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Systematic Literature Network Analysis of Raw Materials in the Amazon Bioeconomy

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Abstract: The growing interest in sustainable raw materials has led to a significant rise in demand for Amazonian vegetable oils, such as pracaxi (*Pentaclethra macroloba* (Willd.) Kuntze) and patauá (*Oenocarpus bataua*). This study examines the patterns of their usage in scientific publications between 2010 and 2023, emphasizing their potential in three key areas: food, cosmetics, and mineral processing. The methodology employed is the Systematic Literature Network Analysis (SLNA), which integrates Systematic Literature Review (SLR) with Bibliographic Network Analysis. We identified sixty-one scientific articles from the Scopus database, with 32 meeting the criteria for Bibliometric Analysis. Using the VOSviewer program (version 1.6.20), we performed a keyword co-occurrence analysis to create bibliometric maps. These maps provided a clear depiction of the main research areas and how they have evolved over time in relation to these oilseeds. To complement the descriptive analyses, the Bibliometrix R package (version 4.4.1) was used to extract bibliographic information. This methodology effectively identifies emerging research sectors and provides a solid foundation for future studies on the Amazon bioeconomy.

Keywords: bioeconomy; Amazon rainforest; vegetable oils; pracaxi and patauá oils; bibliometric mapping

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1. Introduction

The Amazon stands out for its abundant biological richness, housing around 25% of terrestrial biodiversity [1] and contributing approximately 16% of all soil photosynthetic productivity [2]. Furthermore, it plays a crucial role in regulating global carbon and water cycles, being recognized as one of the main biomes in mitigating the global effects of greenhouse gases and regulating the planetary climate [3]; in Brazil, it is recognized as a promising area for the decarbonization of the country's economy [4]. The region is also home to numerous traditional communities that depend on its biological resources for their subsistence and income [1]. The vital importance of the Amazon has encouraged a series of initiatives aimed at the responsible management of this biome's resources, aiming to harmonize regional development with a sustainable economic model.

In recent years, the economy in the region has shown significant growth. In 2020, the Gross Domestic Product (GDP) of the Legal Amazon reached USD 114 billion, representing 8.3% of the Brazilian total. The Legal Amazon is an administrative region of Brazil that encompasses nine Brazilian states: Acre, Amapá, Amazonas, Pará, Rondônia, Roraima, Tocantins, part of Maranhão, and part of Mato Grosso. It includes most of the Amazon Rainforest and covers a total area of approximately 5.2 million km^2, which represents about 61% of the national territory. International exports also registered a notable rise, totaling approximately USD 17 billion, which is equivalent to 11.6% of the country's total and represents 15% of the GDP of the Legal Amazon [4]. Given this prosperous scenario, bioeconomy emerges as an integrated approach to social and economic development and environmental preservation, representing a fundamental tripod of development, as illustrated in Figure 1. Its purpose is to maximize the value of Amazon forests as a public asset, attracting investment for their conservation and driving more sustainable and inclusive growth [5]. This involves not only the preservation of standing forests, but also the improvement of local communities' means of production and the inclusion of Amazonian raw materials in various industrial sectors [4].

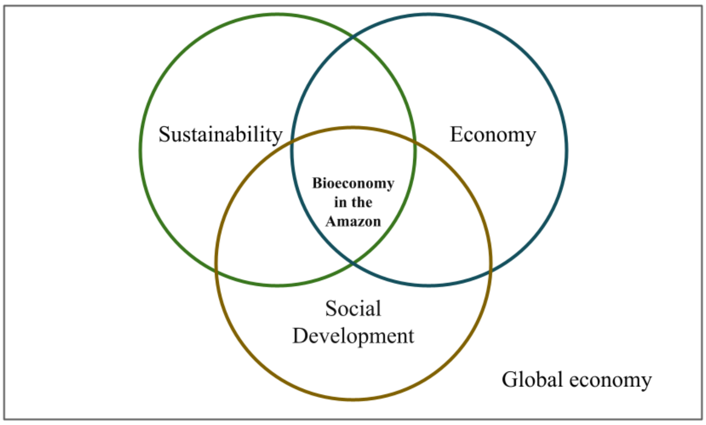

Figure 1. The interconnection between sustainability, economic growth, and social development within the framework of the bioeconomy in the Amazon, situated within the context of the global economy. Source: Elaborated by the authors.

One of the remarkable natural resources in the Amazon is vegetable oils, which offer a substantial economic opportunity for promoting sustainable development and the implementation of the bioeconomy in this area. Deepening scientific knowledge about these species is crucial to offering support to both the public and private sectors in implementing technological projects that drive the growth of the regional bioeconomy [6–8]. Species from this region also have the potential to be used in the fine chemicals industry, being able to be directly applied to cosmetic [9] and food products [10] or processed into structural derivatives used in the pharmaceutical (phytopharmaceutical) industries [11] and in the mining sector as an alternative for ore flotation [12].

Two prominent Amazonian species are the pracaxi (*Pentaclethra macroloba* (Willd.) Kuntze) and the patauá (*Oenocarpus Bataua* Mart.). Pracaxi, a tree in the *Fabaceae* family, is valued for its use in traditional medicine to treat a variety of health disorders, as well as being used in foods and cosmetics [13]. On the other hand, patauá, an oil palm tree from the *Arecaceae* family, has its fruit pulp used in the northern region of the Brazilian Amazon to produce "patauá wine", a nutritious and energetic drink [7]. The benefits of pracaxi and patauá oils have received international recognition, but research into their applications is still limited due to the scarcity of academic publications on the subject.

In this context, the dynamic literature review method called Systematic Literature Network Analysis (SLNA) stands out [14], which allows the evolutionary aspect absent in previous contributions to be taken into consideration. This method combines the Systematic Literature Review Approach and Bibliographic Network Analysis. Unlike descriptive reviews, SLNA relies on objective measurements and algorithms to perform quantitative detection of emerging topics found in the literature [15] based on bibliometric network analysis of retrieved data, such as citation networks and keywords [16].

