Revista AIDIS de Ingeniería y Ciencias Ambientales:
Investigación, desarrollo y práctica. ISSN 0718-378X

Vol. 11, No.3, 376–388
6 de diciembre de 2018

REVISTA AIDIS

de Ingeniería y Ciencias Ambientales:
Investigación, desarrollo y práctica.

WASTE MANAGEMENT ALTERNATIVES IN URBAN AND RURAL QUILOMBOLA COMMUNITIES

Ariadne Barros Andrino[1]
*Priscila de Morais Lima[1,2]
Fernando Jorge Corrêa Magalhães Filho[1]

Recibido el 28 de marzo de 2017; Aceptado el 16 de octubre de 2018

Abstract

Quilombolas are descendants from black slaves who founded isolated communities, the Quilombos. Many of these communities have considerable needs, especially because most are located in rural areas, including waste management, which affects their health and requires studies in the area. Based on this, this paper shows the current conditions of waste management in two quilombola communities, urban and rural, through site visits, questionnaires and gravimetric analyses. Therefore, it was possible to notice that the urban community has better conditions than the rural community, and their 66% of organic matter and 17% of plastics and paper are equivalent to the gravimetric composition of the city in which it is inserted. In the rural community, almost 90% of plastics and paper are burned in the ground and 100% of organic matter, from food, is destined to domestic animals and used as fertilizer. For this reason, the rural community presented a higher generation of plastics and glass in the gravimetric analyses. In conclusion, it is suggested for both communities to perform source separation. In addition, composting for the rural community is recommended. This will improve the sustainability of waste management in both locations. It was also concluded that the conditions of these communities depend on the urban context that they are inserted in, as well as their culture.

Keywords: *Brazil, Quilombola, Solid Waste Management, urban community, rural community.*

[1] Department of Sanitary and Environmental Engineering, Dom Bosco Catholic University (UCDB), Campo Grande/MS, Brazil.
[2] Department of Hydraulics Engineering and Sanitation (SHS), University of São Paulo (USP), São Carlos/SP, Brazil.
**Autor corresponsal:* Department of Hydraulics Engineering and Sanitation (SHS), University of São Paulo, Av. Trabalhador São Carlense, 400 – Centro CEP 13566-590 - CP 359 São Paulo, Brazil. Email: pri.lima.91@gmail.com

Revista AIDIS de Ingeniería y Ciencias Ambientales:
Investigación, desarrollo y práctica. ISSN 0718-378X
Vol. 11, No.3, 376–388
6 de diciembre de 2018

Introduction

The term “kilombo” comes from the Bantu language, and its presence in Brazil is due to some of the Bantu people who were brought from their territory, between Angola and Zaire in Africa, as slaves to work in the country (Munanga, 1995/1996). According to the same author, the Brazilian quilombo is similar to the African quilombo, a community rebuilt by enslaved people to oppose a slave structure, being a territory that was not occupied before, generally with difficult access, to where the rebellious ran from *senzalas* (their living place within the farms) and plantations.

Currently, these communities are inhabited by the descendants of these slaves, who are known as Quilombolas, and they have maintained their African culture, subsistence and religious traditions throughout the centuries (PALMARES, 2018). In Brazil, there are 2,197 communities officially recognized by the State. Thus, there are approximately 214,000 families and 1.17 million Quilombolas nationwide (Brasil, 2013). Approximately 77.7% of the Quilombola population live in the rural area of Brazil, and consequently, only 34.6% of these Brazilian families have a water network, 10% have sewage collection and 26.9% have solid waste collection (SEPPIR, 2016).

Rural areas should be considered in all municipal waste management planning, but that is not what usually happens, as shown in a study by Talyan *et al*. (2007), in which rual areas had not been considered due to dumping waste in open sites. The lack of concern by municipalities regarding rural areas is noticeable, a very evident fact in Brazil, but there are a few studies that can be found worldwide related to the topic, such as Hiramatsu *et al*. (2009), in Thailand, and Abduli *et al.* (2008), in Iran, that reflect how these areas are neglected.

When handling solid waste improperly like the residents of rural areas do, it can cause public health issues, since it attracts vectors that carry out diseases and lots of risks to humans and the environment (Ferreira and Anjos, 2011). The risks from long-term exposure to solid waste can be physical, chemical or biological, which causes all types of pollution: air, soil and water (Alam and Ahmade, 2013).

Guerrero *et al.* (2013) and Henry *et al.* (2006) show that developing countries face a lot of difficulties regarding municipal waste management. They describe that an effective system should consider environmental, socio cultural, legal, institutional and economic aspects, and area-specific solutions in addition to technical arrangements in order to make the system effective.

