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Use of construction waste and fibers alternative technologies for soil treatment, seeking more sustainable materials for risk areas: a systematic review of the literature

Utilização de resíduos da construção civil e fibras como tecnologias alternativas de tratamento de solos, visando materiais mais sustentáveis para áreas de risco: uma revisão sistemática da literatura

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Abstract: In recent years, there has been disorderly growth in the country's main cities, and among the regions highlighted, the Northeast is the second with the highest number of inhabitants in risk areas. Disasters such as flooding and penetration of slopes have been recurrent in recent years, although these problems have a natural origin and are influenced by human activities. This is also the process of generating solid waste, affecting the acceleration of sustainable development and the safety of residents in these environments. The objective of this research is to carry out a Systematic Literature Review (RSL) to analyze the most relevant factors that are profound for penetration, as well as improving the soil by incorporating construction waste (RCC) and fibers. A search was carried out in some databases, limited to scientific articles, review articles and dissertations in the area of civil engineering in the last 6 years (2018-2023), resulting in 42 articles. From the results it was possible to analyze that the main factors that influence the penetration of slopes are human actions. Finally, the incorporation of RCC and fibers into the soil obtained impressive results, as the increase in resistance with the incorporation of these materials acted effectively and beneficially on the properties of the soil.

Keywords: Risk áreas; construction waste; fibers.

Resumo: Nos últimos anos houve um crescimento desordenado nas principais cidades do País, e dentre as regiões analisadas, o Nordeste é a segunda com o maior número de habitantes em áreas de risco. Desastres como alagamentos e deslizamentos de encostas tem sido recorrente nos últimos anos, apesar destes problemas terem origem natural sofrem influências das ações antrópicas. Isto acelera também, o processo de geração de resíduos sólidos, afetando o desenvolvimento sustentável e a segurança dos moradores nestes ambientes. O objetivo desta pesquisa é realizar uma Revisão Sistemática da Literatura (RSL) para analisar os fatores mais relevantes que contribuem para deslizamentos, como também melhoramento do solo como incorporação de resíduos da construção civil (RCC) e fibras. Foi realizada uma pesquisa em algumas bases de dados, limitando em artigos científicos, de revisão e dissertações na área de engenharia civil nos últimos 6 anos (2018-2023), resultando em 42 artigos. A partir dos resultados foi possível analisar que os principais fatores que influenciam no deslizamento de encostas são as ações antrópicas. Por fim, a incorporação de RCC e fibras ao solo, apresentaram resultados satisfatórios, pois, o aumento da resistência com a incorporação desses materiais, agiram de forma efetiva e benéfica nas propriedades do solo.

Palavras-chave: Áreas de risco; resíduo da construção; fibras.

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1. Introduction

The irregular growth of large urban centers is accelerating (Parma, 2023). Among the main regions of Brazil, the Northeast region has the second highest number of people in risk areas (CEMADEN, 2018; IBGE, 2022). One of the main causes that influence this result is the increase in the urban population, which according to the IBGE Census (2022), was estimated at 212.7 million in 2021, which represents an increase of 7.6% if compared to 2012.

As cities become urbanized, in general, there will be impacts due to disorderly population growth, causing harmful effects to physical integrity, material and property losses, loss of biodiversity, carbon emissions, water scarcity, extreme weather conditions and environmental pollution, generally threatening environmental sustainability, (CHAO *et al*., 2023; MACEDO *et al.,* 2022; RUSK *et al*., 2021; LI *et al*., 2020; PAN *et al.,*2020; JIANG *et al*.,2020; RIMAL *et al.,*2019).

According to Souza (2019) the two main factors related to the physical environment of Brazil, which facilitate mass movements in areas of risk is the occurrence of rainfall linked to the process of urbanization and deforestation. Inadequate management of soil, forest, water and increased productive activities negatively impact the ecosystem independent of the biome presented (SILVA *et al*.,2021; PEREIRA *et al*., 2020).

Disasters such as landslides and flooding have been relatively frequent in recent years in Brazil and, although these problems have a natural origin, they are influenced by anthropic actions such as: the irregular discharge of effluents, irregular cutting of slopes, deforestation and irregular disposal of solid waste that intensify the incidence and intensity of these events (SANTOS *et al*., 2020). Therefore, the growth of urbanization has been configured in a global trend, generating considerable environmental impacts (BULTI; ABEBE, 2020).

Knowledge about the characteristics of urban sprawl is useful for coordinating the relationship between urbanization and the environment in such an ecologically fragile area, which makes it urgent to carry out a detailed understanding of the expansion of urban land in space and time (TSAGKIS, BAKOGIANNIS; NIKITAS, 2023; RIMAL *et al*., 2019).

In this context, the search for alternative materials as a subsidy for use in areas of risk is the focus of this Systematic Literature Review, which aims to leverage solutions that are able to offer gains, quality, and safety to communities, in order to ensure greater stability, which is certainly one of the most important aspects of the development of a new material.