The main purpose of this manuscript is to showcase the benefits and uses of pracaxi and patauá oils and to discuss their current applications in the industry. A Systematic Literature Network Analysis (SLNA) was carried out from 2010 to 2023 for this purpose. The investigation aimed to classify scientific contributions in a specific research field, build a comprehensive database, integrate different viewpoints, assess research progress, identify future research directions, and highlight the potential use of Amazonian oilseeds by the industry. The analysis showed a strong need for utilizing these oilseeds in three specific sectors: food, cosmetics, and mining.

2. Materials and Methods

The data used in this manuscript were collected from the Scopus database, chosen for its various advantages:

- On average, 64% of journals are exclusive to Scopus, with a range from 52% to 81% [17];
- Scopus provides broad coverage and is aligned with current literature trends [18];
- It offers the possibility of citation analysis, particularly for articles published after 1995 [19];
- The dynamic methodology known as Systematic Literature Network Analysis (SLNA) [14] is conducted in two stages: the first comprises the Systematic Literature Review (SLR), and the second involves an Analysis of Bibliographic Network. Figure 2 illustrates the flow of this methodological process.

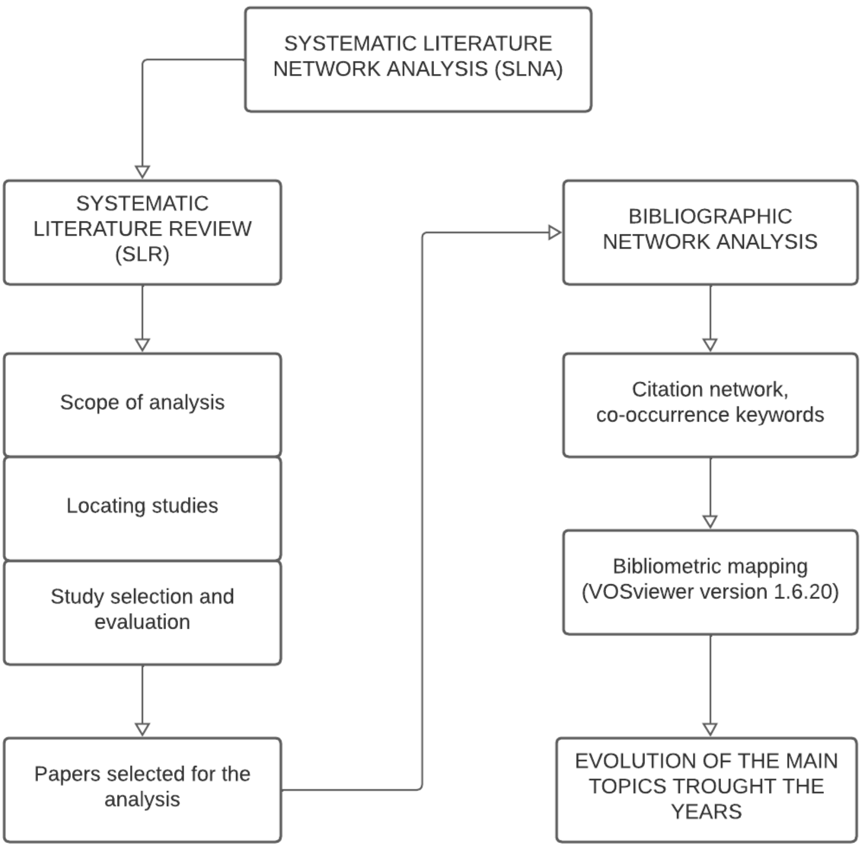

Figure 2. Systematic Literature Network Analysis (SLNA) Schema. Source: Elaborated by the authors.

2.1. Systematic Literature Review (SLR)

During the Systematic Literature Review phase, the extent of the study is defined, considering the following points: (1) scope of analysis; (2) locating studies; and (3) study selection and evaluation.

2.1.1. Scope of Analysis

Pracaxi and patauá are valuable to Amazonian communities due to their medicinal, therapeutic, and nutritional properties [20], in addition to their cultural and economic importance [13]. At a global level, there has been a significant increase in the study of these oilseeds as sustainable raw material alternatives for various industrial sectors. This research focuses on highlighting the benefits and applications of these oils, in addition to identifying their usage trends and dynamics in the industry.

2.1.2. Locating Studies

This study covers scientific articles published from 2010 to 2023 using the Scopus database. The Scopus platform is accessible through its official website at www.scopus.com. The search used the terms "pracaxi", "patauá", and "patawa" in the title, abstract, and keyword fields, concatenated by the Boolean operator "OR". The variation in the spelling of "patauá" was considered during the search. Exclusion criteria were applied, discarding other types of publications such as letters, notes, book reviews, meeting reports, and editorials. Review articles and those focused solely on the morphology or general characteristics of the fruits were also excluded, as well as documents concerning other parts of the fruit. Table 1 shows the illustrated process.

Table 1. Location of the studies.

Title 1	Title 2	Title 3
1	TITLE-ABS-KEY	"pracaxi"
2	TITLE-ABS-KEY	"patauá"
3	TITLE-ABS-KEY	"patawa"
4	TITLE-ABS-KEY	2010–2023

The data obtained were transferred to the VOSviewer software version 1.6.20, a tool used to create and visualize bibliometric maps based on network data [21].

2.1.3. Study Selection and Evaluation

The database search resulted in 61 documents, of which 32 were deemed eligible for further Bibliographic Network Analysis. The selected articles are presented in Appendix A, which contains information about the article titles and the numbers of citations and references. These documents were exported to a spreadsheet, where a manual screening of abstracts and titles was conducted. Citation information, including author(s), title, publication date, keywords, publisher, abstract, and author(s) address, was stored in a comma-separated values (CSV) file. The process of identifying, screening, and including articles is described in detail in the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart illustrated in Figure 3.

In addition to the flowchart, the PRISMA statement includes a checklist designed to assist authors in writing Systematic Literature Reviews (SLRs) and meta-analyses [22], which is available in Supplementary Materials. Developed by an international network of healthcare collaborators, the PRISMA statement aims to enhance and streamline the methodological rigor and quality of SLRs [23]. It consists of a 27-item checklist and a four-phase flow diagram, with the checklist including items deemed essential for the transparent reporting of a systematic review [24].

