

STUDY OF RECYCLING OF POLYMERIC WASTE IN THE CITY OF MANAUS: PART 1 - THE CASE OF WASTE SCAVENGERS

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ABSTRACT

A intense industrialization and the discovery of new technologies have indirectly contributed to population growth worldwide, causing a swell in the number of people in urban areas. With the diversification of products and services, that results from their consumption the waste has become a serious problem that is costly and complex to manage. For example, after 1980 study of management conducted in Brazil found a shortage of waste disposal sites in urban areas, high social costs in waste management, poor public sanitation and environmental contamination. These problems persist in Brazil today. Thus, it is necessary to develop an environmental management policy for solid waste that changes the concept of waste so that more if it can be recycled and reused such a policy would involve innovation with unconventional materials where appropriate. The construction industry offers much potential for the use of recycled materials as part of its efforts to reduce the environmental impact of this sector or reduce costs. However, the process of research and development of new recycled materials must be carried out carefully to ensure the success of these products in the market. In Brazil, research on the use of alternative materials, mainly for construction is producing highly promising results, particularly for the use of polyethylene terephthalate (PET). However, recycling is not yet part of the culture in Brazil. The amount of industrial waste that is recycled is insignificant compared to the amount produced, and every day, this waste assaults the environment because a lack of appropriate handling treatment, and disposal of these wastes. This paper proposes improvements in recycling in the city of Manaus envisioned as part of the manufacturing process of alternative construction materials using polymer waste. The improvements have the potential to greatly reduce the amount of waste in the environment of Manaus and thus to greatly transform the lives of its residents, especially the impoverished slum dwellers who engage in informal recycling as a means of financial support. The first part of the study was targeted specifically at the waste scavengers and was addressed the process of collection, storage and packaging carried out by these scavengers, focusing on the identification of possible kinds of contamination.

Keywords: environment, Manaus, recycle.

1. INTRODUCTION

The utilization of industrial waste as an alternative material is not new and has been successful in several countries. There are three main grounds for the recycling of industrial waste: it prevents the depletion of raw materials; it addresses the increasing of volumes of solid waste, which endangers public health, occupies space and degrades natural resources; and it offsets the high price of oil.¹

Recycling in the construction industry has become an important practice for sustainability by reducing the environmental impact generated by the construction sector and/or reducing costs. However, research on and development of new recycled materials must be carried out cautiously and carefully to ensure the success of these products in the market.²

In Brazil, research directed to the use of alternative materials, mainly in construction, is obtaining highly relevant results.³ One focus of the research is the use of polyethylene terephthalate (PET). As an inert material, even if improperly discarded it, it does not cause any contamination of soil or groundwater. Because it is light, strong and transparent it is now used in manufacturing various products. Thus, studies using PET as an alternative material in construction have been conducted by various institutions in the country.

The Federal University of Rio de Janeiro (UFRJ), through its Institute of Macromolecules (IMA), developed a material called plastic wood, obtained from waste plastic from the city of Rio de Janeiro. This product can replace several materials, mainly natural wood, with many advantages since it can be sawed, screwed, nailed and flattened.

Another type of material that has been developed in the laboratories of the Federal Center of Technology of Paraná / PR-CEFET are blocks called ISOPET, made of lightweight concrete with polystyrene (EPS) made from recycled plastic bottles. These blocks have many advantages in construction projects because of their ease in handling, low cost, improved thermoacoustics, and above all, their ecological advantage since they use both recyclable and non-recyclable materials.⁴

In a project developed at the Building Systems Laboratory at the Federal University Santa Catarina, PET bottles were used as a substitute for brick and wood in the walls and beams of a house. In another project, discarded PET bottles, tires and rice hulls were used as filling mortar in sandwich panels for external walls of a wooden house in order to obtain better thermal performance⁵

In a study conducted in the Department of Materials Science and Metallurgy (PUC-Rio), Goulart et al⁶ replaced natural fine aggregate (sand) with various plastic flakes for the production of precast concrete slabs, mainly for floors.

The above-mentioned research development holds particular promise for Brazil, where recycling has made comparatively less of an impact than in other countries.

Solid waste constitutes a serious problem in most cities of the world, and Brazil is no exception. The management of solid waste is one of the most intractable problems facing city administrators and sanitary/environmental officials.

Refuse collection in Brazil is the responsibility of the Municipal Manager. There is a major problem in meeting the increasing overhead and operating costs of collection and disposal. Close observation of actual waste disposal practices reveals the ever presence of waste scavengers sorting through waste of various kinds (scrap, iron, plastics, etc.) from streets, dumpsites and homes.

