpetuating. Consequently, this type of construction has acquired the inviolability condition regarding scientific research in its different aspects. However, sociologists, anthropologists, folklorists and others have made excellent contributions to a better understanding of habits, customs and funerary practices (MATOS, 2001).

Cemeteries, of all their problems generated to be studied and solved or minimized, the largest is the necrochorume, material generated during the decomposition of the corpse, which may contain toxic substances, such as heavy metals, and contaminate the soil, groundwater and the most significant of them (PACHECO, 1997). What makes it a funerary liquid of grayish-brownish color, with an acrid, fetid smell, more viscous than water (LEITE, 2009).

When an individual dies, the degradation process occurs by enzymes and bacterial action, producing gases and necrochorume (SABA, 2011). This substance

consists of 60% water, 30% mineral salts and 10% organic substances (NEIRA *et al.*, 2008).

After death, in the first five months, the human body undergoes putrefaction, which is the destruction of tissues of the body by the action of bacteria and enzymes, resulting in the gradual dissolution of tissues into gases, liquids, and salts. The gases produced are H_2S, CH_4, CO_2, NH_3, and H_2. The odor is caused by some of these gases and by a small amount of mercaptan, a substance that contains saturated carbon-hydrogen sulfide (MÂCEDO, 2004).

According to Pounder (2011), depending on environmental conditions, putrefaction can be observed 24 hours after death, with the formation of gases in two or three days. The decomposition of the body can last from a few months to several years, depending on the environmental action. According to Matos (2001), the necrochorume composition about the microbiological load is not well known. Due to its chemical composition, it is probable that high numbers of bacteria degrading organic matter (heterotrophic bacteria), proteins (proteolytic bacteria) and lipids (lipolytic bacteria).

2.2 Afforestation

The urban vegetation is represented by arboreal groups of different origins and plays different roles (MELLO FILHO, 1985). Urban forests can be defined as the sum of all the woody vegetation that surrounds and surrounds urban agglomerates from small rural communities to large metropolitan areas (MILLER, 1997).

The parks are usually represented by large, abundantly forested areas and the gardens, or even the squares, are spaces for social interaction. In these places, trees of all sizes can be used (PIVETTA and SILVA FILHO, 2002).

Arborization of private areas corresponds to the afforestation of private gardens such as yards, gardens of hospitals, clubs and industries, among others (PIVETTA and SILVA FILHO, 2002).

According to Milano (1985), qualitative analysis of the city of Curitiba was carried out, where 4,382 trees were analyzed in 15 random samples. The main results were: 93 species, of which 18 were 92% of the population, of the species found, only 2 were about 40% (*Lagerstroemia indica*, 24%, and *Ligustrum lucidum*, 14.7%); 15% of the population originated from irregular planting; 72% were classified as good and satisfactory; 3% had superficial roots causing damage to the sidewalks; *Lagerstroemia indica*, *Tabebuia Alba* and *T. chrysotricha* presented more than 50% of the trees with pests and diseases; the most suitable and promising species were *Lafoensia pacari, Parapiptadenia sp., Cassia leptophylla, Tipuana tipu* and *Melia azedarach*;

Urban afforestation encompasses all vegetation cover of arboreal size existing in cities and which may occupy private or public and potentially collective free areas (courtyards of universities, schools, and churches, for example, which have their access in some controlled way), as well as to follow the road system (FARIA, 2018).

Thus, as a legal basis, the Urban Tree Plan of a city is a complementary instrument to the Master Plan of the Municipality and should be in line with the Organic Law. It is also a requirement of the Statute of Cities - Law 10,257 of July 10, Art. 182 and 183 of the Federal Constitution - Urban Policy (WOJCIKIEWICZ, 2012).

2.3 Innovative proposal under cemetery and torture

Thus, the purpose of this study was to raise the conditions of the municipal public cemeteries of the city of Curitiba (Brazil) and, based on its saturation of the physical space with strong polluting potential, present a proposal regarding the burial of loved ones who do not is the other extreme of the proposal of cremation under the widely propagated conventional view.