In Brazil, only in 2010 a Federal Legislation, National Policy of Solid Waste - NPSW (Law n° 12,305), was created in order to promote health and environmental balance towards waste management. Based on the principles of the NPSW, health and environmental importance of the study in Quilombola communities, this work aimed at studying the conditions of the existing solid waste management in Quilombola communities in urban and rural areas, and to propose alternatives

Revista AIDIS de Ingeniería y Ciencias Ambientales:
Investigación, desarrollo y práctica. ISSN 0718-378X
Vol. 11, No.3, 376–388
6 de diciembre de 2018

for its sustainability, seeking improvement for their living conditions. Furthermore, the objective is to contribute to future research in this field, knowing that literature is sparse when it comes to special communities, and to support the elaboration of appropriate municipal water, sewage and waste management plans for the communities to improve upon their current realities.

Materials and Methods

Study Area

The State of Mato Grosso do Sul (MS) is located in west central Brazil and it has identified 22 Quilombolas communities (Brasil, 2013). This study was conducted in the Eva Maria de Jesus and Furnas do Dionísio communities, respectively urban and rural territories, in order to compare the differences when one is already in the context of a municipality and the other is still somehow isolated and with difficult access, in a rural area.

Furnas do Dionísio

The Furnas do Dionísio community is located in the municipality of Jaraguari/MS, at the coordinates 20°8'11"S and 54°34'56"W, 24 km away from the city limits and 35 km from Campo Grande, the State's capital, as it is shown in Fig. 1. The community currently has approximately 100 families and an area of 1,018.28 acres, being the most populated community in the State (INCRA, 2012).

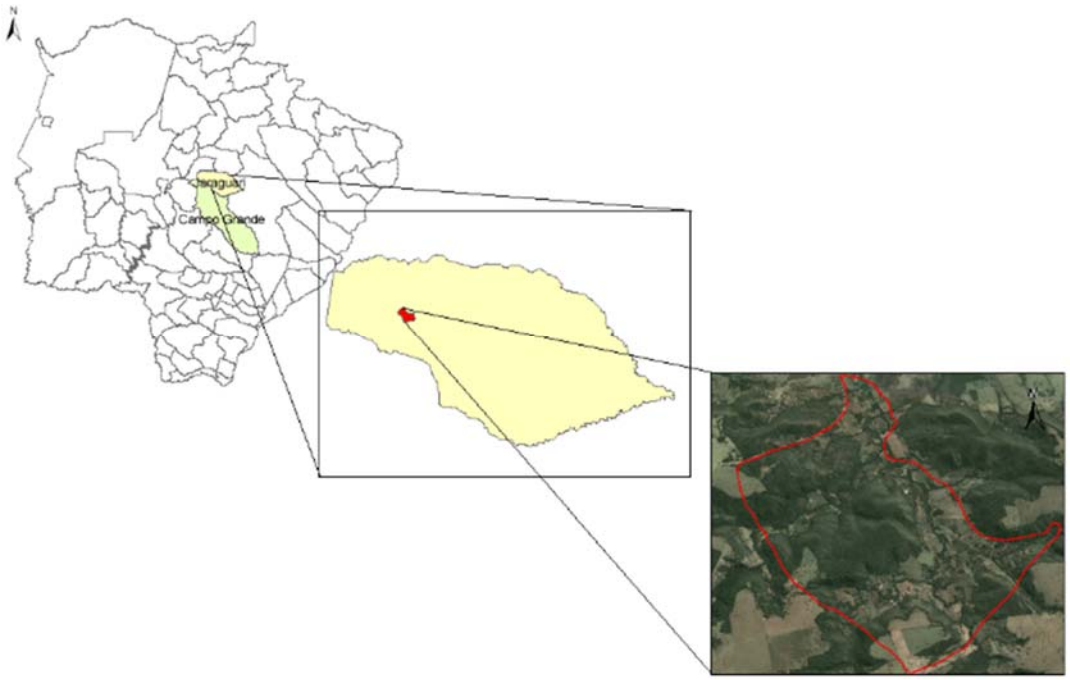

Fig. 1. Location of the Furnas do Dionísio community in the city of Jaraguari.

Revista AIDIS de Ingeniería y Ciencias Ambientales:
Investigación, desarrollo y práctica. ISSN 0718-378X
Vol. 11, No.3, 376–388
6 de diciembre de 2018

Eva Maria de Jesus – Tia Eva

The Eva Maria de Jesus community is composed of descendants from *Eva*, known as "*Tia Eva*" (Aunt Eve), and is located in the municipality of Campo Grande, at the coordinates 20°25'35"S and 54°36'54"W, approximately 10 km from the city's center (Fig. 2). Its area covers about nine acres, it is home to 106 families distributed in 85 houses, with approximately 310 inhabitants (Santos, 2010).

