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# Indigenous collective health and analysis of technogenic deposits of the Ikpeng community: Xingu indigenous park

## Salud colectiva indígena y análisis de depósitos tecnogénicos de la comunidad Ikpeng: parque indígena Xingu

## Saúde coletiva indígena e análises de depósitos tecnogênicos da comunidade Ikpeng: parque indígena do Xingu

**ABSTRACT**
Objective: To characterize the technogenic deposits built in the Ikpeng indigenous community, located in the Xingu Indigenous Park in the northeastern state of Mato Grosso. Method: cross-sectional, quantitative, descriptive and exploratory study carried out through laboratory analyzes of the soil in relation to the existing deposits in terms of characteristic, nature and dimension. Results: They indicate that the wastes are formed mainly by residues resulting from the lifestyle of the community, especially batteries and packaging. In the microbiological analyzes of the soil, the presence of nematodes (parasites) that were harmful to the population's health was not evidenced. contagious. Chemical analyzes showed that the nutrients: potassium, phosphorus and zinc are above average in all samples.Conclusion: The presence of technogenic deposits in the soil may in the future pollute and weaken the health of the indigenous population.
**DESCRIPTORS:** Waste Management; Indigenous Culture; Health of Indigenous Populations; Environmental management.

**RESUMEN**
Objetivo: Caracterizar los depósitos tecnogénicos construidos en la comunidad indígena Ikpeng, ubicada en el Parque Indígena Xingu en el estado nororiental de Mato Grosso. Método: estudio transversal, cuantitativo, descriptivo y exploratorio realizado mediante análisis de laboratorio del suelo en relación a los depósitos existentes en cuanto a características, naturaleza y dimensión. Resultados: Indican que los desechos están formados principalmente por residuos resultantes del estilo de vida de la comunidad, especialmente baterías y empaques. En los análisis microbiológicos del suelo no se evidenció la presencia de nematodos (parásitos) perjudiciales para la salud de la población. contagioso. Los análisis químicos mostraron que los nutrientes: potasio, fósforo y zinc están por encima del promedio en todas las muestras. Conclusión: La presencia de depósitos tecnogénicos en el suelo puede en el futuro contaminar y debilitar la salud de la población indígena.
**DESCRIPTORES:** Manejo de Residuos; Cultura indígena; Salud de las poblaciones indígenas; Gestión ambiental.

**RESUMO**
Objetivo: Caracterizar os depósitos tecnogênicos construídos na comunidade indígena Ikpeng, localizada no Parque Indígena do Xingu no nordeste Estado do Mato Grosso. Método: estudo transversal, quantitativo, descritivo e exploratorio realizado por meio de análises laboratoriais do solo em relação aos depósitos existentes quanto a característica, natureza e dimensão. Resultados: Indicam que os dejetos são formados principalmente por resíduos resultantes do estilo de vida da comunidade, destacando-se pilhas e embalagens. Nas análises microbiológicas do solo não foram evidenciadas presença de nematóides (parasitas) prejudiciais a saúde da população, porém, no que se refere a análise da microbiota de vida livre presente na superfície do solo apresentou quantidade siginifivativamente desses organismos que podem levar a doenças infecto-contagiosas. As análises químicas mostraram que os nutrientes: potássio, fósforo e zinco estão acima da média em todas as amostras.Conclusão: A presença depósitos tecnogênicos no solo podem futuramente poluir e fragilizar a saúde da população indígena.
**DESCRITORES:** Gerenciamento de Resíduos; Cultura Indígena; Saúde de Populações Indígenas; Gestão Ambiental.

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**Damiane Santos Cerqueira**
Master in Environmental Sciences and Health from the Pontifical Catholic University of Goiás, Goiânia, Brazil. Field Nurse in the primary health care area with the indigenous populations in the Parque Indigena do Xingu.
ORCID: 0000-0002-3162-6159

**Julio Cezar Rubin de Rubin**
PhD in Geosciences from UNESP (Rio Claro). Professor at the Pontifical Catholic University of Goiás, Goiânia, Brazil.
ORCID: 0000-0001-9789-2559

**Marieli Basso Bolpato**
Nurse and Physiotherapist. PhD in Public Health from Universidad Americana; PhD in Psychology from the Pontifical Catholic University of Goiás, Goiânia, Brazil. Professor at the Federal University of Mato Grosso, MT, Brazil.
ORCID: 0000-0002-7923-2343