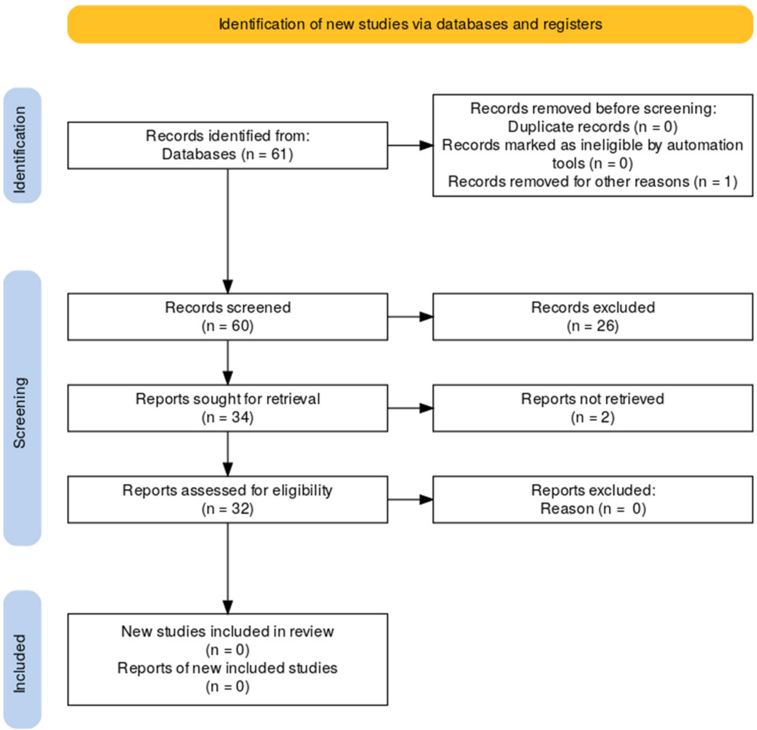

Figure 3. PRISMA flowchart illustrating the process of identifying, screening, and including articles. Source: Elaborated by the authors based on information from www.prisma-statement.org.

2.2. Bibliometrix

Bibliometrix, developed by [25], is an open-source tool designed for quantitative research in scientific and bibliometric analysis. It encompasses all major bibliometric methodologies [26] and operates within the R software environment, a free platform for statistical computing supported by the R Core Team and the R Foundation for Statistical Computing [27]. Proficiency in R is required for using Bibliometrix, as it functions as a coding terminal allowing for extensive customization. It enables the analysis of metrics such as the H-index; G-index; M-index; production over time; and the total numbers of authors, sources, and publications from the database. In this manuscript, we utilized Bibliometrix to conduct the descriptive analysis, including identifying the most relevant journals, main data information, and top manuscripts by citations.

2.3. Bibliographic Network Analysis

Bibliometric, scientometric, and webometric research methods are integral components of contemporary information metrics [28]. Bibliometric network analysis, in particular, investigates and visually represents interactions between publications by examining authorship, citations, or shared terms, often employing integrated mapping and clustering techniques [29]. Various informetric software tools, such as VOSviewer, the Bibliometrix R Package, and CiteSpace, can create clusters and maps using text and citation data [30]. VOSviewer is particularly user-friendly, offering simplicity, flexibility, and responsiveness to users, and does not require programming knowledge [27]. Due to these features, VOSviewer was selected to conduct the co-occurrence analysis, which was based on the 32 articles selected in the previous phase (Systematic Literature Review).

2.3.1. VOSviewer

VOSviewer is a software tool with an intuitive interface that allows one to create and visualize bibliometric connections, enabling users to develop terminology maps based on common terms found in publication titles and annotations [21]. VOSviewer operates by reducing the discrepancy between the strength of association and the distance between pairs of terms [31]. This approach results in the proximity of terms that frequently co-occur in the article title or abstract [32]. The effectiveness of the program's mapping and clustering strategy has been documented by Van Eck and Waltman [21], where the software places terms on a two-dimensional map with high-similarity terms located closer to each other:

$$V(x) = \sum_{i<j} S_{ij} \, ||x_i - x_j||^2 \quad (1)$$

where term i is determined by the vector $x_i = (x_{i1}, x_{i2})$ in the 2D map; n represents the number of other terms in the network; and $||x_i - x_j||$ are the Euclidean distances between terms i and j [29].

The data analyzed by VOSviewer can come from three different sources: data downloaded through the Application Programming Interface (API), data from reference manager files, and data from bibliographic database files [21]. In the context of this study, we chose to obtain bibliographic information from Scopus database files.

From these files, it is possible to analyze the relationships of co-authorship, co-occurrence, citation, bibliographic coupling, and co-citation of academic documents [29]. However, in this research, the analysis was focused especially on the co-occurrence of keywords, aiming to identify trends in the use of pracaxi and patauá oils. Furthermore, the most cited authors were highlighted and the evolution of research on these oils from 2010 to 2023 was analyzed.

2.3.2. VOSviewer Terminology

When working with VOSviewer, knowing its terminology is essential. To facilitate understanding of the terms that will be covered in this study, the Table 2 details the program's terminology.

Table 2. VOSviewer Terminology. Source: VOSviewer Manual.

Term	Definition
Items	Objects of analysis, such as publications, researchers, or terms
Link	Connection between two items
Strength	Positive numerical value indicating link intensity
Attributes	Numerical values like weight and score
Network	Collection of items linked together
Cluster	Group of items labeled by cluster numbers
Weight	Numerical value indicating item importance
Score	Numerical property of items

2.3.3. Co-Occurrence Analysis

The keyword co-occurrence network is built from a corpus of scientific literature that identifies hot research topics, analyzes the strength between the links constructed, and validates an idea or highlights a theoretical gap [33]. Hyk et al. [34] admit that keywords have the potential to effectively describe the content of an article, and, if two keywords occur simultaneously in an article, they have a semantic relationship (coword/co-occurrence) [32].

Occurrence is an attribute that indicates the number of documents in which a keyword occurs [28]. Total link strength refers to the combined strength or weight of the connections between nodes (represented by keywords) in a network visualization [30]. This strength is calculated based on the frequency and strength of links between nodes and provides an indication of the overall importance or centrality of a node within the network [34]. Nodes with higher total link strength values are generally more influential or central in the network, as they have stronger connections with other nodes [35].