2. Theoretical Background

2.1 Land Use and Occupation

The growing population expansion causes several changes in the area, intensifying the transformation of natural spaces and environments from anthropic actions. The conformation of the use and occupation of the soil without planning generates several problems in the process of urbanization of the cities, among these, the geological risks (MIRANDA; LIMA, 2021, PEREIRA; NUNES; ARAÚJO, 2021; MACEDO; SANDRE, 2022). Urbanization is a geographic concept linked to the growth of cities and the consequent development of local infrastructure. By appropriating the territory, society promotes significant changes in the natural region, removing the original vegetation and causing soil waterproofing. Land use represents a union of human activities and organizations linked to the mode of relationship with the environment, in which the city presents various forms of concentration, and the urban soil will be disputed for numerous uses (OLIVEIRA *et al.,* 2015).

Nogueira *et al.* (2020), explains that an integrated territorial planning is necessary, through projects and research that provide sufficient information about the physical environment and its corresponding geologicalgeotechnical that allow the habitability of the site.

It is known that, in places of irregular housing as a result of population growth in large urban centers and the great intensification of industrialization, social problems and environmental impacts have been recurrent, coming from the generation of construction waste (SILVA; FUCALE; FERREIRA, 2019). According to Leite (2022), an alternative for reducing the amount of construction waste disposed in the environment is the recycling of the CW that the industry generated, reducing the disposal of this material to the environment. Figure 1, shows houses located in irregular areas in the City of Recife/Pernambuco.

Figure 1 – (a) Nova Descoberta neighborhood - Corrego da Josélia; (b) Nova Descoberta neighborhood - Alto Dr. Caeté; (c) Macaxeira neighborhood - Buriti and (d) Vasco da Gama neighborhood - Alto Nossa Senhora de Fátima. Source: The authors(2023).

Given the above, the main objective of this work is to analyze the results of the most current research that addressed areas of risk with the inclusion in the soil of construction waste and fibers, with the aim of improving the physical and mechanical properties of through a Systematic Literature Review.

2.2 Systematic Review Literature (SRL)

The Systematic Literature Review (SLR) is a research modality that seeks to give coherence to the work that will be developed from criteria in the protocol steps (PICOLLI; STECANELA, 2023; OKOLI, 2019; GALVÃO, 2019).

The review comprises published papers that offer an examination of the literature covering specific subjects (GALVÃO, 2019). Articles that present literature reviews are usually among the most sought after by readers of publications and scientific works (BAEK *et al.,* 2018).

The (SRL) technique aims to gather, analyze, critically evaluate and conduct a synthesis of the results of several studies. It allows you to know within a field of knowledge, identify, evaluate and interpret the studies according to established criteria (SILVA; CUNHA; OLIVEIRA, 2022).Okoli (2019), describes that there are eight fundamental steps required to conduct a systematic literature review, among them; identifying the research objective, planning the protocol, applying research criteria, conducting the literature search, data extraction, evaluation and quality of the criteria, synthesizing the studies, and finally writing the review.

3. Metodology

Based on the steps suggested by Okoli (2019), a protocol using the PICOC (Population, Interest, Control, Outcome, and Context) strategy was developed to define the question to be answered: What are the most relevant factors that influence landslides?

The Systematic Literature Review consists of conducting a study in a time frame between the years 2018 and 2023. Among the search terms are; risk areas, landslides, construction waste (CW), fibers and erodibility

Thus, the research was divided into four phases, which delimited the systematic method of the research: (1) Database search, (2) Meta-analysis, (3) Bibliometric Analysis and (4) Descriptive Analysis, according to figure 2.

