CC BY NC SA

Espirales
Revista multidisciplinaria de investigación científica

# Characterization of the residential solid waste of the inhabitants of the Anegado Parish of the Jipijapa Canton

## Caracterización de los residuos sólidos residenciales de los habitantes de la Parroquia el Anegado del Cantón Jipijapa

Xavier Enrique Chinga Cevallos*
Rodrigo Paul Cabrera Verdesoto*

Received: February 09, 2023
Approved: May 12, 2023

**Cite this:**

*Asanza, J., Hernández, A. (2023). Training plan for landslide and flood risks for the inhabitants of the Miguelillo-Portoviejo site. Espirales Revista Multidisciplinaria de investigación científica*, 7 (46), 53-64

**Abstract**

This study allowed us to analyze, through a quantitative and qualitative perspective with a systemic approach taking as a reference the methodology of the Pan American Center for Environmental Health C.E.P.I.S. evaluating, through the application of a survey whose study population was 1.536 inhabitants in 246 houses, structured according to the approach of the Manual of statistical procedures for the studies of solid waste characterization CEPIS (HDT 97), allowing us to determine a waste production of 0.26Kg/per/day with a non-compacted waste density of 119.21 Kg/m3, such as food waste 34.49%, plastics 14.91%, special waste 11.44%, cardboard 9.77%, paper 7.47%, metallic 3.63%, wood waste 2.88%, cardboard 9.77%, paper 7.47%, metal 3.63%, wood waste 2.88% and wood waste 2.88%, The survey showed that 80% of the population is aware of the importance of good waste management and thus contribute to the environment by generating management strategies based on good waste management habits from generation to final disposal.

**Keywords:** Good habits, Final Disposal, Management strategy, Perception.

* Engineer. Master's Program in Environmental Management, Graduate Institute, Universidad Estatal del Sur de Manabí. chinga-xavier6635@unesum.edu.ec https://orcid.org/0000-0002-1407-2422

* Engineer. Master's Program in Environmental Management, Graduate Institute, Universidad Estatal del Sur de Manabí. rodrigo.cabrera@unesum.edu.ec https://orcid.org/0000-0002-9560-5795

**Abstract**

Este estudio nos permitió analizar, a través de una perspectiva cuantitativa y cualitativa con un enfoque sistémico tomando como referencia en la metodología del Centro Panamericano de Salud Ambiental C.E.P.I.S. evaluando, por medio de la aplicación de una encuesta a cuya población de estudio fue de 1.536 habitantes en 246 Viviendas, estructurada de acuerdo al planteamiento del Manual de procedimientos estadísticos para los estudios de caracterización de residuos sólidos CEPIS (HDT 97), permitiéndonos determinar una producción de residuos de 0,26Kg/per/día con una densidad no compactada de desechos de 119,21 Kg/m3, como restos de alimentos 34,49%, plásticos 14,91%, desechos especiales 11,44%, cartón 9,77%, papel 7,47%, metálicos 3,63%, residuos de madera 2,88%, y otro tipos de desechos 1, 63% concluyendo que mediante la aplicación de la encuesta se pudo conocer la percepción de los pobladores sobre el manejo y gestión de los desechos sólidos considerando que el 80 % conoce de la importancia de una buen manejo de los residuos y así contribuir con el medio ambiente generando estrategia de gestión enmarcadas a los buenos hábitos de manejo desde su generación hasta la disposición final.

**Key words:** Buenos hábitos, Disposición Final, Estrategia de gestión, Percepción

## Introduction

The environmental, economic and social problems associated with the inadequate management of existing solid waste comes from ancient times and are increasing, (Fazenda & Tavares-Russo, 2016), thus through time health and safety were the subject of concern related to solid waste management considering that currently they are associated with other issues such as conservation of natural resources, environmental risks, (Guerra, 2014)Regarding the above, it is estimated that the generation of municipal solid waste worldwide is approximately 1.3 billion tons per year, and it is expected that this volume will increase to 2.2 billion tons by the year 2025 (Burke et al., 2012)..