Co-occurrence analysis of all keywords (including author keywords and index keywords) was performed from VOSviewer version 1.6.20 using the full count method, in which a minimum of 3 occurrences resulted in 37 keywords. This choice was made with the aim of ensuring the consistency of the clusters in terms of content and size [33]. A second selection was made to ensure that synonyms did not appear on the map using the thesaurus tool provided by the program itself, resulting in a reduction to 30 selected items.

3. Results

The authors analyzed 32 publications, of which three clusters defined, depending on the field, the distribution of the 30 keywords, namely: food (represented in red), cosmetics (represented in green), and mining (represented in blue). Although the words were arranged in three groups, it must be noted that there were intersecting relationships between them, briefly highlighted in this study.

3.1. Descriptive Analysis

Initially, the distribution and evolution of the 32 scientific articles selected over the period from 2010 to 2023 were analyzed. The Figure 4 shows that, between 2010 and 2012, only one publication was published per year, possibly due to the incipient nature of studies on the applications of pracaxi and patauá oils.

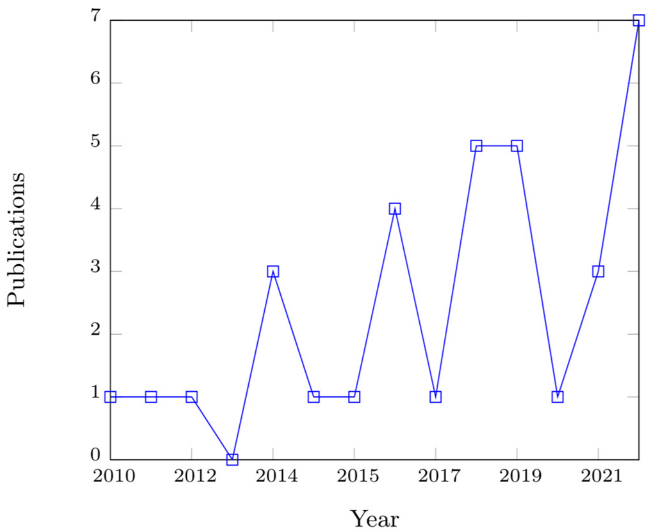

Figure 4. Documents per year. Source: Elaborated by the authors based on information from Scopus Database.

The scenario began to change from the year 2014 onwards, when the number of publications increased to three. Although the rates of publications per year have shown fluctuations over time, the years 2017, 2019, 2020, and 2023 were the ones that showed greater scientific production, with emphasis on the year 2023, when seven scientific articles were published.

The analyzed publication profile demonstrates the potential of these two species in terms of chemical composition, particularly regarding bioactive fatty acids. However, the low number of publications highlights the need for further exploration of these Amazonian oilseeds.

Table 3 lists the five most relevant journals on the applications of pracaxi and patauá oils. Food chemistry leads, with approximately 10% of the scientific articles selected for this study, followed by the Brazilian journal Ciência e Tecnologia de Alimentos and Minerals Engineering, each accounting for 6.25% of the published articles. An interesting observation is that the two most active journals on this topic are associated with fields such as food, nutrition, food safety, and processing engineering. This is due to the significantly higher volume of publications on pracaxi and patauá oils in these areas compared to other application fields.

Table 3. Most relevant journals. Source: Elaborated by the authors using Bibliometrix.

Journal	Number of Publications	Percentage of Publications
Food Chemistry	3	9.37
Ciência e Tecnologia	2	6.25
Minerals Engineering	2	6.25
Advances in Skin and Wound Care	1	3.12
Biocatalysis and Agricultural Biotechnology	1	3.12

It is also worth noting that the palms of the genus Oenocarpus produce fruits which are highly valued by Amazonian communities and can substantially contribute to daily nutrient and bioactive compound intake. For example, the patauá fruit from this palm genus is a rich source of various amino acids. It contains tryptophan and lysine in smaller amounts, making it comparable to animal meat or human milk. Additionally, it is rich in high-quality oil, highlighting its considerable potential as a food product [36]. The oil extracted from pracaxi seeds, on the other hand, is rich in phenolic compounds, contains approximately 40.8% oleic acid (omega-9), and is produced on a large scale in the Amazon [6,37].

The additional analysis conducted using Bibliometrix revealed an annual growth rate of 16.15%, an average of 22.12 citations per document, and 3.002 citations per year. The dataset included a total of 1413 references, as shown in Table 4. Furthermore, Table 5 highlights the five most productive authors, detailing their contributions to research on this topic. The impact of their publications was assessed based on both the total number of articles and fractionalized values. Notably, the most productive author focused on the application of oils in the food industry, which was the most influential sector among the three analyzed clusters.

Table 4. Main data information. Source: Elaborated by the authors using Bibliometrix.

Parameter	Value
Annual Growth Rate (%)	16.15
Average Citations per Document	22.12
Average Citations per Year per Document	3.002
Total Number of References	1413

Table 5. Most productive authors. Source: Elaborated by the authors using Bibliometrix.

Authors	Articles	Fractionalized Articles
DA SILVA LHM	3	0.783
OLIVEIRA PD	3	0.700
RODRIGUES AMC	3	0.750
RODRIGUES DA SILVA G	3	0.583
BEZERRA CV	2	0.500

Figure 5 presents the top-ranked manuscripts based on total citations. This chart visually highlights the most cited research papers within the dataset, emphasizing their impact and significance in the field. By ranking these manuscripts according to citation counts, the chart offers insights into their influence and prominence in the literature.

Additionally, it includes the publication year and the journal for each manuscript, providing a comprehensive context for understanding their subject matter.