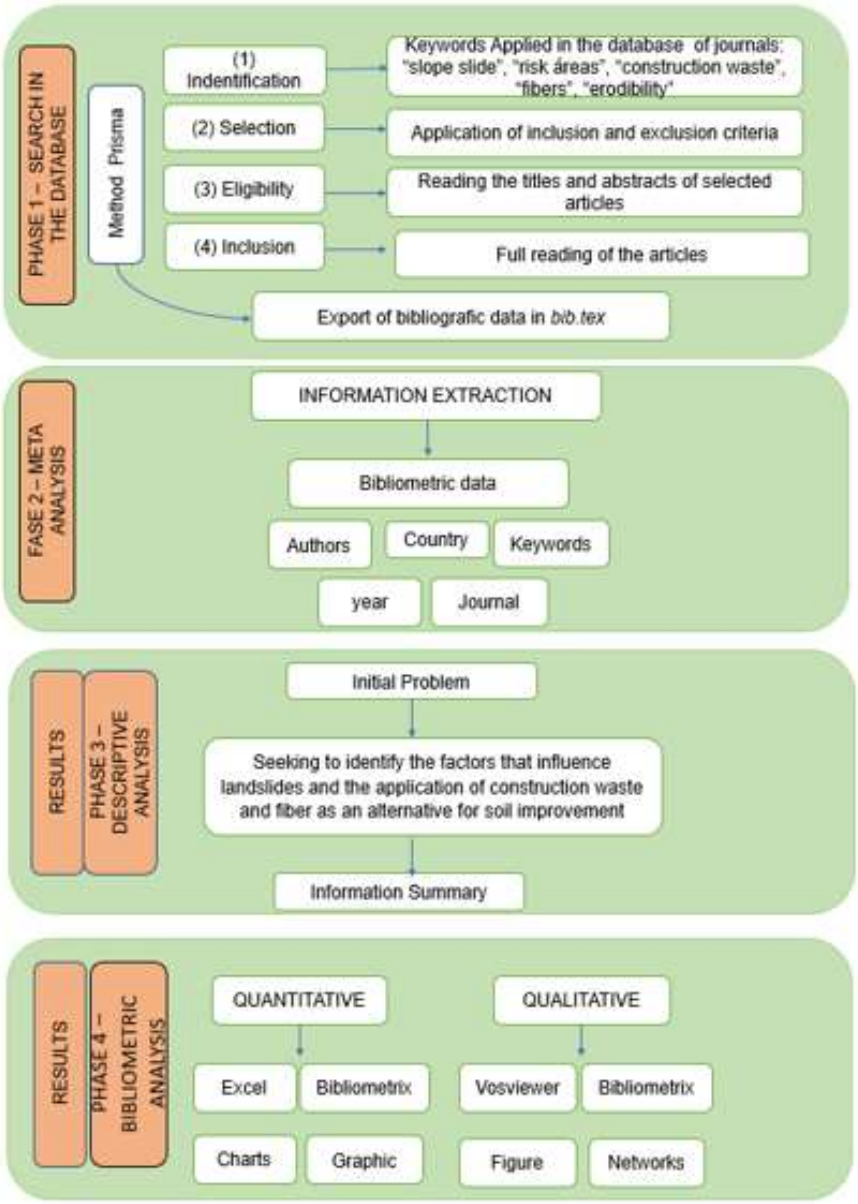

Figure 2 – Systematic flowchart of the literature research.
Source: The authors(2023).

3.1 Database Search and Meta-Analysis

The tool used was the Portal de Periódicos da CAPES (Coordination for the Improvement of Higher Education Personnel), a Brazilian virtual library in which he consults articles, books and journals, was useful for conducting research in three databases: Scopus, Science Direct, Scielo and Google Academic; Using the search strings composed of the Boolean keywords and operators (OR, AND): ("Slope slide" OR "Risk Areas") AND ("Construction Waste" OR " Fibers" OR "Erodibility").

In the development of the research, some limitations/filters were applied, such as: - Keywords found only in the title, abstract and keywords; - Publication area: Civil Engineering; - Language of articles: English, Spanish and Portuguese; -

Period of articles: 2018 to 2023 (last six years); - Types of articles: Review articles, research articles, books and dissertations.

The articles were selected adopting the following inclusion criteria: (1) The article brings information about risk areas (2) Articles that bring information about soil improvement with the use of fibers and CW; (3) Articles with full texts; and excluded for: (1) Duplicate articles; (2) Articles that do not present abstracts; (3) Articles without methodology and well detailed results; (4) Articles that are not related to risk areas.

Then, the titles were selected, including the following items: year of publication of the study, keywords; country of origin of the authors; type of article; publication journal; words present in the title and abstract selection of articles for descriptive and bibliometric analysis.

4. Results and Discussion

4.1 Descriptive Analysis

As a result of landslides in risk areas, a descriptive analysis was carried out on soil improvement studies with construction waste and fibers, with the objective of developing the physical and mechanical properties of these materials in erodible soils susceptible to landslides.

4.2 Risk Areas

In the study conducted by Almeida (2021), it was possible to analyze through a cause and effect diagram, the main factors and indicators that favored the landslide of a slope located in the City of Recife/ PE, in the winter of 2019.

For the environmental indicator "vegetal suppression", one of the main causes was the reduction of native vegetation, the increase of exposed soil, and the reduction of soil shear strength. For the indicator "absence of sanitation system", the causes were the sewage disposal directly into the soil and the reduction in the shear strength of the soil. For the environmental indicator "types of occupation", the most relevant causes were irregular constructions and land overload. Finally, for the indicator "population density", the most important cause is the increase in urban sprawl on the site (ALMEIDA, 2021).

These processes occur due to the increase in the number of inhabitants in the urban space, emerging new forms of modifications in the environment, and, thus, there is the favoring of the intensification of the anthropization process, such as the suppression of the vegetation cover, the decharacterization of the relief and damage to the watercourses (PEREIRA; NUNES; ARAÚJO, 2021).