According to (Canchucaja, 2018), environmental problems associated with poor waste management are closely linked directly to urban environmental conditions in most cities, inadequate environmental management of solid waste can lead to the spread of agents with high pathogen load (intermediates), leading to the emergence of diseases such as hemorrhagic fever, leptospirosis, digestive disorders, respiratory and skin infections, according to (Mohammadi et al., 2017), other affectations caused, solid waste towards the environment significantly is towards atmosphere, water, soil and flora and wildlife, air pollution from waste is produced by methane (CH ) and carbon dioxide (CO2) (Tangri & Wilson, 2017), which contribute to global warming (greenhouse effect), as a result of indiscriminate burning of waste and poor waste management (MINAN, 2018).

Considering that the problems under study are related to the inadequate management of solid waste, they have a direct impact on human beings and their environment in a significant way. (André & Cerdá, 2015), especially on health, environmental factors such as renewable and non-renewable resources, such as contamination of soils, surface and groundwater (Mohammadi et al., 2017), social, economic factors, whose components are essential for every human being on the planet earth. (MINAN, 2018)other factors identified is the affectation of the scenic beauty where these wastes accumulate, due to poor management by local governments (Tangri & Wilson, 2017). (Tangri & Wilson, 2017).

In Latin America and the Caribbean, household solid waste (HSW) reaches a per capita production of 0.63 kg of waste per inhabitant/day (kg/inhab/day); and Urban Solid Waste (USW) reaches 0.96 kg of waste kg/inhabitant/day, generating 295 thousand tons of waste in homes (USW), 436 thousand tons in schools, stores, offices, markets, hospitals, sweeping and cleaning of streets and public areas (USW), and of this total 45% of waste is not treated and is not adequately recycled (United Nations Organization for Economic Cooperation and Development). (United Nations - Environment (UN), 2018)..

In Ecuador, around 0.58 kilograms of solid waste per inhabitant is generated daily. Meanwhile, it is estimated that 72.9% of solid waste management was handled directly by the municipalities, which disposed of their waste in sanitary landfills; 36%, corresponding to 79 municipal governments, did so in dumps; and 21%, corresponding to 46 municipal governments, disposed of their solid waste in pop-up cells, collecting an average of 12,897.98 tons daily.897.98 tons per day, of which 11,641.94 tons (90.3%) were collected in a non-differentiated manner and 1,256.04 tons (9.7%) were collected in a differentiated manner (Cookson & Stirk). (Cookson & Stirk, 2019).

In the canton of Jipijapa in the province of Manabi and notoriously in the parish of Anegado del Canton Jipijapa, there is a lack of studies related to solid waste management, in this area the lack of knowledge and lack of control by the authorities in charge has led to poor management of solid waste, causing a significant impact on its inhabitants and the environment is why the objective of the research is: To evaluate the solid waste management of the inhabitants of the Anegado parish of the Jipijapa canton in the province of Manabí.

It must have the problem, the formulation of the problem, the objectives, the justification of the work, the theories and the theoretical framework. The introduction should contain a dialogue between the authors and be specified using the APA 7th Edition norms.

## Materials and methods

The methodology of the present research involves the quantitative and qualitative perspective, the same that has a systemic approach, which allows an integrative analysis taking as a reference the methodology of the Pan American Center for Environmental Health (Paraguay, 2018), the same that indicates the statistical and field procedures to

evaluate the solid waste of the parish el Anegado of the canton Jipijapa, as information collection determined the population and sample to study with a survey application previously structured to each family in the area under study based on the methodology raised as a reference C.E.P.I.S., which includes a technical disclosure sheet (HDT 97), considering it as an application technique for the identification and determination of solid waste generated in the study area.

El Anegado Parish has a territorial extension of 117.05 Km2; it is located 16 km, from the Cantonal head of Jipijapa and 120 km from Guayaquil, it has a population of 6,864 inhabitants, positioning itself as one of the most populated parishes of the canton Jipijapa, where there are 1,460 homes in the parish of which 96.89% do not have the basic needs satisfied, the poverty level of 6.814 corresponds to 99.34% according to PDOT Anegado 2015, the productive economic activities of the rural parish El Anegado correspond mainly to the Primary Agricultural and Livestock Sector of the Economy with 76.0%, followed by the Secondary Sector Industry and Manufacturing with 6.1% , and the Service Sector with 17.9%, In the parishes, solid waste management is inefficient on the part of the authorities in charge of garbage collection, which is why 66.37% of the households choose to burn their garbage, and only 25.43% benefit from the collection service provided by the garbage truck twice a week in the parish seat.