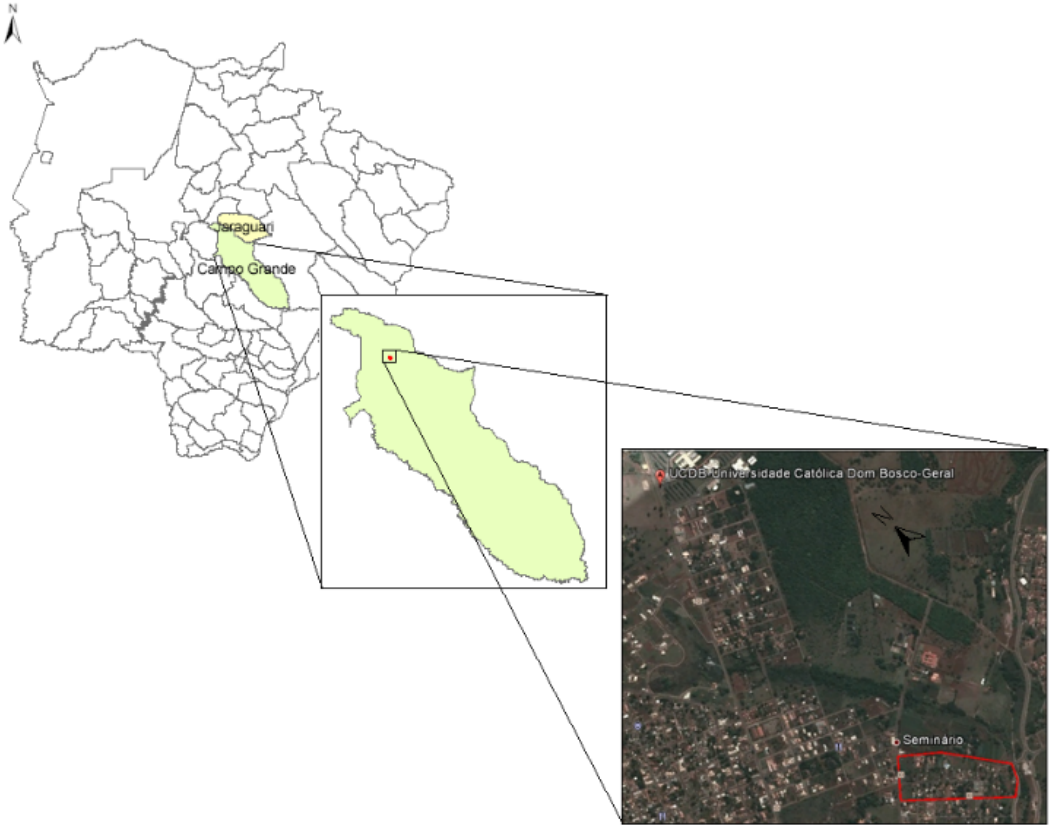

Fig. 2 Location of the Eva Maria de Jesus community in the city of Campo Grande

The communities were chosen due to their physical proximity to each other while having different urbanization contexts. The problem of solid waste management and sanitation itself was drawn from visiting the communities and interviewing the presidents of the Residents' Association from each community.

Data Collection

The Quilombola communities' data collection was performed in three steps: sample size determination, questionnaire application and qualitative and quantitative characterization of the waste.

Revista AIDIS de Ingeniería y Ciencias Ambientales:
Investigación, desarrollo y práctica. ISSN 0718-378X
Vol. 11, No.3, 376–388
6 de diciembre de 2018

Sample Size Determination

Due to the large amount of residents in the communities it was not possible to obtain data from the entire population, making statisc sampling necessary. This way, the number of interviewers in each community was calculated according to the methodology from Anderson *et al.* (2013) where it is possible to determine the sample according to Equation 1.

$$n=\frac{Z^2\times P\times Q\times N}{e^2\times(N-1)+Z^2\times P\times Q} \qquad \textbf{Equation 1}$$

Where:
n – sample size.
Z – confidence level.
P – expected hit (%).
Q – expected error (%).
N – total population.
E – precision level (%).

The sampling error considered was 2% with a level of confidence of 95% and precision of 5%. Using N = 100 and N = 85, 21 families in the Furnas do Dionísio community and 20 families in the Tia Eva community was obtained.

Questionnaire Application

The questionnaire was related to the current water supply, wastewater treatment and solid waste management situation in the communities, alongside sustainable alternatives in order to clarify the population's knowledge on the subject and to evaluate their interest in incorporating it in the community. The households were selected randomly with random start and constant jump.

Accordingly, different questionnaires were applied toeach community, since they are in different urban contexts. Both questionnaires had between 09 and 10 questions and were applied by an informal chat with the locals, in order to address and explain the contents and to facilitate understanding.