Thus, '*Capsula Mundi*" is a cultural and broad-based project that provides a different approach to how one thinks or discloses about death. It is an egg-shaped pod, an old and perfect form, made of biodegradable material, where loved ones are placed for burial. The ashes will be carried out in small egg-shaped urns, while the bodies will be placed in the fetal position in larger pods. The Capsule will then be

buried like a seed in the earth. A tree, chosen in life by the deceased, will be planted on top of it and will serve as a memorial for the deceased and as a legacy for posterity and the future of our planet. Family and friends will continue to care for the tree as it grows. Cemeteries acquire a new look and, instead of the cold gray landscape they have today, they will become vibrant forests, sacred forests (CITELLI and BRETZEL, 2003).

3 METHODOLOGY

The methodological processes used in the research were a bibliographical review that, according to Lakatos and Marconi (2010), is indispensable for delimiting the problem in a research project and for obtaining a precise idea about the current state of knowledge about a theme , on its gaps and on the contribution of research to the development of knowledge; as its research nature is applied because it aims to generate knowledge for practical application directed to the solution of specific problems, that is, solve the problems of the municipal cemeteries with the creation of a cemetery as a wooded environment for urban areas and refuge of the existing fauna.

A qualitative research approach was made in which the researcher requires greater contact with the studied environment. As a result, it was necessary to carry out field research and a case study. According to Gil (2008), the field study studies a single group or community regarding its social structure, which is, emphasizing the interaction of its components. Thus, the field study tends to use much more techniques of an observation than of interrogation. They seek much more in depth from the proposed questions.

Based on the studies, a survey was carried out of the public cemeteries, mainly the municipal ones, in the city of Curitiba (PR) to be our object of study and a listing of the trees that are most suitable for the Vale do Paraíso proposal, valid for this city focus.

It was defined that our universe of study would be the city of Curitiba where, in a preliminary survey, it was identified that the city has only 16 cemeteries in its metropolitan area, and in the urban area there are 4 municipalities (Boqueirão, Santa Cândida, Água Verde and São Francisco de Paula), where the target of the present study was constituted.

4 RESULTS AND DISCUSSION - CASE STUDY

The present study was divided into two parts: a superficial survey of the diagnosis of municipal public cemeteries and the visit, as a counterpoint, of a crematorium so that the proposal to be made would conciliate the acceptable parts of the two proposals, that is, culturally maintain the conventional burial, but without polluting the environment.

For the accomplishment of this first part, the municipal public cemeteries in the city of Curitiba (Brazil) were selected to verify the quality and quantity, about the support load and the conditions in which they are found.

Based on data from the prefecture of Curitiba (PREFERENCE OF CURITIBA, 2018) the first settlers, as they were common at the beginning of the colonization, when they were richer or more important, were buried within the churches; and the least wealthy were given the right of burial in the cover rasa, in places not far from the villages. In Curitiba, the rule was the same, until the Royal Charter of 1801, for hygienic and sanitary reasons prohibited this practice, hence the secular cemeteries.

The city grew, and the need for holy fields prevailed. At the end of the last century, these cemeteries were created (MUNICIPAL FUNERAL SERVICE, 2018).

The strong immigration current that was installed here in the same period led to the emergence of communities and their cemeteries. From the beginning of the 18th century, the first burials were carried out in the small courtyard enclosure of the former headquarters of Nossa Senhora da Luz in Curitiba (CURITIBA PREFECTURE, 2018).
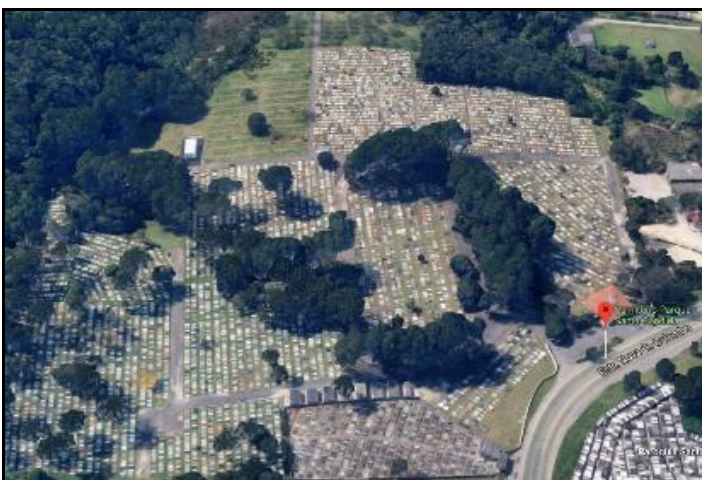
In 1999, the Municipal Department of the Environment ordered the drilling of water quality monitoring wells in all municipal cemeteries, to evaluate the index of groundwater contamination, which demonstrates the concern of this administration (MUNICIPAL SECRETARY OF THE ENVIRONMENT, 2018).