## Results

The necessary information was collected for the evaluation and analysis of the object of study where the procedure to obtain the sample according to the disclosure sheets (CEPIS/PAHO, 2005), establishes the division of the population through the socioeconomic strata considering that there is no visible economic stratification because it reflects a common stratum, registering 246 homes with a population of 1,536 people with an estimated six people per home applying the sample through the equation presented below:

$$\mathbf{n} = \frac{\mathbf{Z2\ p{*}q\ N}}{\mathbf{e2\ (N\text{-}1) + Z2p{*}q}}$$

Where:

n = sample size.

N = Population or universe.

Z = Confidence level.

p = probability in favor.

q = probability against.

e = sampling error

$$n = \frac{0.952\ 0.5 * 0.5\ (246)}{0.0882\ (246 - 1) + 0.9520.5 * 0.5}$$

$$n = \frac{0.45 * 123}{1.89 + 0.22}$$

$$n = \frac{55.35}{2.11}$$

$n$ = 26,23

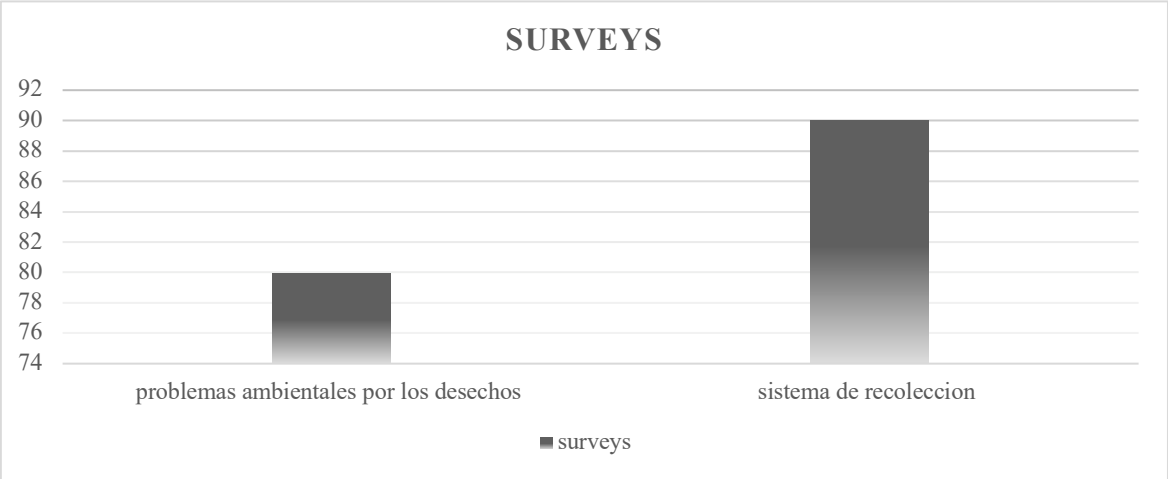
In order to avoid sample loss, the sample was increased by 10% of the original sample.

n= 26.23 + 10% of the sample (=2,623)

n= 28.853 = 29

The application of the survey revealed the perceptions of the residents regarding waste management and handling, where 80% stated that they were aware of the environmental problems caused by poor solid waste management and 90% considered the collection system to be inefficient.

***Figure 2.*** Structured survey on the perception of solid waste management among the inhabitants of El Anegado Parish.