Qualitative and quantitative characterization of the waste

This step was developed based on the methodology explained by Rezende *et al.* (2011). Two stages for the qualitative and quantitative characterization of generated waste were established: the generated waste *per capita* and the physical composition of the waste by gravimetric analysis, for which generated waste in one day was considered for both communities.

A date was set with the households to segregate their waste and leave it for the team to collect. On the set date the waste from the sampled families was collected and taken to each community hall. The waste was initially weighed per household, by a hand scale and an electronic scale, to obtain a familiar pattern and a *per capita* generation from the community. Then the waste was segregated by material type and weighed again.

Revista AIDIS de Ingeniería y Ciencias Ambientales:
Investigación, desarrollo y práctica. ISSN 0718-378X
Vol. 11, No.3, 376–388
6 de diciembre de 2018

Analysis of Existing Alternatives

The study of posible alternatives leaned on the principles of the NPSW and the Manual for Integrated Management of Municipal Waste of Campo Grande/MS, in addition to articles, booklets and trusted websites, referenced throughout this paper. The alternatives considered for the waste management are:

- Collection: door to door and through Point of Volunteer Delivery (PEV);
- Packaging: plastic bags, drums, cans and baskets without plastic bags, bins and moving containers, buckets;
- Final Destination: reuse, recycling, composting and thermal treatment;
- Final Disposal: open dump, controlled landfill and sanitary landfill.

Results and Discussion

Identification and Waste Issues

Due to hard access to the area, the Furnas do Dionísio community remained isolated for several decades, leading to the preservation of morals and social values of the community, making it unique. According to Mrs. Cida, president of the community, there is no waste collection provided by the municipality; therefore, waste management/handling is of the responsability of each household. Furthermore, they have 04 wells for water supply, drilled by FUNASA (National Health Foundation), aside from the surface water supply from the river that flows through the community.

Regarding their sewage system, the wastewater generated by each household is unintentionally separated into greywater (e.g. from the washing machine) and blackwater (from the toilets), which are discharged directly into the soil and directed to dry pits, respectively. As shown by Magalhães Filho and Paulo (2017), dry or absorbent pits are commonly used in rural communities and should be combined with the reuse of greywater, which can make the system somewhat sustainable. However, the residents need some extra actions regarding groundwater for potable uses (such as filtering and boiling), since the lack of protection in the pits can cause groundwater contamination.

The gathered information meets what Lima and Paulo (2018) documented in the Quilombola communities of Mato Grosso do Sul, in which 74% are served by community wells for their water supply, 91.8% have pits as a wastewater destination and 28.8% of the residents already reuse water from their washing machine. Regarding waste collection, the same study verified that only 30% of the communities in the state is served by a solid waste collection system.

On the other hand, being in the urban context of Campo Grande, the Tia Eva community should have their conditions met by the municipality. According to Mrs. Lucia, president of the community, they are supplied with piped water, which the concessionaire that serves the capital

Revista AIDIS de Ingeniería y Ciencias Ambientales:
Investigación, desarrollo y práctica. ISSN 0718-378X
Vol. 11, No.3, 376–388
6 de diciembre de 2018

is responsible for, and the area is covered by the public waste collection. As for the sewage system, the area is still not served by the municipality's collection and treatment systems (Santos, 2010).

From the analysis of the information obtained through interviews it was observed that none of the communities have proper management for their waste, while each household disposes of it the way they can. Although the Tia Eva community has a public waste collection, a large portion of its residents do not perform waste separation for recycling. Thus, the awareness of residents to perform waste separation is of great importance, especially in order to help residents themselves whom have their livelihood in the practice of recycling, and also to reduce the volume of waste that is destined for the municipal landfill in Campo Grande. This practice was confirmed in other Quilombola communities, as there are "waste pickers" in the Família Os Pretos, Chácara Buriti, and Furnas de Boa Sorte communities, all located in different parts of Mato Grosso do Sul (Lima & Paulo, 2018).

As for Furnas do Dionísio, many problems derive from their current waste management, or lack thereof. Such as accumulating it in their yards, causing damage to the soil and potentiating health problems, and also their habit of burning waste, even for preparing food like barbecues, which exposes them to toxic gases. According to Lima & Paulo (2018), 72.9% of the Quilombolas in Mato Grosso do Sul burn their waste, and therefore are exposed to the same issues. Therefore, residents should seek disposal alternatives for organic and inorganic waste in order to create a condition for sustainable use in these families.