According to Grimberg⁷, 63.6% of Brazilian municipalities deposit all of their waste in landfills, most of which attract scavengers including women and children. In some cases these scavengers live within the landfill areas themselves. This creates serious public health problems but there is no alternative employment for these people. Informal disposal of garbage into rivers and streams is another serious concern, resulting in environmental and health problems such as flooding and spread of disease.

This paper proposes improvements in recycling in the city of Manaus, Brazil envisioned as part of the manufacturing process of alternative construction materials using polymer waste. These improvements have the potential to greatly reduce the amount of waste in the environment of Manaus and thus to greatly transform the lives of its residents, especially the impoverished slum dwellers who engage in informal recycling as a means of financial support. The first part of the study was targeted specifically at the waste scavengers and was addressed the process of collection, storage and packaging carried out by these scavengers, focusing on the identification of possible kinds of contamination.

2. Methodology

The present study examined the activities of the waste scavengers in the landfill of Manaus. A questionnaire was designed and administered orally to the scavengers to obtain information about sources of waste collected, types of waste, and purpose of collecting the waste. Other information relating to the demographic and social

characteristics of the waste scavengers was also obtained. This study looked specifically at the path followed by PET waste collected by scavengers and consolidated in recycling centers, which then sell this material to LM Amazon, a company that manufactures “green” tiles that are used in construction. The company has encountered major problems in the consistency and quality of PET waste from this source. This company purchase PET waste from three sources: scavengers, middlemen and companies shows distributed in Figure1.

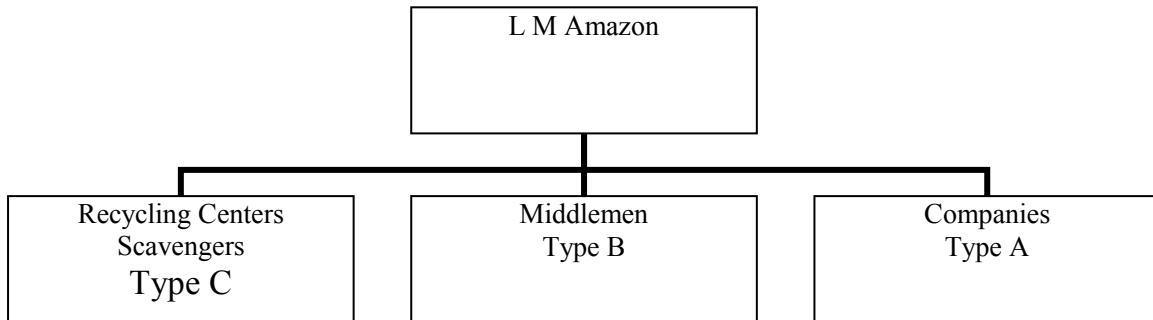


Figure 1: The suppliers of PET waste for L.M.Amazon

The PET waste from these three sources is classified according to quality: Type A from companies, Type B from middlemen and Type C from recycling centers. This company also purchases PET waste indirectly from scavengers through middlemen, but the quality control has been somewhat better in this case, and PET waste purchased directly from companies such as soft drink manufactures has not presented any quality problems.

3. Results and Discussion

Most urban centers in Brazil have recycling centers or cooperatives for recyclable materials. These recycling centers are created by autonomous scavengers or family groups which have united themselves voluntarily to seek improvements in their working conditions and economic remuneration. In addition, these recycling centers are based on values of mutual support and responsibility, democracy, equality, equity and solidarity ⁸. Most of the recycling centers which negotiate with LM Amazon, are formed by family groups. Each one of these groups consists of four members. The distribution of families at the five recycling centers in this study is shown in Table 1.

Table 1: Distribution of scavengers and price of PET waste by recycling centers in Manaus

| Recycling Centers | Scavengers | US \$ per kg* |
|-------------------|------------|---------------|
| AMMAR I | 20 | 0.35 |
| AMMAR II | 16 | 0.41 |
| AMMAR III | 20 | 0.41 |
| AMMAR IV | 20 | 0.41 |
| A R P Ambiental. | 45 | 0.35 |

*(At an exchange rate of R\$ 1.7 to 1 US \$)

Concerning Table 1, 80 percent of these recycling centers are formed by family groups. Most of these family groups consist of a single mother who was either divorced or abandoned, along with a grandmother and children. Over 60 percent of the scavengers were women, with average age of 30 years. The majority of recycling centers are headed by a woman. ⁹ The scavengers have a low level of education, with most of them having attended primary school. When all of them wanted to form a cooperative or recycling center, the government offered training to teach them how to recycle materials. The Figure 2 shows two scavengers works in the collection space of one unit of recycling.