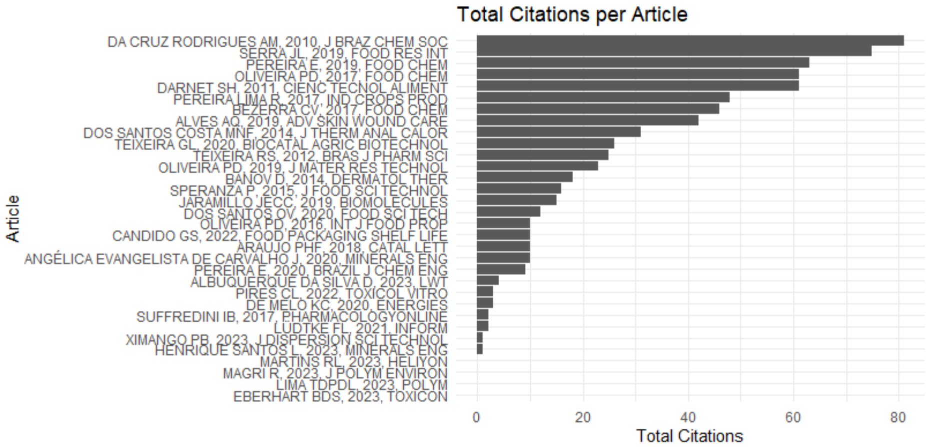

Figure 5. Top manuscripts per citations. Source: Elaborated by the authors using Bibliometrix [6,10–12,20,37–63].

3.2. Network Visualization

The visualization of the bibliometric network in the Figure 6 provides a visual representation of the arrangement of groups of analyzed keywords, allowing for the identification of three distinct application areas or clusters: food (in red), cosmetics (in green), and mining (in blue). Details about the clusters, keywords, and their occurrence numbers and total link strength are presented in the Table 6. These last two concepts (occurrence and total connection strength) are used, respectively, to evaluate the importance and centrality of nodes in this network [64].

In summary, occurrence indicates the number of documents that include a specific keyword, while total link strength reflects the importance or centrality of a node in the network. This is calculated based on the frequency and strength of connections between nodes [21]. Nodes with greater total link strength are generally more influential or central in the network due to their stronger connections with other nodes [32]. Based on this, the term "fatty acid" stands out as the largest node, showing significant intersection among the clusters and greater relevance in the analysis. This is due to the multifunctional properties of the bioactive fatty acids present in these Amazonian oilseeds [65].

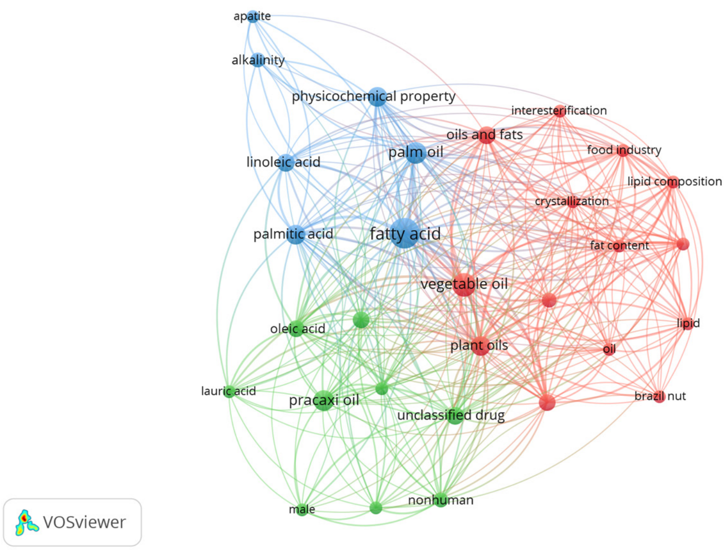

Figure 6. Keyword co-occurrence. Source: VOSviewer coming from literature review.

Table 6. Number of occurrences of each keyword included in the clusters. Source: VOSviewer.

	Keyword	Occurrences	Total Link Strength
Cluster 1	Vegetable oil	10	87
	Plant oils	7	78
	Oils and fats	6	54
	Triacylglycerol	5	51
	Fatty acid analysis	4	45
	Crystallization	3	41
	Fat content	3	41
	Food industry	3	41
	Lipid composition	3	41
	Melting point	3	41
	Oil	3	24
	Interesterification	3	21
	Brazil nut	3	16
Cluster 2	Pracaxi oil	9	39
	Unclassified drug	6	53
	Oleic acid	5	54
	Pentaclethra macroloba	5	24
	Nonhuman	4	30
	Behenic acid	3	31
	Lauric acid	3	27
	Controlled study	3	26
	Male	3	20
	Human	3	13
Cluster 3	Fatty acid	17	98
	Palm oil	9	62
	Palmitic acid	7	58
	Physicochemical property	7	34
	Linoleic acid	6	37
	Alkalinity	4	15
	Apatite	3	12

Overlay Visualization

Overlay visualization is a powerful tool for analyzing trends in the academic field, as it can categorize elements based on a temporal scale [21,66]. In Figure 7, the keywords in blue correspond to the year 2017, those in green represent the period from 2018 to 2019, and those in yellow indicate the year 2020. The color bar, positioned in the lower right corner, facilitates the understanding and analysis of temporal data associated with the keywords.

The evolution of research on pracaxi and patauá oils, as illustrated in this map, reveals interesting patterns in different application clusters. Cluster 1, focused on food applications, showed high activity between 2017 and 2018, with more moderate production in the subsequent years. In this cluster, the results obtained by Bezerra et al. [10] revealed that the oils and fats chosen for the study, including commercial ones, have interesting individual characteristics. When combined, they create blends with physicochemical properties suitable for various applications, especially in the vegetable fat (margarine) and confectionery (cakes and coatings) industries. Pracaxi oil stands out for its high content of monounsaturated fatty acids (MUFA), making it a natural source of behenic acid. Additionally, pracaxi oil exhibits high oxidative stability, surpassing that of many traditional oils [10].

Meanwhile, cluster 2, related to cosmetic applications, demonstrated significant activity from 2017 to 2020. We highlight Lima et al. [40], which set a precedent for new investigations with *Pentaclethra macroloba* oil in the generation of multizonal bioproducts for tissue regeneration, associated with hydrogels. This promising approach combines biomaterials, hydrogels, and Amazonian bioactives with the potential to stimulate cell migration and proliferation. The study revealed that pracaxi oil has a composition rich in oleic, linoleic, and behenic acids, which are important in cellular signaling and communication for wound healing and tissue regeneration [40].