Solid Waste

Tia Eva Community

Regarding solid waste, the questionnaire in Tia Eva addressed general knowledge about the population and how their generated waste is separated. It was verified that 66% of the respondents knew what the term "recycling" means and 45% knew how to perform wet and dry separation. Meanwhile, for waste destination, only 8% knew what the term "compost" refers to and 52% did not know the current destination of the waste that they put in front of their homes and showed no interest in knowing.

It was noticeable that most of the population in the community have knowledge about recycling and dry and wet waste separation, but nevertheless, the separation is performed by less than 50% of residents, demonstrating a lack of interest and/or lack of knowledge that these residents have about the importance of recycling. In this community, metal is the material with the highest percentage of separation for recycling, followed by plastics, paper/cardboard and glass. Just over 20% of the population separates organic materials to feed livestock.

Revista AIDIS de Ingeniería y Ciencias Ambientales:
Investigación, desarrollo y práctica. ISSN 0718-378X
Vol. 11, No.3, 376–388
6 de diciembre de 2018

Furthermore, less than 20% of the residents knew the meaning of a Point of Volunteer Delivery (PEV), but after an explanation a little more than half of them volunteered to take their recyclables to the PEV as long it was close to their houses.

Since the Tia Eva community is served by the municipality's solid waste collection, there is a certain comfort that this collection provides, making it difficult to raise the residents' awareness regarding the benefits that waste separation for recycling and/or proper disposal provides.

Furnas do Dionísio Community

As for this rural community, where waste handling is entirely up to the residents, all alternatives were addressed in the questionnaire, both to get an idea of their knowledge about them, and to verify their viability.

Despite the precarious conditions that exist in the community, part of the residents were aware of ways to properly dispose of solid waste: 80% of respondents had knowledge about landfill, 82% about open dump, 42% about compost, 20% about incineration and 68% about recycling.

Moreover, 42% know how to perform wet and dry separation and 100% knew that solid waste can bring health risks when disposed improperly. The practice of composting and incineration were explained to those who had no knowledge of it and composting was encouraged to all residents who answered the questionnaire.

Table 1 shows the main destinations for different waste fractions, where it is possible to see that about 80% of households feed animals with the organic matter; paper, plastics and cardboard are burned with the frequency that they are generated; glass, construction and demolition waste (CDW) and cooking oil are placed in the ground, in an organized manner in some residences and in an unorganized manner in others.

Table 1. Solid Waste Final Destination– Furnas do Dionísio

Type of Solid Waste	Destination of Solid Waste				
	Animal Feed	Ground Disposal	Sold	Burned	No answer
Organic Matter	81%	19%	-	-	-
Glass	-	87%	13%	-	-
Paper/Cardboard	-	6%	6%	75%	13%
Plastics	-	6%	6%	88%	-
Metal	-	19%	81%	-	-
CDW	-	81%	-	-	19%
Kitchen Oil	-	44%	-	13%	43%
Batteries	-	6%	-	13%	81%

Revista AIDIS de Ingeniería y Ciencias Ambientales:
Investigación, desarrollo y práctica. ISSN 0718-378X
Vol. 11, No.3, 376–388
6 de diciembre de 2018

Metal is the material that in 81% of households is set apart to be sold to a collector who goes through the community from time to time to collect this material. We emphasize that a fraction of residents did not know or did not want to share what the destination was, especially for batteries, which 81% chose not to answer.

In the rural area of Thailand, as studied by Hiramatsu *et al*. (2009), 47.1% of households burn waste in their yards and 5.9% throw it onto a garden or field. The other 47% had their waste collected by the municipality, which does not serve the community in the study. The rural management in the province studied by Abduli *et al.* (2008) in Iran was based on collection and ground disposal or open dumping of the waste on the ground.

Waste characterization

In the Eva Maria de Jesus community the results were very close to those found in the literature for urban regions in general, with a higher organic waste generation (66%). In Fig. 3, there is a comparison between the gravimetry obtained in the Eva Maria de Jesus community and the city where it is inserted (Campo Grande).

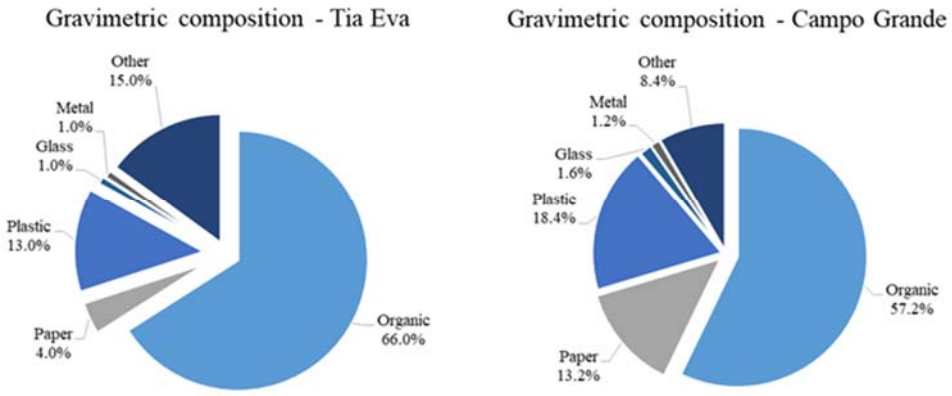

Fig. 3. Comparison between the gravimetry obtained in the Eva Maria de Jesus community and the city of Campo Grande (CAMPO GRANDE, 2012).