From 1988 to 2023, the total number of victims in the entire Brazilian territory was 4196, with an annual average of 119 victims. In February 2023, for example, there was a landslide on the North Coast of São Paulo, victimizing 50 people. Among the death data, there are four groups, according to Table 1.

Table 1 – Distribution of the number of deaths by group, between 1988 and 2023.

Group	No. of deaths	Distribution
I	< 30	23%
II	31 - 100	51%
III	101 - 300	20%
IV	> 301	6%

Source: The authors(2023).

Group I, years in which the events did not exceed 30 deaths, equivalent to 23% of the distribution; group II, which corresponds to a number of fatalities between 31 and 100, 51%; group III, which generated between 101 and 300 deaths, equivalent to 20%; and group IV, where the number of victims increased from 301, proportional to 6% of cases, corresponding to 2011 and 2022 (MACEDO; SANDRE, 2022).

Also according to Macedo and Sandre (2022), it is observed that there are some anomalous cases over the years, but among all the distribution, the year 2011 has greater prominence, because it has an extremely higher number of deaths (969) than the other years. This is due to an extreme event that hit the mountainous region of Rio de Janeiro in the summer of 2011, according to Table 2.

Affecting mainly the municipalities of Nova Friburgo (429 deaths), Teresópolis (382 deaths), and Petrópolis (74 deaths), totaling 885 deaths in this region.

Table 2 – Deaths in the mountainous region of Rio de Janeiro, caused by climatic events in 2011.

No. of deaths	Mountain Region of Rio de Janeiro
429	Nova Friburgo
382	Teresópolis
74	Petrópolis
885	Total

Source: Adapted from Macedo and Sandre (2022).

Another year that stands out is 2022, whose data are still partial, with 443 victims. However, except for these two years, the other anomalies are present in group III, between 101 and 300 deaths, occurring in 1988, 1995, 1996, 2003, 2008, 2010 and 2020. Regarding the results, the state that presents the highest number of deaths is Rio de Janeiro, with 3.8 times more than the state of São Paulo that appears in second place, Minas Gerais in third and fourth place Recife (MACEDO; SANDRE, 2022).

The state of Pernambuco has in its climatic characteristics, potentializing or even triggering factors of risk situations, whose annual isohyets reach 2,000 mm (SANTOS *et al.*, 2018). In 2022, Pernambuco had a total of 132 victims in the winter period, (Table 3), as a result of the high rainfall rates that intensified with anthropic actions in the region (MACEDO;SANDRE, 2022).

Table 3 – Deaths in Pernambuco by weather events in 2022.

No. of death	City of Pernambuco
64	Jaboatão dos Guararapes
50	Recife
7	Camaragibe
6	Olinda
1	Paulista
1	Bom Conselho
1	Limoeiro
1	Jaqueira
1	Iati

Source: Adapted from Macedo and Sandre (2022).

4.3 Soil treatment with CW and fiber

The use of recycled aggregate is an interesting alternative for use in engineering works, mitigating the environmental impacts caused by the exploration of deposits and inadequate disposal in the environment of waste generated by construction activities (DUARTE; REZENDE, 2023;SILVA; FUCALE; FERREIRA, 2019). The construction waste are generated in buildings, renovations, repairs, as well as resulting from excavations of land, whether from small to large companies or by informal generators.

Maia *et al*, (2014), states that the improvement of soils with aggregates has been increasingly framed in the technology of composite materials, being these originated from the combination of two or more different elements, whose properties are not found in the source materials, once its features are optimized.

These materials should be seen not only as a form of correct destination to waste, but also as a way to reduce the need for raw material, becoming a viable alternative for various types of works in construction (PIVETTA; VENDRUSCOLO,

2020). The recycled aggregate can achieve interesting results in several uses, such as the increase in the mechanical and physical properties of the soil (BATISTA *et al.,* 2022; SOBRAL *et al*., 2022).

Pivetta and Vendruscolo (2017) used construction waste, with the percentages of 0%, 25%, 50% and 75%. Parameters can be obtained for the combination of construction waste with compacted clay soil to compose a new material that can be used as a base for surface foundations or as landfills for road construction.

It was found that the samples with addition of 50% and 75% of CW maintained a behavior of the volumetric variation similar to the soil. From the data of shear stress and normal stress of each residue, the linear correlation coefficients gave higher than 0.98, which can be considered good, for the results obtained in the shear test (PIVETTA; VENDRUSCOLO, 2020). The addition of recycled aggregate increases the maximum dry density of the mixture and reduces the optimum moisture content. This behavior can be found in the works of Santa Rosa et al. (2022), Pivetta and Vendruscolo (2017), Santos (2020), Silva (2020) and Almeida (2021).