**Jefferson Carlos de Oliveira**
Nurse, Master of Nursing from Centro Universitário São Camilo, Professor of the Nursing and Postgraduate Course in Urgency and Emergency - Centro Universitário Anhanguera de São Paulo - Vila Mariana, São Paulo – SP.
ORCID: 0000-0002-5258-7099

## INTRODUCTION

According to the Brazilian Institute of Geography and Statistics (IBGE) in Brazil, there are 305 indigenous ethnic groups and 274 languages, revealing a high cultural diversity, in addition to very different epidemiological and demographic conditions. [1] Indigenous people are possibly going through a complex process of epidemiological transition, in which, although infectious and parasitic diseases persist as an important cause of death, a significant increase in non-communicable chronic diseases and external causes related to the occurrence of deaths can be seen in parallel. [2]

Since the first contacts between the Indians and the surrounding society, the number of diseases brought to the Indians by the colonizers is considerable, many of them with fatal effects for the indigenous society. Each group that lives in a situation of isolation has a peculiar combination of agents with whom it lives, its fatal effects seem to be mitigated by this coexistence. [3]

When indigenous populations are exposed to other germs, viruses or parasites present in the soil, mortality is significantly high. Thus, the social condition of life is an important determinant when it comes to the health of a population, especially when it comes to the public vulnerable to health conditions and the precariousness of basic infrastructure in the households. [4]

In this context, it is worth mentioning that the technogenic deposits are those originated by human action, which can be classified as constructed, induced and modified [9], and for other authors they are considered as landscapes modified by the action of the human being, with direct influence on the natural dynamics of the formation of the natural processes of the region and may be responsible for causing the entry of toxic substances in the environments. [5]

Given the above, it is possible to note the importance of attention to indigenous health, since indigenous peoples represent 0,4% of the national population [5], presenting health indicators two to three times worse when compared to those of Brazilian society, with high rates of endemic diseases, lack of medical assistance and chronic diseases. [6]

In this sense, the Unified Health System (SUS) created a subsystem coordinated by the Special Indigenous Sanitary Districts (DSEI - Distritos Sanitários Especiais Indígenas), which carry out health actions in indigenous territories focused on local indigenous health carried out by being formed by a network of services structured in the interior indigenous lands, and is responsible for providing basic health care actions and services for the indigenous population, based on the health surveillance model. [7] The continuity of specialized assistance is carried out at other levels of care within the SUS in the reference municipalities. [8]

The present study emphasized the indigenous community of the Ikpeng belonging to the Karib language family who currently live in four villages: Moygu, Arayo, Tupara and Rawo based on an indigenous post located at the Base Base Pavuru, in the Xingu Indigenous Park. Its population was estimated at 347 indigenous people, according to the Local Information System.

In short, the research was justified by addressing the technogenic deposits built in the Ikpeng community in the Xingu Indigenous Park, which can alter the characteristics of the environment (soil) and affect the health of the community.

Therefore, the present study aimed to characterize the technogenic deposits built in the Ikpeng indigenous community and to establish, through laboratory analyzes, the environmental aspects of the soil and the possible implications for the health of the population.

## METHOD

It is a field research, with a quantitative, descriptive and exploratory approach, with field, office and laboratory activities. In the field research, the research area was searched for identification, preliminary characterization and quantification of the technogenic deposits. In the characterization, the constituents, length and width of the deposits were identified using a measuring tape of 30 meters.

Five (5) points were selected for the characterization of technogenic deposits (DT - Depósitos tecnogênicos) and soil sample collection, being named as follows: DT 1 and 2 - Napiki Ikpeng's house (Bebeto); DT 3 - Mogori Ikpeng's house; DT 4 - Nugare Ikpeng house

(Tugu); DT 5 - location with a large amount of battery disposal.

The Ikpeng indigenous community lives in the Moygu village belonging to the Polo Base Pavuru and consists of 22 houses, with a population of 347 indigenous people. The presence of technogenic deposits in the community has become a worrying factor, since they can contaminate the soil, the water table and become favorable places for the shelter of vectors that transmit diseases such as dengue, malaria, parasites, diarrhea, leishmaniasis, among others.