The average generation *per capita* differed significantly from family to family, as some residents were absent most of the day, which favored a very low waste generation. On average, the community generates, *per capita* per day, 0.49 kg of solid waste, packed in plastic bags.

On the other hand, in Furnas do Dionísio some families had a very high average generation *per capita* (a family of 02 people produced 2.5 $kg.day^{-1}$) related to the community average (0.63 $kg.inhab^{-1}.day^{-1}$); this could be because on the day of the analysis some people added waste from their backyards. Since some families with 03 and 04 people had an average of 0.07

Revista AIDIS de Ingeniería y Ciencias Ambientales:
Investigación, desarrollo y práctica. ISSN 0718-378X
Vol. 11, No.3, 376–388
6 de diciembre de 2018

kg/person, and some with 02 and 03 people had an average above 0.33 kg/person, it can be concluded that the community's average is inaccurate because the discrepancy suggests that the additional amount of waste was not generated in a single day, besides the fact that families with lower averages forgot the date set for the collection and collected what they had at the time. Mihai *et al.* (2014) stated that average waste generation in rural areas is around 0.4 $kg.inhab^{-1}.day^{-1}$. Therefore, this assumption can be used in cases where on-site data cannot be collected, such as in Furnas do Dionísio. Perhaps a broader explanation could help the residents to understand the importance of this type of analysis and participate in the future in order to improve data quality.

The result of the gravimetric analysis is shown in Fig. 4, revealing the physical waste composition in Furnas do Dionísio. Since some of the families raise pigs and chickens, they use their food scraps to feed them, while others have farming as a livelihood and also reuse food waste in their plantations. This significantly altered the composition as there was a lack of food waste in the samples, therefore paper coming from toilet use was the only organic matter analyzed for the organic fraction.

This assumption is also made in other rural community gravimetric studies, as this type of destination is common for organic waste in this type of community. Thus, for purposes of this study, an estimate of the generated organic fraction was made through the description by Pereira Neto (1996) that defines values for generated organic residues in rural communities around 0.050 $kg.inhab^{-1}.day^{-1}$. Therefore, the daily production of organic waste *per capita* in Furnas do Dionísio would be somewhere around 0.95 kg and about 66% of the total generated waste. This is an amount that approaches the organic load generated in other rural communities, such as in Thailand, where more than 70% of organic matter was generated (Hiramatsu et al., 2009). The comparison between the obtained composition and what was estimated can be observed in Fig. 4.

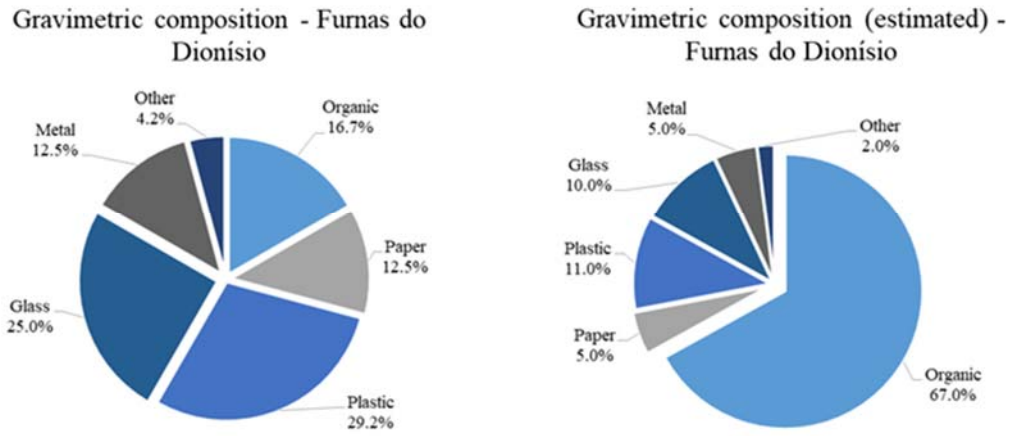

Fig. 4. Comparison between the gravimetry obtained in the Furnas do Dionísio community and its estimate.

