

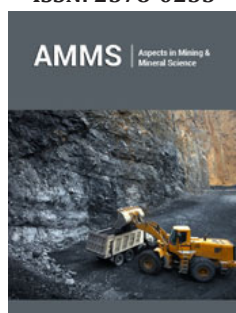
Urban Mining in Developing Countries: An Ally to Circular Economy

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Opinion

The consumption behavior of contemporary society, based on products with reduced useful life, combined with poor and inefficient waste management systems, contributes greatly to the accumulation of materials in the environment. For decades, the level of urban pollution has been alarming. Rivers, seas, oceans, and even forest environments are relentless victims of the disregard that many governments have for the environmental issue. Fortunately, this behavior is changing. With the efforts of some political leaders and the activism of organized civil society, along with the engagement of corporations, environmental health stands out on international agendas. Discussions about sustainable practices in companies and a more vibrant performance of different actors in relation to this topic have boosted improvements regarding waste production. However, this is still hardly enough. Every year, tons of polymeric material are inappropriately disposed of without any sort of treatment [1]. This amount is constituted by several types of packaging, toys, fabrics, automotive components [2], and also in the form of hybrid materials in the composition of which there is at least some polymer component. Although the disposal of polymers causes undeniable impact on the environment [3-15], they have the potential to be reused, reclaimed, and/or recycled [16]. The above processes are technically and economically feasible and can be used on different materials. Their adoption constitutes a circular economy practice by allowing a material or part of it to be reintegrated into the production cycle. As these processes are assimilated by the productive sector and disseminated, the need to use virgin raw materials of petrochemical origin is reduced, thus preserving the oil and gas reserves. For this logic to be well established there needs to be an efficient system for screening, sorting, and processing waste. In this regard, urban mining becomes essential for prospecting waste that is suitable to be returned to the production chain [17-21]. Developing countries, notorious for their large urban waste generation, can generate foreign exchange by investing in urban mining practices.

Urban mining cannot be mistaken for recycling or waste treatment techniques alone, although they are integral parts of the whole. It requires the use of an industrial process which is capable of recovering elements of an artifact that for some reason has turned into urban waste. Like the original idea of mining, which involves extracting ores for refining and obtaining high value elements, urban mining requires prospecting and concentration in stages. In this sense, not just any man-made materials can be prospected, but only those in which there is technical and environmental feasibility to do so with a financial return [22,23] and with lower waste generation than that of previously used processes. Plastics recovery, through chemical recycling (where monomers are obtained from polymeric artifacts), requires both proper logistics and knowledge about the inventory of available landfills. Zhou and co-authors (2014) evaluated the characteristics of a decommissioned landfill in China that had operated for 15 years, with an estimated overall volume of 551,000m³. Out of this amount, plastic materials accounted for 5-15%, out of which 69% were used plastic bags (11% white PE bags, 30%

colored PE bags) and 31% other plastic materials. Worldwide, it is estimated that less than 10% of the produced polymers were recycled [24-27]. In South America, the recycling rate lies below 20%, being Brazil one of the countries that has recycled polymer the least in the region [28]. In a scenario of undeniable environmental pollution, in which polymers account for a large portion of the urban waste, it is essential that waste management policies be implemented. The adoption of such policies, besides contributing to the reduction of environmental impacts, may represent business opportunities in the area of urban mining. Developing countries, such as Brazil, have the potential to disseminate such practices, reconciling the rigors of their environmental legislation with the need for generating employment and income.

Authors Contribution

Material preparation was performed by Harrison Lourenço Corrêa and Marco Gaya de Figueiredo. The first draft of the manuscript was written by Harrison. Both authors commented on previous version of the manuscript, read and approved the final version.

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