The quantification and identification of the constituents was performed by estimation and the geographic coordinates were obtained with the Global Positioning System (GPS) of the Garmim and Etrex H. types. Subsequently, analyzes of the collected soils were carried out and sent to specific laboratories (Laboratório JEM Análise Agrícola - Aparecida from Goiânia/GO) for microbiological analysis in order to identify the presence of fungi and nematodes and, for Laboratório Solocria Agropecuário Ltda (Goiânia/GO), for chemical analysis (cadmium, chromium, nickel and lead).

In the collection of soil samples, the following procedures were used: with a lobe-type digger samples were obtained at depths of 0,0-0,20 meters and 0,20-0,40 meters, packed in plastic bags, sealed and tagged.

In relation to the office, bibliographic searches were carried out; analysis of all technogenic deposits built and initially identified; choice of deposits to be detailed, quantification, characterization of constituent waste; construction of demonstrative tables. Subsequently, soil samples were sent for laboratory and chemical analysis. Fifteen samples of five technogenic deposits were sent to identify chemical factors (lead, chromium, nickel, among others) and microbiological factors (bacteria and fungi).

The collection took place in the beginning in October 2018 through observation by the researcher who has worked as a nurse with this population for seven years. Soil samples were collected in May 2019. The identification and characterization of a geochemical anomaly in a soil is only possible through laboratory analysis, where soil samples are analyzed and characterized according to their composition.

The inclusion criteria were technogenic deposits that presented a diversity of material (waste) and that were within a radius of up to 50 meters from the houses. In the exclusion criteria, technological deposits with little representativeness of material culture were discarded, with the exception of accumulation of batteries, which has a very high significance in terms of the chemical element present in that location.

The research project was approved by the Research Ethics Committee of PUG Goiás on CAAE: 12738619.6.0000.0037, respecting Resolution No. 466, of December 12th, 2012, which has guidelines and regulatory standards for research involving human beings. [9] However, it is noteworthy that the research did not directly involve people and the possibility of existing risks was related only to the researcher during the period of data collection.

**In the case of the analysis of the free-living and isolated microbiota for the analysis of the species Fusarium spp., Rhizoctonia spp. and Trichoderma spp. different levels of these microorganisms were evidenced in the samples, which proved to be preponderant for the emergence of infectious diseases.**

## RESULTS

During visits around the homes of the community, a large amount of waste was found in the various spaces of the village, such as old clothes, slippers, cans, soda bottles, oil cans, disposable diapers, carcass equipment television, old stoves, plastic and aluminum basins, batteries, oil bottles used to supply boats, among others. It was also found that there are some holes or ditches that are probably used for burning certain types of waste produced by the community.

In Table 1 in relation to the microbiological laboratory analyzes of samples collected from the soil, the presence of nematodes (parasites) was not detected. In the case of the analysis of the free-living and isolated microbiota for the analysis of the species Fusarium spp., Rhizoctonia spp. and Trichoderma spp. different levels of these microorganisms were evidenced in the samples, which proved to be preponderant for the emergence of infectious diseases.

The soil of DT 1 presented the largest amount of these organisms (972 - 10 cm; 1.560 - 20 cm; 420 - 30 cm). The presen-

ce of these fungi, when in large quantities can compromise the cultivation of some crops, however they play an important role in the ecosystem, helping in the cycling of nutrients. Also in DT1, there was a great presence of species (Trichoderma sp - 16.000), the concentration of these microorganisms in the soil, which may contribute to the natural imbalance of this environment, as well as, propitiating the appearance of infectious diseases.

Regarding DT 3 and 4, they maintained a natural and acceptable balance of those of the colony forming units in the soil. However, in the analysis of DT 5 there was little presence of free-living microorganisms (320 - 10 cm; 192 - 20 cm; 80 - 30 cm). These results may be associated with the location of the deposit since it is more distant from the village where the presence of the indigenous people happens less frequently when compared to the other study sites.

According to Table 2 where chemical analyzes of the soil were carried out, it was noticed that the nutrients potassium (K), phosphorus (P) and zinc (Zn) were above average in all samples, according to data exposed by Embrapa. 10 The sample taken at a depth of 10 cm from DT2 showed the highest potassium (176,4) and phosphorus (255,0) values. Regarding zinc, high values were observed in the three sample depths of DT5 (81,0 - 10 cm; 48,3 - 20 cm; 18,9 - 30 cm). Although the zinc values are above the average recommended by Embrapa 10 for soil fertility, they are not considered toxic to human health.