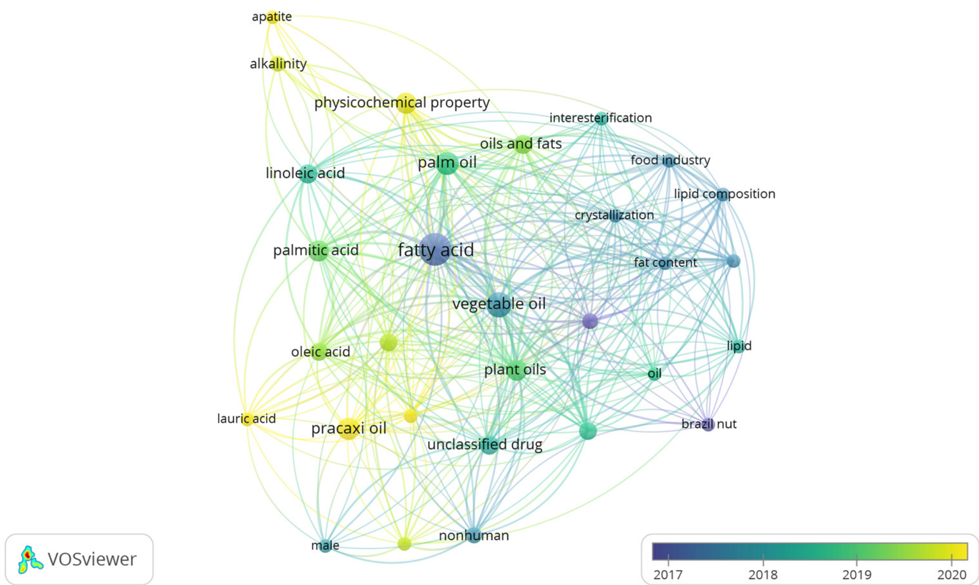

Figure 7. Keyword co-occurrences. Source: VOSviewer coming from literature review.

The evolution of research on pracaxi and patauá oils, as illustrated in this map, reveals interesting patterns in different application clusters. Cluster 1, focused on food applications, showed high activity between 2017 and 2018, with more moderate production in the subsequent years. Meanwhile, cluster 2, related to cosmetic applications, demonstrated significant activity from 2017 to 2020.

On the other hand, cluster 3, focused on mineral application, emerged in 2019. This emergence aligns with the work proposed by Oliveira et al. [12], Angelica Evangelista de Carvalho et al. [41], Martins et al. [42], and Henrique Santos et al. [43] on the flotation of ores using Amazonian oils during the same period. Among these studies, Oliveira et al. [12] investigated patauá oil in terms of its fatty acid chemical profile, saponification and iodine values, acidity index, and its potential as a source for a collector to be used in phosphate ore flotation. The results indicated that patauá oil is primarily composed of oleic acid, with smaller amounts of linoleic, palmitic, lauric, myristic, palmitoleic, stearic, and linolenic acids. In this regard, patauá oil showed great potential to be used as a source of flotation reagents, particularly as a substitute for traditional oils.

4. Discussion

4.1. Impact of Food, Cosmetic, and Mineral Industry Applications of Pracaxi and Patauá Oils

Pracaxi and patauá oils are heavily explored as emerging raw materials in the food field (cluster 1). From a chemical standpoint, pracaxi oil is notably rich in long-chain unsaturated fatty acids, particularly oleic acid, which on average constitutes 47.57% (C18:1) [44], and linoleic acid, averaging 12.08% (C18:2) [45]. Additionally, it boasts a high content of behenic acid, averaging at 17.88% (C22:0), a rarity among other vegetable oils [46], which diversifies the applications of this oilseed. According to Banov et al. [11], formulations based on anhydrous silicone containing pure pracaxi oil or combined with other active substances in clinical trials resulted in significant improvements in wound healing and scar attributes. These formulations are a potentially useful option for treating surgical, traumatic, or burn wounds, and they led to the issuance of a patent [11].

Pracaxi oil is considered an effective functional food in combating retinal diseases, as it is an excellent source of vitamin E and natural antioxidants [47]. Speranza et al. [48], demonstrated that pracaxi oil has an interesting fatty acid profile from a nutritional standpoint, showing the lowest aterogenicity and thrombogenicity indices [67]. This can help maintain cardiovascular health and reduce the risk of related diseases. The main applications of the mixtures obtained in this study, based on pracaxi oil, are in margarine, making this Amazonian oilseed a promising alternative for developing new functional foods [10,37].

Due to its remarkable stability against oxidation, Candido et al. [45] proposed a bionanocomposite containing a pracaxi oil nanoemulsion to stabilize butter samples against oxidation processes. This study examined a bionanocomposite formed by incorporating various concentrations of pracaxi oil nanoemulsion into a plasticized xylitol–pectin matrix [45]. The results indicated that the addition of the nanoemulsion increased the activation energy for water vapor permeation, reducing the permeability of the films, and also increased the number of active sites on the surface, enhancing water adsorption. Thus, this approach shows promise for extending the shelf life of table butter [45].

Patauá oil, in turn, has a high content of oleic acid (C18:1), constituting around 74.5% of its chemical composition, a value similar to that found in olive oil [47]. Due to this similarity, patauá oil can be used in cooking as a substitute for olive oil [49,68]. Studies show that including this oil in the diet can contribute to the prevention of coronary diseases and the reduction in platelet aggregation [50]. In the industrial context, patauá oil is an alternative for the production of structured oils with desirable physicochemical properties for the food industry [48]. Oliveira et al. [51] presented an alternative to partial hydrogenation, suggesting a balanced mixture of 50% patauá oil and 50% palm stearin, which demonstrated an adequate melting point and favorable atherogenic and thrombogenic indices.

In the cosmetic field (cluster 2), pracaxi is the most explored plant material, a finding supported by numerous studies. Pracaxi oil is widely used by both national and international cosmetic industries in oil blends (including coconut, olive, andiroba, argan, and acai oils). It is also a common ingredient in soaps, moisturizers, exfoliants, skin cleansers, conditioners, and shampoos [52]. Banov et al. [11] evaluated the usefulness of the fatty acids found in pracaxi oil in an anhydrous silicone-based topical compound for wound and scar therapy. The application of this compound, containing pracaxi oil alone or in combination with other active substances, has resulted in considerable improvements in wound healing and scar attributes. This makes it a potentially useful option for the treatment of surgical, traumatic, or burn wounds, as well as scars.