The incorporation of CW (Figure 3) for the improvement in the performance of material properties has been shown to be quite satisfactory. Some authors report that the addition of fibers to the residue and soil may provide changes in the characteristics of compaction, deformability, crack appearance, resistance to compression, shear strength among others (SILVEIRA, 2018; ALMEIDA, 2021). However, it is very important to know and understand its physical, chemical mechanical characteristics, especially in compressibility in clay soils (OLIVEIRA JÚNIOR *et al.,*2018).

Figure 3 – Recycled aggregates used in the research a) gravel 19mm; b) gravel 25 mm; c) coarse sand..
Source: The authors(2023).

Chen *et al*. (2021), used bamboo fiber for the improvement of the turba soil (fertilizer soil). For 10% fiber addition the result was not significant, but observed that the addition of 50% fiber, in 7 days of cure, showed 40 times more resistance to shear than the soil without reinforcement.According to results obtained by using sisal fiber as a soil improvement, the ideal content has a range of 0.4 to 0.8% for increasing compressive and shear strengths (BAI *et al*., 2019; WU *et al.,* 2020; SILVEIRA; CASAGRANDE, 2021).The kenaf fiber (*Hibiscus cannabius* L.), used by EsmaeilpourShirvaniet al. (2019) presented an alternative for improving the soil on slopes, avoiding cracking of the paving layers and increasing the shear strength of the soil by 15%.

Santos (2020), considers that the addition of construction waste and babassu coconut fibers (Figure 4) showed gains of 76, 79% from 182 kPa to 237 kPa of the simple compressive strength at 120 days, when compared to natural soil, indicating that the technique is effective and beneficial to the mechanical properties of soil.

Figura 4 – Babassu coconut fiber processing.
Source: Santos (2020).

The best materials tested were composites with S70R29.5F0.5 (70% soil + 29.5% CW + 0.5% babassu coconut fibers) and S50CW49F1 (50% soil + 49% CW + 1% babassu coconut fibers), with resistances of 1230 kPa and 1209 kPa respectively (SANTOS, 2020).

Composites made with construction waste and polyester fibers (Figure 5) showed gains in simple compressive strength, with the percentages of S69.5CW30F0.5 (69.5% soil + 30% CW and 0.5% polyester fibers) and S49CW50F1 (49% soil + 50% CW and 1% fibers) showed the values of 902.571 kPa and 743.15 kPa at 60 days (PEDROSA, 2021).

Figura 5 – Polyethylene terephthalate fiber (PTF).
Source: Pedrosa (2021).

It was observed by Almeida (2021), resistance gains in the addition of sisal fibers (Figure 6) in the soil reaching 860.15 kPa at 60 days, allowing a greater ductility to the materials, causing a greater deformation before the rupture. The deformations were in the order of 7 mm before the rupture. The ductile behavior is more desired in the processes of stabilization of slopes, for providing a greater perception about risk situations and allowing more effective actions, preventing natural disasters reach greater proportions.

Figure 6 – Sisal .
Source: Almeida (2021).

A systematic review prepared by Duarte and Rezende (2023), reinforced that the use of natural fibers is a low cost and environmentally more appropriate technique, when compared to the use of synthetic materials. In addition, by including natural fibers as enhancement or adsorption, the technique follows the goals set in Agenda 2023. The most used fibers are coconut fiber, sugar cane bagasse fiber, almond, pineapple, banana fiber, jute, and corn, representing more than 40% of the total fibers.

4.4 Bibliometric Analysis

A systematic review of the literature was carried out, analyzing the articles from 2018 to 2023. In the research, 159 articles were found in the mentioned databases and by Google Academic, and subsequently were subjected to filtering. The PRISMA model flowchart (Figure 7) shows the results after filtering.