Table 1: Microbiological Analysis in relation to the samples collected in the soil and the microbiota of species fusarium spp., rhizoctonia spp. And trichoderma spp. Goiânia, 2021.

| DT | Profundidade (cm) | Fusarium Solani | Fusarium sp. | Rhizoctonia sp. | Thichoderma sp. | Crinonemella sp. | Vida Livre |
|---|---|---|---|---|---|---|---|
| | **10** | **0** | **1.333** | **4** | **16.000** | **0** | **610** |
| DT1 | 20 | 0 | 1.000 | 5 | 5.000 | 0 | 70 |
| | 30 | 0 | 1.667 | 4 | 4.667 | 0 | 84 |
| | 10 | 1.667 | 7.000 | 9 | 2.667 | 0 | 972 |
| DT2 | 20 | 0 | 2.333 | 8 | 1.667 | 0 | 1.560 |
| | 30 | 0 | 3.000 | 3 | 1.333 | 0 | 420 |
| | 10 | 1.000 | 3.667 | 0 | 8.000 | 0 | 1.240 |
| DT3 | 20 | 0 | 1.667 | 3 | 5.000 | 0 | 1.060 |
| | 30 | 1.333 | 2.667 | 1 | 2.667 | 0 | 710 |
| | 10 | 0 | 2.333 | 0 | 3.000 | 10 | 190 |
| DT4 | 20 | 0 | 1.333 | 1 | 3.333 | 0 | 370 |
| | 30 | 0 | 1.667 | 2 | 3.333 | 0 | 190 |
| | 10 | 0 | 1.667 | 2 | 0 | 0 | 320 |
| DT5 | 20 | 0 | 667 | 3 | 0 | 96 | 192 |
| | 30 | 0 | 2.000 | 0 | 0 | 110 | 80 |

UFC = Colony forming unit/g of soil; UFC/100 g of soil.
Source: JEM Análises Agrícola, Goiânia (2019).

Table 2 - Interpretation of soil chemical analysis - Goiânia, 2021.

| Local | Prof | Ca | Mg | Sat. Al | pH | Sat. Bases | Zn | Pb | Cd | Cr | Ni |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Cm** | **cmolc dm-3** | **%** | **CaCl2** | **%** | **mg dm-3** | | | **ppm** | | |
| DT -1 | 10 | baixo | baixo | baixa | médio | média | alto | baixo | baixo | baixo | baixo |
| DT - 2 | 10 | adequado | baixo | - | adequado | adequada | alto | | | | |
| DT -1 | 20 | baixo | baixo | muito alta | baixo | baixo | baixo | | | | |
| DT -2 | 20 | baixo | baixo | baixo | médio | médio | alto | | | | |
| DT - 1 | 30 | baixo | baixo | muito alta | baixo | baixa | baixo | | | | |
| DT - 4 | 20 | baixo | baixo | baixo | médio | médio | baixo | baixo | baixo | baixo | baixo |
| DT - 4 | 30 | baixo | baixo | alta | médio | médio | baixo | | | | |
| DT - 5 | 10 | baixo | baixo | muito alta | baixo | baixo | alto | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DT - 5 | 20 | baixo | baixo | muito alta | baixo | baixo | alto |
| DT - 5 | 30 | baixo | baixo | muito alta | baixo | baixo | Alto |

Source: Solocria Agropecuário, Goiânia (2019).

Regarding soil fertility, the DT 1 and DT 5 sites presented acid soils, due to the low values of base saturation (Sat. Bases <50%). [10] Also, the high values of aluminum saturation and the combination of hydrogen and aluminum (Sat Al; H + Al) favor the low fertility of these locations.

The soil samples collected in DT3, at a depth of 30 cm, did not have a satisfactory classification for the results of chemical analysis, since the samples collected proved to be unsatisfactory in obtaining these data. However, the results of these analyzed samples made it possible to ascertain results that characterize the fertility quality of the soil, revealing to be an eutrophic (productive) soil, due to variables such as base saturation greater than 50% and the low values of aluminum saturation (Sat. Al) and the combination of hydrogen and aluminum (H + A).