$$GPPC = \frac{NumeroTotaldePersonas\ (Nt)}{0.26\ \text{kg}}$$

$GPPC$ = 1,536 pop. = 399.36kg/d 399.36kg/d

Table 1. *Estimated values of waste production.*

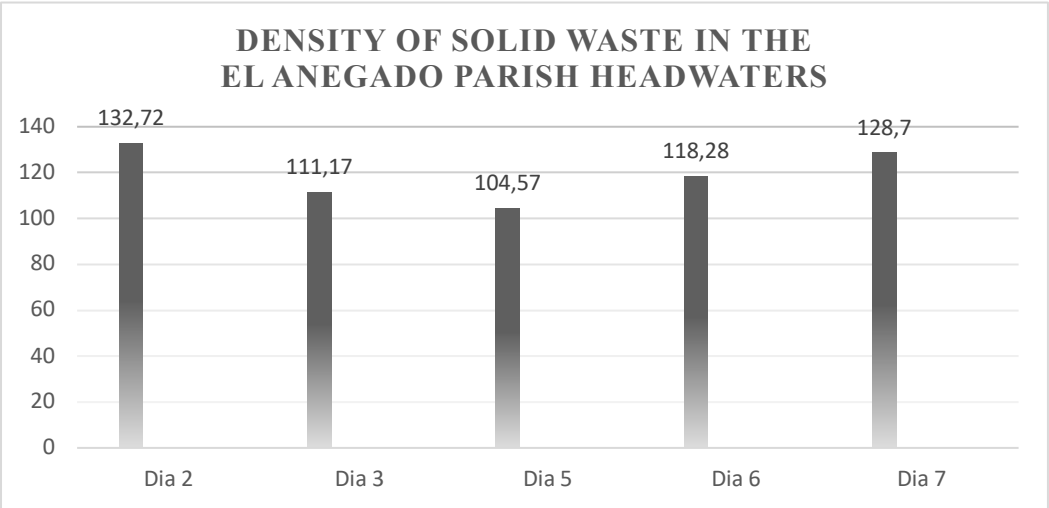
| Waste production values in the Cabecera Parroquial El Waterlogged. | | |
|---|---|---|
| Diary | 339.36 kg | 0.34 tons |
| Weekly | 2,375.52 kg | 2.37 tons |
| Monthly | 10,180.80 kg | 18.18 tons |
| Quarterly | 30,542.40 kg | 30.54 tons |
| Semiannual | 61,084.80 kg | 61.06 tons |
| Annual | 122,196.60 kg | 122.19 tons |

The waste density was determined using the process described in the methodology applied in HDT 97 (CEPIS/PAHO, 2005) using the following formula:

$$\text{Densidad } D\ (Kg) = \frac{Pesodel Residuo\ W\ (Kg)}{m3\ Volumendela Basura\ (m3)}$$

The average density of solid waste in the parish of El Anegado is 119.21 kg/m3.

*Figure 3*. Density of solid waste in the Cabecera Parroquial El Anegado.




Characterization and quantification of solid waste composition.

This process involves three phases:

(1) Determination of Per Capita Generation (gpc) and Total Daily Solid Waste,

(2) Determination of waste density

(3) Determination of the Physical Composition of Solid Waste.

The data obtained in the waste characterization process helped to determine the physical composition of the solid waste generated in the parish of El Anegado. Based on these values, environmental management mechanisms can be established that will contribute to the proper management and use of solid waste in order to minimize the impacts that it could generate.

According to the composition of solid waste determined in the Cabecera Parroquial El Anegado, it was identified that the most generated waste is food waste with a value of 34.49%, as a result of this the average number of inhabitants per family (6 inhab/fam) and the estimated food consumption (data not determined).

In second place in waste production is plastic waste with 14.91%. This is followed by glass waste with 13.78%.

A suggestive value is that of special waste, located in fourth place with 11.44%. The reason for this is due to the null management assigned to them, due to the fact that the waste collection cart that circulates weekly in the area does not collect this type of waste and the health sub-center does not manage the management of this waste either. (Pincay & López, 2021).. For them, through the process of daily waste collection in the sample houses, a great value of medical waste was found such as; serums, injections, sharps and medicines. This amount collected produced a high value of this type of waste in the first two days of sampling.

The cardboard and paper group is represented with 9.77% and 7.47% of production, respectively.

Metallic waste accounts for 3.63%. Wood waste accounts for 2.88% of production in the area.

Lastly, we have miscellaneous waste made up of materials such as rubber, leather, jute, soil or any other material different from the classification used with 1.09% and plant waste with 0.54%.