Investigations into applications in the mineral sector (cluster 3) began in 2019, making it the most recent field of application compared to other clusters. Patauá oil is the most studied vegetable material in this context. Currently, there is a growing demand for environmentally sustainable strategies that replace traditional inputs with sustainable products, such as vegetable oils. In this context, patauá oil has been studied as a promising alternative collector in apatite flotation [12]. An analysis conducted by Henrique Santos et al. [43] supports this application: the relationship between the physical–chemical characteristics of patauá oil and its effectiveness as a collector of apatite, calcite, and dolomite is superior to that of sodium oleate and sodium palmitate, which are traditional inputs.

4.2. Sustainability of the Application of Pracaxi and Patauá Oils in Highlighted Research Fields

The concept of "sustainability" emerged in the 1970s to express concerns about global environmental effects [69]. Since then, it has driven the development of several industrial strategies to align procedures and products with this principle, replacing conventional inputs with emerging and sustainable alternatives such as raw materials from the Amazon, highlighting the pracaxi and patauá oilseeds.

In the mining sector, for example, a study examined the use of patauá oil as a collector in the flotation of phosphate ore, highlighting its potential as an effective and environmentally friendly collector [12]. Another study, conducted by Speranza et al. [48], proposed replacing traditional oil extraction methods with hydraulic presses, using supercritical CO_2 for a more efficient and ecological extraction of Amazonian oils. This finding is significant as it can be applied not only in the aforementioned industrial sectors, but can also promote sustainability in several other sectors.

The materials engineering sector is actively seeking sustainable inputs. Magri et al. [53] conducted research on converting patauá oil into sustainable polymers. Their focus was on the epoxy/dianhydride crosslinking process using various proportions. The aim was to create materials with enhanced mechanical properties. Consequently, the researchers successfully generated thermoset polymers from this oil, showing promise for use in electronic devices and insulation applications.

4.3. The Potential of the Bioeconomy: Global and Regional Analysis

The bioeconomy is an innovative approach rooted in sustainable practices, converting renewable biological resources into a wide array of products [70]. This strategy must adapt to the biocapacity of ecosystems, evolving through economic activities that preserve delicate ecological balances crucial for environmental health [5]. This economic model is gaining global importance at an accelerating pace. In 2022, the World Bioeconomy Forum assessed the bioeconomy's total value at approximately USD 4 trillion. A study by the Henderson Institute of the Boston Consulting Group (BHI) suggests this value could soar to USD 30 394 trillion by 2050. Brazil, too, is poised for a promising outlook. A joint study by the Brazilian BioInnovation Association and Embrapa projected that the country's bioeconomy could yield an annual industrial revenue of USD 284 billion by 2050 [3].

In the Amazon region, the bioeconomy is experiencing significant growth. In 2015, the annual Gross Production Value (VBP) reached approximately USD 3 billion, with the state of Para emerging as a prominent leader, contributing 73% of the Legal Amazon's wage bill [4]. During the same period, the VBP of non-timber forest products, such as oilseeds, totaled around USD 256 million, accounting for 83% of the national total [4]. A report by the World Resources Institute (Brazil) and The New Climate Economy projects that the Gross Domestic Product (GDP) of the Legal Amazon could reach approximately USD 7.72 billion by 2050, leading to the creation of 833 thousand new jobs [4].

5. Conclusions

The analysis of 32 publications on pracaxi (*Pentaclethra macroloba*) and patauá (*Oenocarpus bataua*) oils, conducted between 2010 and 2023, reveals three main application clusters: food, cosmetics, and mining. From 2014 onward, there was a gradual increase in the number of publications, with peaks in activity in 2017, 2019, 2020, and 2023, the latter being the most productive year, with seven articles. The food cluster highlighted the oils' potential due to their chemical characteristics, such as the high content of unsaturated fatty acids in pracaxi oil and the elevated oleic acid content in patauá oil, making them promising for applications in margarine and other food products. In the cosmetic field, pracaxi oil proved significant in formulations for wound healing and tissue regeneration, with studies focusing on its combination with hydrogels to promote cellular migration. The mining cluster, the most recent, explored patauá oil as a sustainable alternative for reagents in phosphate flotation, demonstrating its superior effectiveness compared to traditional reagents. Data analysis also indicated an annual growth rate of 16.15% and an average of 22.12 citations per document. Publications were primarily concentrated in journals within the food and cosmetic fields. The sustainability of these oils is evident, as their use promotes ecological alternatives across various sectors. The growing importance of the global and regional bioeconomy highlights the potential of these Amazonian oils to significantly contribute to sustainable industrial practices and the economic development of the region.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su17115015/s1. PRISMA 2020 Checklist.

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. List of articles with citations and references.

Title	Cited by	Reference
Fatty acid profiles and tocopherol contents of buriti (*Mauritia flexuosa*), patawa (*Oenocarpus bataua*), tucuma (*Astrocaryum vulgare*), mari (*Poraqueiba paraensis*) and Inaja (*Maximiliana maripa*) fruits	81	[38]
Alternative sources of oils and fats from Amazonian plants: Fatty acids, methyl tocols, total carotenoids and chemical composition	75	[47]
Physical properties of Amazonian fats and oils and their blends	63	[54]
Chemical interesterification of blends with palm stearin and patawa oil	61	[51]
Nutritional composition, fatty acid and tocopherol contents of buriti (*Mauritia flexuosa*) and patawa (*Oenocarpus bataua*) fruit pulp from the amazon region	61	[20]
Murumuru (*Astrocaryum murumuru* Mart.) butter and oils of buriti (*Mauritia flexuosa* Mart.) and pracaxi (*Pentaclethra macroloba* (Willd.) Kuntze) can be used for biodiesel production: Physico-chemical properties and thermal and kinetic studies	48	[46]
Technological properties of Amazonian oils and fats and their applications in the food industry	46	[10]
The fatty acid composition of vegetable oils and their potential use in wound care	42	[37]
Characterization of *Pentaclethra macroloba* oil: Thermal stability, gas chromatography and Rancimat	31	[6]
Composition, thermal behavior and antioxidant activity of pracaxi (*Pentaclethra macroloba*) seed oil obtained by supercritical CO_2	26	[52]