Figure 2: Waste scavenger at backyard dumpsite, Manaus, Brazil.

The magnitude of the total waste in Manaus is estimated at 2.5-3 t per day. The scavengers collected four categories of waste – plastic, metals, paper and glass. They collect two types of plastics but PET bottles are the most important because they provide income for the family.

On average each family fills two or three bags of 10 kg per week to receive an average income of \$ 50 dollars a month. Fortunately, the collection of PET is not the only source of income of scavengers, which also includes other recycled materials such as metals, paper and glass.

The sequence followed by PET waste in its recycling and sale to Amazon to the production of tiles is shown in Figure 3.

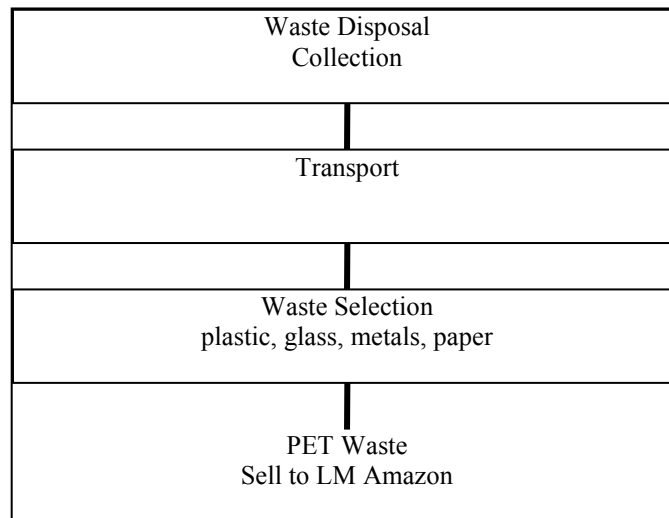


Figure 3: Path of PET waste from backyard dumpsite, Manaus, Brazil.

Waste is collected by the city without any kind of sorting; potentially recyclable material is mixed with organic and other types of waste. Then the material is transported to recycling centers where the waste is separated into plastic, metals, paper, glass and organic material which material the latter of which usually going to the municipal landfill.

In this part of the process, there are two major problems that cause contamination in the system. The first is the absence of a selective collection program by the municipal administration which would make the work of waste scavengers easier and more humane. The second is the absence of a cleanup process by which caps and labels are

removed from PET waste and the material is cleaned. This additional stage of the process would generate a material with higher value and lower the costs of cleaning that occurs within industry.

While unsorted waste collected by the city presents the above set of problems are magnified by the fact that scavengers also collect waste along the banks of streams and streets of the city, because the scavengers need to have a critical mass of material to generate enough income for their families.

In collecting the material, there is no selectivity by the scavengers, only the need to fill their bags and sell them, which results in a mix of materials and their subsequent contamination. This procedure is perhaps the most damaging to the recycling process.

In addition to the loss of quality of contaminated materials, which the use of products made with this type of material the contamination can cause a threat to the health of scavengers.

After the selection of material, it is kept for some time at the recycling centers, where for the most part there is no infrastructure for appropriate storage and packaging of the material to be sold. The only recycling center that had acceptable storage is "AMRA III", which kept the material cataloged and stored in an enclosed and covered compartment for subsequent sale to LM Amazon Company.

4. Conclusions

In this study it was observed that the paths by which municipal waste reach waste scavengers result in frequent contamination. The PET collected by scavengers from municipal trash as well as from stream banks and city streets is often contaminated, but scavengers must collect all of this material in order to achieve a critical mass so that their financial returns will be adequate to support themselves and their families.

One way to solve the problem of contamination and thus increase the value of PET that is collected would be to implement a deposit program, similar to that in the United States. This would bestow monetary value on PET bottles, making it less likely that people would throw them away. However, Brazilians are not accustomed to returning bottles to the place of purchase could but be persuaded to set these bottles out for the scavengers, knowing that they would take them away and receive some financial benefit in the process. Such a policy would reduce contamination of PET waste and thus increase the income of waste collectors while at the same time improving their working conditions.

Acknowledgements

The authors would like to thank the Universidade Federal do Amazonas(UFAM) and the Programa de Pós-Graduação da Engenharia Civil (PPGEC) for the use of the facilities. AKV thank the CNPq for her fellowship.

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