4.1 Municipal cemetery santa cândida

It is one of the largest municipal cemeteries, has an area of 132,299.75 m^2; 8000 tombs and, approximately, 96,584 buried. The Santa Cândida Municipal Cemetery was founded in 1957 on the Colombo Road in Santa Cândida. In 1996, the mortuary chapels underwent reforms, to better serve the population. The temporary graves of the Cemetery of the Holy Candida are destined to the emergency burials of people, whose low-income families do not have resources and also of destitute ones. In these terms, if the burial occurred in Santa Cândida, the relatives have a term of 2 years to transfer to another cemetery (Figure 1). After this period and if relatives have not manifested, the remains are removed to the general ossuary (MUNICIPAL SECRETARY OF THE ENVIRONMENT, 2018).

Figure 1 – Aerial view of Santa Cândida Cemetery
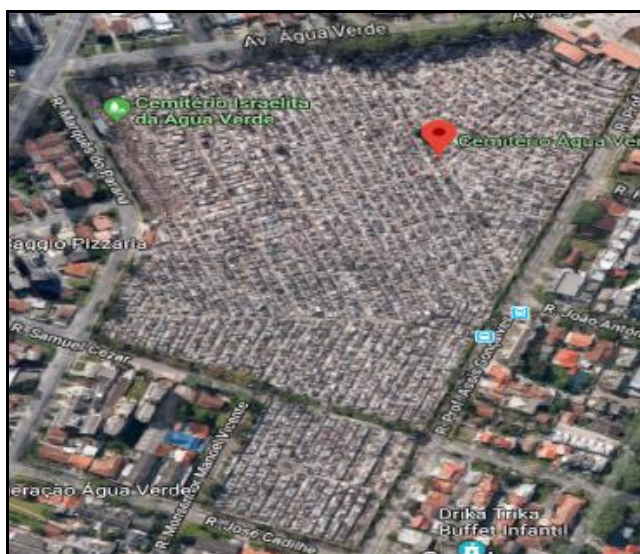

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4.2 São Francisco de Paula cemetery

This one is better known by the municipal cemetery and the oldest of Curitiba, founded in 1866. Located in the center of the city has 51,414 m^2; 5,700 tombs and approximately 67,579 burial sites. The Municipal Cemetery is a kind of synthesis of the history of Curitiba. They buried in him, for example, the dead of the Federalist Revolution of 1894; in it is the tomb of heroin and martyr of popular belief, Maria Bueno, being the most visited in holy field (MUNICIPAL SECRETARY OF THE ENVIRONMENT, 2018).

The Figure 2 represents the aerial view of the São Francisco de Paula Cemetery, while Figure 3 shows the necrochorume leaking to the streets and contaminating the soil.

Figure 2 – Aerial view of the San Francisco de Paula Cemetery

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Figure 3 – Surface necrochorume leaking

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4.3 Água Verde municipal cemetery

The Água Verde Municipal Cemetery was open in 1888, near the Church of the Parish of the Green Water, where the Italian Catholics lived, now Sagrado Coração de Jesus Square. The Água Verde Cemetery, in turn, measures 97,827 m^2; 11,300 tombs and approximately 82,946 burial sites. Since its inception, the administration of the Cemetery has been entrusted to the Curated Chapelania of Agua Verde until 1928, when the Municipality of Curitiba, through Law No. 728 of May 2, 1928, began to administer it. In view of the preference of the population, a first enlargement was necessary for 1930; in 1935 it was once again enlarged, and on May 16, 1940, the Municipality acquired an additional 3153 m^2, annexing them to the Agua Verde Cemetery, according to Figure 4, expressing the cemetery's capacity (MUNICIPAL SECRETARIAT OF THE ENVIRONMENT, 2018).