**Table 2.** *Estimated waste production values.*

Composition of solid waste from the parish headwaters of El Waterlogged

| Types of solid waste | Total of waste collected (1-7) | Percentage value |
|---|---|---|
| Paper | 1,79 | 7,47% |
| Cardboard | 2,34 | 9,77% |
| Wood | 0,69 | 2,88% |

| | | |
|---|---|---|
| Plant residues | 0,13 | 0,54% |
| Food scraps | 8,26 | 34,49% |
| Plastics | 3,57 | 14,91% |
| Metals | 0,87 | 3,63% |
| Special (Batteries/light bulbs/sharps/medicines/medicine). nts) | 2,74 | 11,44% |
| Glass | 3,30 | 13,78% |
| Other (Rubber, soil, etc.) | 0,26 | 1,09% |
| TOTAL | 23,95 | 100% |

Regarding the collection, transport and final disposal of waste generated in the parish of El Anegado, according to the survey applied to the inhabitants, it was determined that one of the main factors in the management of waste is the collection service, which is irregular and terrible, with vehicles that are inadequate for the job, with low load capacity and low frequency on collection days.

Another problem to be evidenced is the lack of ecological points where the inhabitants can deposit solid waste until the day of collection and do not choose to carry out activities such as burning, burying, throwing into rivers or other ways to dispose of the waste they generate.

On the other hand, the social actors that exist in the territory do not exercise a role of responsibility and commitment regarding environmental issues and problems in terms of training, awareness raising, periodic mingas, among other activities.(Moraga, 2010)

Within the studies conducted by (Ortega, 2017), in the Recinto La Libertad de Ñauza belonging to the Canton Alfredo Baquerizo Moreno - Province Del Guayas, within the characterization of solid waste it was possible to identify that the per capita production of in the study area is 0.37 kg/inhab/day, with a generation value of 70.91 tons in a year, This represents 1% of the total generation of the canton, data obtained with a population of 528 inhabitants located in 125 homes, with an average of four members per family, considering that in our research conducted in the Parroquial El Anegado, we obtained a per capita production of 0.26 kg/inhab/day and an annual generation of 122.19 tons., whose study population was 1,536 inhabitants in 246 homes, with an average of six members per family.

The data obtained through the surveys conducted among the population of Libertad de Ñauza, allowed identifying that the population does not have an environmental culture regarding the handling and management of their waste, due to the lack of education and environmental awareness, they are unaware of the consequences that can be caused by improper waste management to the environment and towards their health, (Ortega, 2017). Unlike in El Anegado Parish, it has the help of the GAD Municipal

de Jipijapa regarding the activities of collection, transportation and final disposal of waste generated in the parish headwaters. However, according to the survey applied to the inhabitants who participated in the characterization project, it was determined that the collection service is regular to terrible, the reasons are due to the use of inadequate vehicles for the job, as they have a low load capacity, in addition to the low frequency of collection days.

Another problem to be evidenced is the lack of ecological points, where the inhabitants can deposit solid waste until the day of collection and do not choose to perform activities such as burning, burying, throwing into rivers or other ways to dispose of the waste generated in such a way that the social actors that exist in the territory do not exercise a role of responsibility and commitment in terms of environmental issues and problems in terms of training, awareness, periodic mingas, among other activities.

Therefore, the implementation of a solid waste management model will provide lines of action (at the local level and in nearby communities) in the parish of El Anegado, Canton Jipijapa, helping to control waste management activities and minimize the impacts they may cause in the medium and long term, also involving the participation of the Gad, community leaders, neighborhood leaders and other population due to the demand that these lines of action would exert as a primary part in the internal management of waste, generating income to the parish head neighborhoods and communities to solve the problems or needs that exist in the place.

The data determined in the characterization will be analyzed and according to this, programs will be designed for each phase in the process of integrated solid waste management, from generation to final disposal.

- Program to strengthen relations between social actors.
- Social communication program where the work ideas should be shared and socialized to the entire local population, thus including educational institutions as the main articulator of awareness.
- Waste collection, temporary storage and commercialization program The reduction and use phase was developed as part of the social participation in ecological activities (CAPS program).
- Program specifically related to the management of infectious and hospital waste.