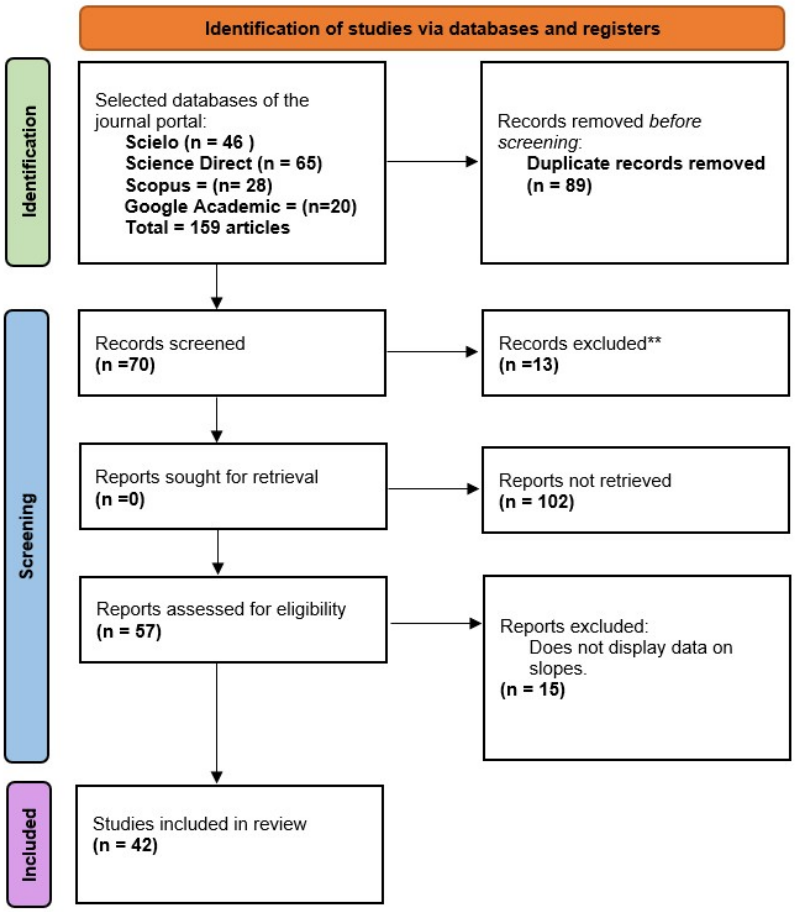

Figure 7 – Identification of studies by database and records.
Source: The authors(2023).

Figure 8 shows the number and percentage of articles found in each database of selected journals. Science Direct was responsible for 65 selected articles generating a percentage of 41%, followed by Scielo with 46 (29%), Scopus with 28 articles (18%) and Google Academic with 20 articles equivalent A12.57% approximately.

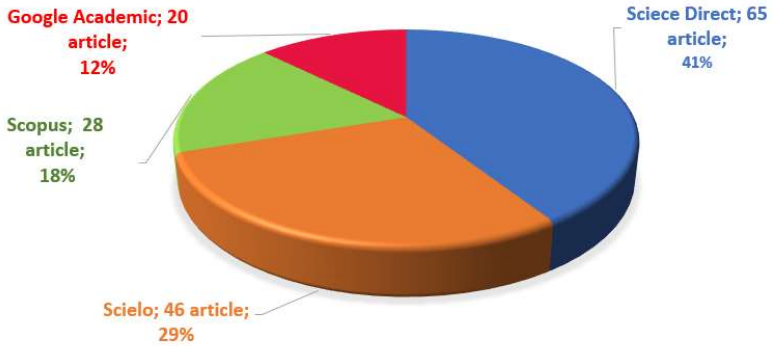

Figura 8 – Articles selected through the databases.
Source: The authors(2023).

From the analysis of inclusion and exclusion criteria, reading of the textual abstract, keywords, it was seen that only 42 articles were in agreement with the objective of the research. This number corresponds to approximately 26.41% of the articles that were selected.

Figure 9 shows the result of the number of articles by countries that published more on the topic of areas of risk and soil improvement with CW and fibers. Brazil stands out with 33 publications, followed by China with 3 articles and the United Kingdom, South Korea, Ethiopia, Iran and Japan with 1 article. It is noteworthy that most of the articles found in Brazil are within the thematic risk areas, while the articles found in other countries are within the theme of soil improvement.

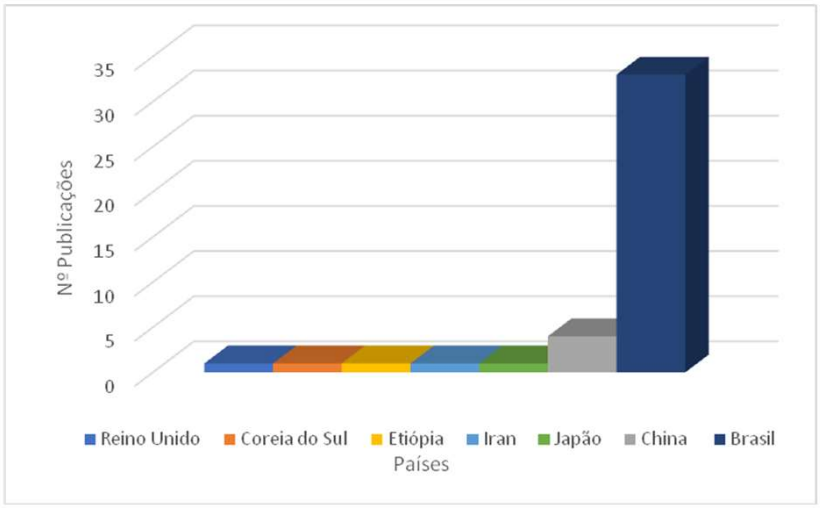

Figure 9 – Number of publications of articles found by countries.
Source: The authors(2023).

In the period from 2018 to 2023, the year that presented the most prominence was in 2019 with 12 articles followed by the years 2020 and 2021 with 10 articles, 2022 with 7 articles and 2018 with 3 articles, as shown in fig 10.