Revista AIDIS de Ingeniería y Ciencias Ambientales:
Investigación, desarrollo y práctica. ISSN 0718-378X
Vol. 11, No.3, 376–388
6 de diciembre de 2018

Iranian rural areas generate 42.49% organic matter, 8.77% paper and cardboard, 8.24% plastics, 6.08% metal, 5.89% glass, 5.1% rubber and leather, 4.83% textile and 18.6% non-recyclables (Abduli *et al.*, 2008), which is somehow similar to the results found in this community.

Alternatives Proposed

From the characterization of the waste generated in these communities, it was possible to evaluate which alternatives are best suited to their current conditions for sustainable management.

Furnas do Dionísio

In Furnas do Dionísio, waste packaging is done in plastic bags, a common habit in the whole country. For its destination, four alternatives are suggested: composting, city collection, source separation to sell materials and material reuse to make crafts. In a study by Abduli *et al.* (2008) composting, source separation and improvement of existing collection services were also proposed.

1. Composting: since most of the population works in agriculture, home composting is strongly advised, where the generated compost could be used in their own plantations or even as a secondary source of income through the sale of the compost itself. This can be achieved by using piles or adding it directly to crops when it is a small scale operation. However, it is known that the proportion of the population who uses their organic waste for animal feed have no interest in changing their habits, which makes this alternative hard to implement.
2. Collection by the city through PEV: the locals who helped the crew to collect the waste for the gravimetry analysis were willing to collect the waste from the whole community, door to door, with a tractor, up to twice a week and concentrate it into a central point for the later collection from the city of Jaraguari. However, this is an alternative that should be discussed between the town and the community, since, despite the interest of the Mayor in making this collection, Jaraguari also faces problems with their waste disposal and transport it to Bandeirantes, to a landfill site;
3. Source separation to sell materials for recycling: source separation should also be encouraged in the community, emphasizing the economic value of the different recyclables. However, this alternative is rather weak, since the community is isolated from the buyers' routes (when a buyer passes buy, he hardly travels throughout the community, and passes by sporadically);
4. Reuse of materials: this is an alternative strongly recommended, since many reusable materials are disposed indiscriminately on the land. In addition to reducing the risks exacerbated by the provision on the ground, this is an alternative for the local economy, such as crafts, which can even be sold in neighboring cities and may acquire enough expressiveness that recycling (waste pickers) cooperatives could be assembled.

Revista AIDIS de Ingeniería y Ciencias Ambientales:
Investigación, desarrollo y práctica. ISSN 0718-378X
Vol. 11, No.3, 376–388
6 de diciembre de 2018

Tia Eva

In the Tia Eva community, because they already have the city's waste collection, the only remaining alternative would be to encourage waste separation for recycling. This practice could help the community's residents who draw their source of income from it, and also contribute to the reduction of waste in Campo Grande's sanitary landfill. Because more than half of the residents have shown readiness to take their waste to a PEV and consequently separate their recyclable waste, it is noticed that what they lack is environmental education and awareness, the knowledge of how to perform this and what exactly to separate for this purpose.

Conclusions

The Tia Eva community presented a gravimetric composition of 66% organic matter and 17% plastics and paper which are equivalent to the city's composition in which it is inserted. In Furnas do Dionísio, almost 90% of plastics and paper are burned in the ground and 100% of food waste is destined to domestic animals and used as fertilizer.

In Furnas do Dionísio the advisable alternatives are composting, collection held by the city of Jaraguari (in PEVs as it would be difficult to collect door to door due to the bad road conditions of the community and its big area), source separation, recycling and reuse of generated waste. Meanwhile in the Tia Eva community, solid waste source separation should be encouraged.

The studied communities present similar water, sewage, solid waste and household conditions to communities in the same urbanization context, which suggests that they are all limited by the conditions that are imposed, not by their cultural practices. Furthermore, these communities should be included into their muncipalities' water, wastewater and solid waste management plans, taking into account the information obtained in this study and in other studies regarding current living conditions and necessities.

Even though the analysis and proposal of sustainable alternatives for solid waste management in the communities was performed, it is known that it is very difficult to make changes to the habits of a community. This suggests the need for very strong environmental education in order to emphasize the importance of implementing what was proposed. One of the ways to accomplish environmental education is by distributing explanatory folders that address sustainable alternatives and changes that can be made in waste management for the prevention of potential risks (what and how to items, highlighting the principal risks and most urgent changes that can be made to avoid them).

References

Alam P, Ahmade K (2013) Impact of Solid Waste on Health and the Environment. *International Journal of Sustainable Development*, **2**, 165–168.