## Conclusions

Through the process of characterization of solid waste in the parish of El Anegado, it was determined that the per capita production of the parish of El Anegado is 0.26 kg/inhab/day, where these values represent an annual production of 122.19 tons of "garbage". The composition of solid waste in the territory is mainly represented by organic matter with 34.49%, plastic waste 14.91%, glass 13.78%, cardboard 9.77% and paper 7.47%.

The application of the survey allowed us to know the perception of the inhabitants about the handling and management of waste in their homes and we were able to identify

problems such as; classification of waste in situ, environmental culture and inadequate service in municipal waste collection.

The implementation of a management model (MoM) will allow the El Anegado parish government to promote an environmental culture in each of its inhabitants through the proposed program and achieve sustainable development of economic, social and environmental factors. In addition to involving all social actors in the responsibilities they must share in the management of solid waste generated in the parish headwaters.

## References

André, F. J., & Cerdá, E. (2015). *Municipal solid waste management : economic analysis and public policies. January 2006*.

Burke, C. S., Salas, E., Smith-Jentsch, K., & Rosen, M. A. (2012). Measuring macrocognition in teams: Some insights for navigating the complexities. *Macrocognition Metrics and Scenarios: Design and Evaluation for Real-World Teams*, 29-43. https://doi.org/10.1201/9781315593173-4.

Canchucaja, A. P. (2018). Urban-environmental effects produced by the solid waste management of the "La Hermelinda" food market in the district of Trujillo, 2017. *Universidad César Vallejo*.

Cookson, M. D., & Stirk, P. M. R. (2019). *済無 No Title No Title No Title No Title*.

Fazenda, A. and, & Tavares-Russo, M. (2016). Characterization of municipal solid waste in Sumbe: tool for waste management. *Recvista Ciencias Holguín. Centro de Información y Gestion Tecnológica Del Holguín. Cuba.*, *22*(4), 15. http://www.redalyc.org/articulo.oa?id=181548029002. http://www.redalyc.org/articulo.oa?id=181548029002

Guerra, E. E. (2014). Damage to health by poor disposal of solid and liquid waste in Dili,

Timor Leste. *Revista Cubana de Higiene y Epidemiologia*, *52*(2), 270-277.

MINAN (2018). *APPENDIX 4 Environmental pollution caused by solid waste Basic scientific knowledge*. 1-6.

Mohammadi, K., Movahhedy, M. R., Khodaygan, S., Gutierrez, T. J., Wang, K., Xi, J., Trojanowska, A., Nogalska, A., Garcia, R., Marta, V., Engineering, C., Catalans, A. P., Capsulae.com, Pakdel, Z., Abbott, L. A., Jaworek, A., Poncelet, D., Peccato, L. O. D. E. L., Sverdlov Arzi, R., & Sosnik, A. (2017). No **主観的健康感を中心とした在宅高齢者における** 健康関連指標に関する共分散構造分析Title. *Advanced Drug Delivery Reviews*, *135*(January 2006), 989-1011. https://doi.org/10.1016/j.addr.2018.07.012%0Ahttp://www.capsulae.com/media/Microencapsulation - Capsulae.pdf%0Ahttps://doi.org/10.1016/j.jaerosci.2019.05.001

Moraga, J. (2010). Forest fire risk assessment in the Tempisque river basin, Costa Rica. *Revista Geográfica de América Central*, *2*(45), 33-64.

United Nations Environment Organization (UN). (2018). *Perspective of Waste Management in Latin America and the Caribbean Perspective of Waste Management in Latin America and the Caribbean*.

PARAGUAY, G. N. (2018). *municipal solid waste Table of Contents.* https://procurement-notices.undp.org/view_file.cfm?doc_id=182765

Pincay, C. V. S., & López, C. G. N. (2021). Evaluation of sanitary waste generated by the care of COVID patients, in the Jipijapa Basic Hospital. *Linguistics and Culture Review*, *6*(July 2021), 13-23.

https://doi.org/10.21744/lingcure.v6n4.1936.
https://doi.org/10.21744/lingcure.v6n4.1936.

Tangri, N., & Wilson, M. (2017). Waste gasification and pyrolysis : high-risk, low-cost procedures for waste treatment. *Gaia*, *1*, 1-18.