Figure 4 – Aerial view of the Agua Verde Cemetery

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Figure 5 represents a hole where it is probably necrochorume flowing into the streets and contaminating the soil and environment.

Figure 5 – Leaking liquid necrochorume

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4.4 Municipal cemetery Boqueirão

The Municipal Cemetery of Boqueirão was created in 1950. In 1996 began the construction of 2 chapels and reform of its Administration. However, only in the following year were the new chapels inaugurated (CURITIBA PREFECTURE, 2018).

The Figure 6 depicts the aerial view of the Boqueirão Cemetery, while Figure 7 shows the mismanagement, and pipes out of the graveyard.

Figure 6 – Aerial view of the Boqueirão cemetery
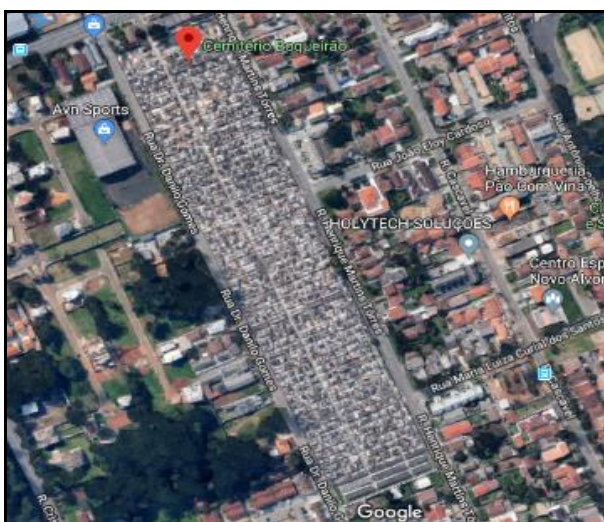
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Figure 7 – Location where necrochorume is leaked

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It has been stated that a new municipal cemetery will emerge in Curitiba, the bidding process comes from 2015, for the creation of the Municipal Zona Sul Cemetery, in the Umbará. According to the director of the Department of Special Services, it is to be ready by 2018. According to information, the new cemetery will serve 2 thousand families because the four municipal cemeteries of Curitiba do not have more space for new deposits. There are families that have been waiting since 2003 for the possibility of this space. It is expected that new concessions will also be released for the burial sites of Boqueirão and Santa Cândida (DURVAL, 2017).

On the other hand, we also visited a crematorium to verify the value of cremation, and how the whole process of this stage works.

Opting for cremation, that is, the person would be cremated, and with the ashes of it (the mineral part), conventionally the loved ones keep it in an urn.

As it is an irreversible process, it needs the death certificate of the deceased and the permission of a medical examiner. Also, if the person has not left his written and documented will, a completed cremation authorization form is required and signed by the next of kin. There are also some requirements regarding the container that will be used in the process, which must be resistant to leakage of body fluids and protect the operators of the crematoriums that need to handle these boxes.

If the deceased has a cardiac pacemaker, it is recommended to remove it before cremation, as it may explode and cause damage to the incinerator, as well as

injuring those who are operating. Also, this equipment contains mercury, which is harmful when released into the atmosphere.

After all, the body is placed in a cremation chamber where extreme heat and direct flames are set at a temperature of 1400 - 1800 °C.

No cell in our body resists a temperature above 1000 degrees. This process can only be done after 24 hours after death and takes about 2 to 3 hours, depending on each body (GRUPO SÃO JUDAS TADEU, 2017).

The parts that were not burned are separated with an ima. The remaining pieces of bone are crushed and cremated again and turned into fine powder and placed in a container and delivered to the family (Figure 8).