## DISCUSSION

The study carried out in the XINGU indigenous territory in the Moygu village, allowed the identification of five DTs, evidenced by the presence and accumulation of solid waste disposed of inappropriately in the environment. Chemical and microbiological analyzes of the soil showed that in the short and long term they can impact the health of the population and the quality of the soil. [11]

Corroborating with the findings, authors confirm that technogenic deposits can be considered as appropriate sites for the proliferation of vectors favoring diseases such as diarrhea (acute, dysentery, typhoid fever) observed mainly in children and adults living in areas with poor basic sanitation. [6]

In this regard, diarrheal diseases persist as one of the main causes of death among indigenous children, before they reach the age of five. [9] The vectors that are found in the technogenic deposits in the village not only cause disease, they also act as a barrier to the development of these villages, causing problems with the soil. [12]

Therefore, there are two ways in which vector-borne diseases in the village: amechanics occurs when a vector simply carries pathogenic microorganisms in its body and transfers them to food, which we then consume. [14] And, due to the waste of electrical and electronic equipment, called "electronic waste", which contains dangerous substances released or generated directly after disposal or during the recycling process. [2]

In this sense, hazardous waste, if not properly managed, can cause adverse effects on the health of populations living near the places where they are dumped or processed. The contamination of different environmental matrices, including food, water, soil and air, represents a risk to the health of these populations. [13]

The context presented above highlights the health and environmental impacts that can be associated with technogenic deposits, as inadequate disposal directly damages the environment and health. [17] Indigenous populations are generating a lot of waste and cannot deal with it in a sustainable way, which is a serious problem and must be addressed by state policies. [14]

Therefore, in this current scenario, it is necessary to integrate the multiprofessional team working with indigenous health in the construction and planning of actions aimed at making communities in the villages aware of the waste that is being generated and its possible consequences on health and the environment. 4 N In this context, it is important to strengthen the relationship between non-governmental institutions, managers, health staff and communities, in the routine of interventions for proper waste management. [15]

The amount of waste collected in the present study reveals the need to seek, with the participation of indigenous communities, forms of management and control. [7] Such management practices did not integrate the daily life of indigenous communities in the past, as there was no consumption of industrialized products.

It became evident during this research and in the educational and practical actions developed with the Ikpeng community, the large amount of solid waste increasingly visible in the surroundings of the houses, in the courtyard and in the backyards of the village. This problem requires planning and carrying out a reverse logistics policy, as well as care plans related to solid waste management. [16]

The results of this research showed the absence of nematodes and/or parasites in the soil and the presence of the free-living microbiota. This fact corroborates with the study where they observed the interaction between soil microorganisms and nutrients as being important for the maintenance of their cycling, thus maintaining soil integrity. [17]

In the study area, the presence of heavy metals, such as zinc and aluminum is still low, are below the standards of prevention for human health, but on the other hand they characterize a soil with excess nutrients corroborating with a study carried out in a reservoir. of water supply in Pelotas (RS), which was built on deposits with human interference, finding high concentration values of heavy metals, including zinc, which is an inorganic compound resulting from the degradation of industrial products. [18]

In short, it is important to emphasize that technogenic deposits are an indication that it is necessary to be more careful with regard to the disposal of technological material in indigenous territories. Sin-

ce the degradation of this type of material is slow, it can influence soil contamination, and thus directly affect the health of the local indigenous population. [19]

In view of the above, it is necessary to control and manage solid waste integrated into the routine of the villages and must include knowledge and the way of life of indigenous peoples. The lack of planning and strategic actions to manage the final destination of solid waste can have serious impacts on the health of indigenous peoples and the environment in which they are inserted. [20]

## CONCLUSION

It was concluded that the implications registered in the five studied technogenic deposits do not cause risks to the quality of health of this community, however it is worth mentioning that in the long term, these residues can increase in proportions in order to impact not only the health of this population, but also the environment that permeate them.

The microbiological analyzes of soil samples, carried out in these places allowed to ascertain that there are some species of fungi, however in quantities that provide balance, and contribute to natural soil cycling, in this sense, the findings did not portray soil damage today.

In the current context, it is important to empower the multiprofessional team working with indigenous health, in the construction and planning of actions aimed at raising the awareness of communities, about the waste that is being generated, its impacts on the aggravation of health and the environment. ■

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