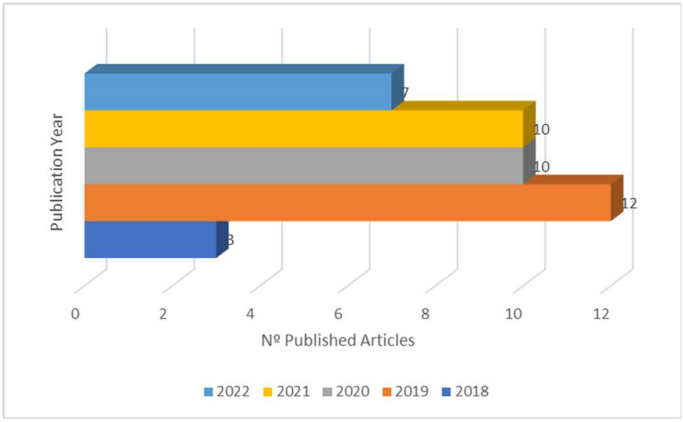

Figure 9 – Number of articles x Year of publication.
Source: The authors(2023).

As the keywords used were *"landslide", "polyethylene terephthalates", "mechanical properties", "compressive strenght", "wastedisposal", "permeability", "polymer", "riskpercetion", "urban área" e "construction and demolition"*, according to Figure 11.

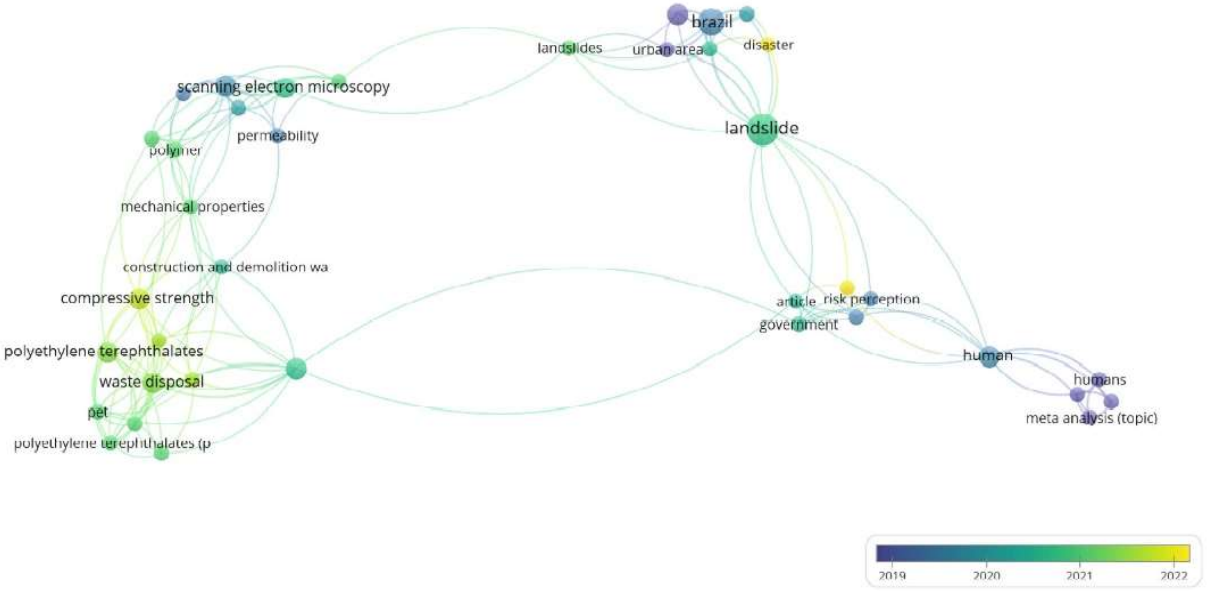

Figure 10 – Word cloud - frequency of publication by journal.
Source: The authors(2023).

It was also generated a cloud of words (Figure 12) with the names of the journals that appeared more frequently, among them, the journal "Revista Brasileira de Geografia Física" appeared in greater font size, indicating that it is the journal that most published articles related to the objective of this SRL.

Figure 11 – Word cloud - frequency of publication by journal.
Source: The authors(2023).

Among the selected articles, the works that provided the most support for the methodologies employed in this systematic review were gathered, as shown in Table 4. 21 articles were listed and, among them, ten addressed the use of CW and fibers for

the study of soil improvement, and the remaining 11 articles analyzed the processes of land use and occupation as well as the influence of disorderly occupation in risk areas resulting in landslides.

Table 1 – Analysis of articles presented in the systematic review and methodologies adopted in the research.