Figure 8 – Cremation process and steps
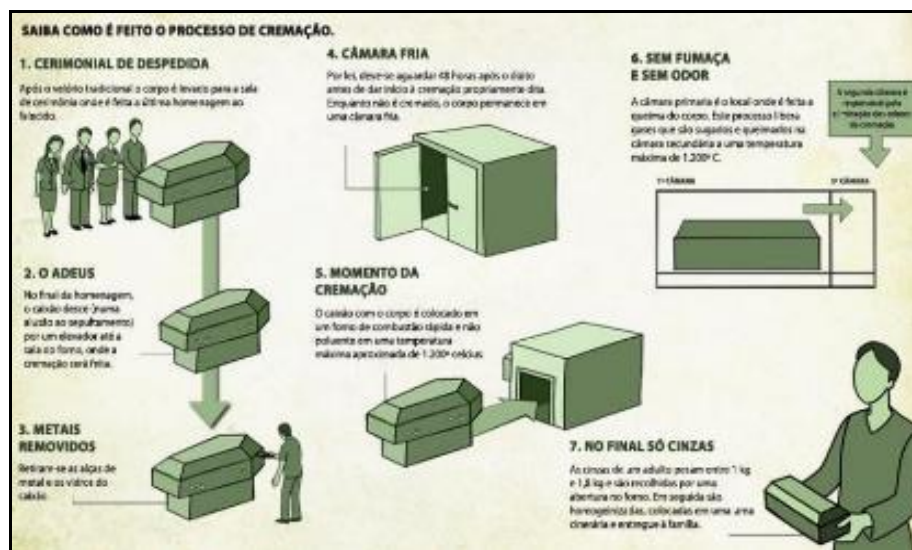
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Cremation is the most correct and ecological way to die, for a person weighing 70 kg becomes between 1.0 and 2.0 kg of ash, whereas when buried this decomposition can last up to two years and leaves 13 pounds of bones.

As for the cost of cremation, in Brazil, for the current year, it varies from R$ 290,00 to R$ 17,000, depending on the package chosen. Already the values for the ceremony of funeral and burial vary a lot from city to city, being able to diverge from R$ 3,77 thousand to R$ 43,6 thousand.

4.4.1 Proposed project as an intermediate model

Adopting the cremation model, the mineral part would not be filed in an urn and would turn to fertilizer to feed a tree seedling of the family's choice, among those existing as potential and viability.

In this case, we sought some species of trees for the family members to choose best for their deceased entity. Having the option of planting a tree in the same way and leaving the environment of the cemetery and the city as a whole more beautiful and free of toxic substances from the necrochorume to the ground.

It's just an example of how it could be our "Valley of Paradise." Inside it will already own the crematorium, an administration, and each tree would be identified with a tombstone or a plaque on the trunk of the tree. It would have benches for people to feel more comfortable, being similar to any well-structured park (Figures 9, 10 and 11).

Figure 9 – Cemetery entrance called "Valley of Paradise

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Figure 10 – "Valley of Paradise" inside view

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Figure 11 – Crematorium

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However, after surveying the character of overcrowding in the municipal public cemeteries of Curitiba, we conclude that all of them are crowded, and there are no more spaces.

It was also observed that, of course, the Santa Cândida Cemetery is the most arboreal. However, in general, these cemeteries are all poorly maintained and look horrible, so we opted for cremation for afforestation in park format, believing it will improve the environment and make the city cleaner and more spacious, dark air of conventional cemeteries for something quieter.

5 CONCLUSION

After this study, it can be concluded that:

The municipal public cemeteries of Curitiba are all crowded and do not guarantee the environmental safety promoted by the generation of the necrochorume seen in the presented figures of each cemetery that there are leaks that contaminate the ground, due to the conventional burial;

The proposal of cremation hurts the religious and cultural precepts of a people, although it is recognized that it does not cause the polluting effects when compared with the conventional burial;

In this way, the present study intends to present an intermediate proposal of the use of cremation and burial, as a reference to relatives, replacing the space occupied by the mausoleums by trees and its innumerable positive aspects to a city, providing a burial also ecological.

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