Revista AIDIS de Ingeniería y Ciencias Ambientales:
Investigación, desarrollo y práctica. ISSN 0718-378X

Vol. 11, No.3, 376–388
6 de diciembre de 2018

Anderson, D.R., Sweeney, D.J., Willians, T.A. (2013) Estatística Aplicada à Economia e Administração, 3rd. Pioneira Thomson Learning, São Paulo, SP, Brasil.

Brasil (2010) Lei 12.305/2010. Institui a Política Nacional de Resíduos Sólidos. Brasília, DF, Brasil.

Brasil. Secretaria de Políticas de Promoção da Igualdade Racial (2013) Programa Brasil Quilombola: Relatório De Gestão 2012. Brasília, DF, Brasil.

Ferreira, J.A., Anjos, L.A. (2001) Aspectos de saúde coletiva e ocupacional associados à gestão dos resíduos sólidos municipais. *Caderno de Saúde Pública*, **17**(3), 689–696. doi: 10.1590/S0102-311X2001000300023

Guerrero, L.A., Maas, G., Hogland, W. (2013) Solid waste management challenges for cities in developing countries. Waste Management, **33**(1), 220–232. doi: 10.1016/j.wasman.2012.09.008

Henry, R.K., Yongsheng, Z., Jun, D. (2006) Municipal solid waste management challenges in developing countries - Kenyan case study. *Waste Management*, **26**(1), 92–100. doi: 10.1016/j.wasman.2005.03.007

Hiramatsu, A., Hara, Y., Sekiyama, M., Honda, R. (2009) Municipal solid waste flow and waste generation characteristics in an urban – rural fringe area in Thailand. *Waste Management & Research*, **27**(10), 951-960. doi: 10.1177/0734242X09103819

INCRA, Instituto Nacional de Colonização e Reforma Agrária (2012) Coordenação Geral de Regularização de Territórios Quilombolas. Accessed 12 May 2013. Available in: http://incra.gov.br/index.php/estrutura-fundiaria/quilombolas

Lima, P. de M., Paulo, P.L. (2018) Solid-waste management in the rural area of BRAZIL: a case study in Quilombola communities. *Journal of Material Cycles and Waste Management*, **20**, 1583–1593. doi: 10.1007/s10163-018-0722-9

Magalhães Filho, F.J.C., Paulo, P.L. (2017) Water supply, sanitation and health aspects in Quilombola communities in the State of Mato Grosso do Sul. Interações, **18**, 103. doi: 10.20435/inter.v18i2.1435

Mihai, F.-C., Oişte, A.-M., Chelaru, D.-A. (2014) Rural Waste Generation: a Geographical Survey At Local Scale. 14th Int Multidiscip Sci GeoConference SGEM 2014, **1**, 585-592. doi: 10.5593/SGEM2014/B51/S20.080

Munanga, K. (1995/1996) Origem e histórico do quilmbo na África. Revista USP, dez./fev.(28), 56–63. doi: https://doi.org/10.11606/issn.2316-9036.v0i28p56-63

Palmares, F.C. (2018) Comunidades Remanescentes de Quilombos (CRQs). Accessed 15 Sep 2018. Available in: http://www.palmares.gov.br/?page_id=37551

Pereira Neto, J.T. (1996) Manual de Compostagem, processo de baixo custo. UNICEF, Belo Horizonte, MG, Brasil.

Prefeitura Municipal de Campo Grande (2012) Plano Municipal de Saneamento Básico - gestão integrada de resíduos sólidos. Campo Grande, MS, Brasil.

Rezende, J.H., Carboni, M., Murgel, M.A. de T., Capps, A.L. de A.P., Teixeira, H.L., Simões, G.T.C., Russi, R.R., Lourenço, B.L.R. (2013) Composição gravimétrica e peso específico dos resíduos sólidos urbanos em Jaú (SP). *Engenharia Sanitária e Ambiental*, **18**, 1–8 . doi: 10.1590/S1413-41522013000100001

Santos, C.A.B.P. dos (2010) Fiéis descendentes: redes-irmandades na pós abolição entre comunidades negras rurais sul-mato-grossenses 477 f., il. Tese (Doutorado em Antropologia Social) . Universidade de Brasília, Brasília, DF, Brasil.

SEPPIR, Secretaria de Políticas de Promoção da Igualdade Racial (2016) Sistema de Monitoramento das Políticas de Promoção da Igualdade Racial. In: Painéis Monit. PBQ. Accessed 13 Jan 2016. Available in: http://monitoramento.seppir.gov.br

Talyan, V., Dahiya, R.P., Sreekrishnan, T.R. (2008) State of municipal solid waste management in Delhi, the capital of India. Waste Management, 28(7), 1276–1287. doi: 10.1016/j.wasman.2007.05.017Alam P, Ahmade K (2013) Impact of Solid Waste on Health and the Environment. *Int J Sustain Dev*, **2**, 165–168.