Reference	Research Methodologies	Journal
Santa Rosa *et al.* (2022)	Studied the influence of construction waste in the production of ecological bricks.	ResíduosSólidos: Gestão e gerenciamento. 1ªed. Recife: EDUFRPE e Gampe/UFRPE, 2022.
Zhou *et al.* (2018)	Analyzed the physical and mechanical behavior of soil with the addition of brick waste and concrete.	Coatings
Wu *et al.* (2020)	It analyzed the behavior of sandy soil with the incorporation of sisal fiber.	Envrinmental and Engineering Geoscience
Chen *et al.* (2021)	It analyzed the behavior of soil with the addition of cement residue.	International Journal of Geomate
Santos (2020)	Studied the consequences of landslides and the social and environmental impacts.	Diversitas Journal
Nascimento *et al.* (2020)	Analyzed the influence of urbanization and environmental degradation associated with landslides.	Ciência E Natura
Batista et al. (2022)	Analyzed the geomechanical behavior of a soil reforçado com construction waste and polyethylene fibers.	Resíduos Sólidos: Gestão e gerenciamento. 1ªed. Recife:EDUFRPE e Gampe/UFRPE
Almeida (2021)	Analyzed the main factors that influence the landslide of slopes, through a diagram of cause and effect and temporal analysis.	European Academic Research
Pereira, Nunes e Araújo (2021)	Analysis of land use and occupation in the city of Caxias/Maranhão/Brazil	Revista Brasileira de Geografia Física
Santos *et al.* (2018)	Analyzed the effects related to mass movements and erosion occurred in the Northeast of Brazil.	Caderno de Geografia
Silva, Fucale e Ferreira (2019)	Studied the effect of construction waste addition on soil properties.	Revista Matéria
Bulti e Abebe (2020)	Analyzed impacts caused by urbanization in the city of Adama in Ethiopia.	SN Appl. Sci.
Carvalho *et al.* (2021)	Conducted a systematic review on construction waste management between the years 210 to 2020.	Research, Society and Development
Sobrinho *et al.* (2022)	Conducted a geoenvironmental mapping for delimitation of regulated use and occupation.	Journal of Management and Sustainability.
Zebalos*et al.* (2022)	Applied the methodology of spatio-temporal analysis the soil cover in the Municipality of Theobroma in the State of Rondônia.	Revista Brasileira de Gestão Ambiental e Sustentabilidade
Bispo *et al*.(2019)	Analyzed the process of irregular occupation of urban slopes in the city of Maceió-AL/ Brazil	Revista OKARA: Geografia em debate

Sobral *et al*.(2022)	Evaluated the erodible soil of a slope located in Itamaracá/ PE through the processing with alternative material.	Resíduos Sólidos: Gestão e gerenciamento. 1ªed. Recife:EDUFRPE e Gampe/UFRPE
Santos *et al*.(2022)	Conducted a systematic review of the literature, with articles using fibers and construction waste as improvement of erodible soils	Conjecturas
Santos, E.I *et al.* (202)	Used geotechnologies in the study of soil degradation in the Sucuru river basin, in Paraíba/ Brazil.	Ciência E Natura
Leite (2022)	Used construction waste in the addition of polyethylene in the construction of interlocked pavement.	Brazilian Journal of Development

Source: The authors(2023).

5. Final Considerations

The systematic review with bibliometric analysis proved to be an effective method to analyze and understand the main influences on landslides and study of soil improvement, as well as to guide future research.

Through the inclusion, exclusion and filtering criteria it was possible to perform a descriptive analysis of the selected articles. It was found that scientific studies have been increasing over the years, especially from the year 2019, showing that the theme is on the rise.

From the descriptive analysis, it was found that the increase of urbanization in large capitals is characterized by high demographic density and socio-environmental factors, such as income inequality. Irregular occupations in the hills of cities have become more frequent, bringing various risks to residents and generating enough changes in the characteristics of the place (ALMEIDA, 2021; BISPO; MELO; TOUJAGUEZ, 2019; PEREIRA; NUNES; ARAÚJO, 2021).

One of the main factors that influence the landslide of slopes are anthropogenic actions, such as the construction of housing in inappropriate places, the indiscriminate release of rainwater and wastewater, the reduction of plant suppression, increasing the exposed soil and decreasing the shear strength, irregular cuts in the slopes among other factors.

Among the results obtained, due to the high rainfall rates that intensified, added anthropic actions generated large impacts in the capitals, caused several deaths from landslides.

Regarding the results related to soil improvement using construction waste and fibers, it was possible to analyze that the use of these materials has been shown to be quite efficient due to the improvement in mechanical performance, however, it is very important to emphasize that this performance is only valid, knowing and understanding its physical, chemical and mechanical characteristics, especially in the compressibility of clay soils.

It is observed that the percentages of ideal fiber content and CW for soil improvement are quite diverse. Several parameters can change these percentages such as: soil type; fiber type and CW; characteristics of each fiber; amount of water used in the tests.

Finally, the addition of construction waste and fibers has shown satisfactory results, contributing to the stabilization of slopes susceptible to landslides and erosion in areas of risk. The increase of shear strength and simple compression with the incorporation of these materials, acted effectively and beneficial in the physical and mechanical properties of the soil.

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