Table A1. *Cont.*

Title	Cited by	Reference
Mushroom tyrosinase inhibitory activity and major fatty acid constituents of Amazonian native flora oils	25	[55]
Apatite flotation using pataua palm tree oil as collector	23	[12]
Case Series: The Effectiveness of Fatty Acids from Pracaxi Oil in a Topical Silicone Base for Scar and Wound Therapy	18	[11]
Lipase catalyzed interesterification of Amazonian pataua oil and palm stearin for preparation of specific-structured oils	16	[48]
Impact of the mode of extraction on the lipidomic profile of oils obtained from selected amazonian fruits	15	[56]
Evaluation of quality parameters and chromatographic, spectroscopic, and thermogravimetric profile of pataua oil (*Oenocarpus bataua*)	12	[57]
Bionanocomposites of pectin and pracaxi oil nanoemulsion as active packaging for butter	10	[45]
Direct and Solvent-Free Aminolysis of Triglyceride from *Oenocarpus bataua* (Patawa) Oil Catalyzed by Al_2O_3	10	[49]
Predicting Temperature-Dependent Viscosity of Amazonian Vegetable Oils and Their Mixtures from Fatty Acid Composition	10	[50]
Selective flotation of apatite from micaceous minerals using pataua palm tree oil collector	10	[41]
Deacidification of Amazonian Pracaxi (*Pentaclethra macroloba*) and Patawa (*Oenocarpus bataua*) oils: experimental and modeling of liquid–liquid extraction using alcoholic solvents	9	[58]
Physicochemical and technological properties of pracaxi oil, cupuassu fat and palm stearin blends enzymatically interesterified for food applications	4	[44]
Pracaxi oil affects xenobiotic metabolisms, cellular proliferation, and oxidative stress without cytotogenotoxic effects in HepG2/C3A cells	3	[59]
Study of the antioxidant power of the waste oil from palm oil bleaching clay	3	[60]
Physicochemical properties of andiroba (*Carapa guianensis*) and pracaxi (*Pentaclethra macroloba*) oils	2	[61]
Pracaxi impairs general activity and locomotion in male mice	2	[62]
Preparation and characterization of pataua and pracaxi Brazilian vegetable oil emulsions	1	[63]
Synergetic effects of fatty acids in Amazon oil-based collectors for phosphate flotation	1	[43]
Characterization and subchronic oral toxicity of Pentaclethra macroloba (pracaxi) oil in *Rattus norvegicus* (lin. Wistar)	0	[39]
From Pataua Oil to Sustainable Polymers: Investigation of Epoxy/Anhydride Crosslink in Different Proportions	0	[53]
Poly (ϵ-caprolactone)-Based Scaffolds with Multizonal Architecture: Synthesis, Characterization, and In Vitro Tests	0	[40]
The use of pracaxi oil collector in the selective flotation of xenotime from silicates	0	[42]

References

1. Hanusch, M. *Equilíbrio delicado para a Amazônia Legal Brasileira—Um memorando econômico*; World Bank Group: Washington, DC, USA, 2023; Volume 1, pp. 2–7. Available online: https://coilink.org/20.500.12592/q10bk3 (accessed on 13 May 2024).
2. Instituto Clima e Sociedade. A Bioeconomia Global-Levantamento Preliminar das Estratégias e Práticas do G20:Uma contribuição para a Iniciativa de Bioeconomia do G20. 2024, 1, 1021. Available online: https://climaesociedade.org/publicacoes/a-bioeconomia-global-levantamento-preliminar-das-estrategias-e-praticas-do-g20-uma-contribuicao-para-a-iniciativa-de-bioeconomia-do-g20/ (accessed on 20 May 2024).
3. Alves, A.A.; Brambilla, A.K.; Silva, E.d.C.e.; Angelkorte, G.B.; Soares, G.A.; Teixeira, L.; Lopes, M.A.; Zotin, M.Z.; Chagas, M.; Coutinho, P.; et al. Identificação das Oportunidades e o Potencial do Impacto da Bioeconomia para a Descarbonização do Brasil. *J. Environ. Res. Public Health* **2022**, *1*, 21–25. (In Portuguese)
4. Nobre, C.A.; Feltran-Barbieri, R.; De Assis Costa, F.; Haddad, E.A.; Schaeffer, R. Nova economia da Amazônia. *New Clim. Econ.* **2023**, *1*, 75–85. [CrossRef]
5. Albert, J.S.; Carnaval, A.C.; Flantua, S.G.; Lohmann, L.G.; Ribas, C.C.; Riff, D.; Carrillo, J.D.; Fan, Y.; Figueiredo, J.J.; Guayasamin, J.M.; et al. Human impacts outpace natural processes in the Amazon. *Science* **2023**, *379*, eabo5003. [CrossRef] [PubMed]
6. dos Santos Costa, M.N.F.; Muniz, M.A.P.; Negrão, C.A.B.; da Costa, C.E.F.; Lamarão, M.L.N.; Morais, L.; Silva Júnior, J.O.C.; Ribeiro Costa, R.M. Characterization of Pentaclethra macroloba oil: Thermal stability, gas chromatography and Rancimat. *J. Therm. Anal. Calorim.* **2014**, *115*, 2269–2275. [CrossRef]
7. Pesce, C. *Oleaginosas da Amazônia*; MCT/MPEG: Belém, Brazil, 2009. Available online: https://repositorio.iica.int/handle/11324/12004 (accessed on 7 March 2024).
8. Nobre Lamarão, M.L.; Ferreira, L.M.d.M.C.; Gyles Lynch, D.; Morais, L.R.B.; Silva-Júnior, J.O.C.; Ribeiro-Costa, R.M. Pentaclethra macroloba: A review of the biological, pharmacological, phytochemical, cosmetic, nutritional and biofuel potential of this Amazonian plant. *Plants* **2023**, *12*, 1330. [CrossRef]
9. Mosquera Narvaez, L.E.; Ferreira, L.M.d.M.C.; Sanches, S.; Alesa Gyles, D.; Silva-Júnior, J.O.C.; Ribeiro Costa, R.M. A Review of Potential Use of Amazonian Oils in the Synthesis of Organogels for Cosmetic Application. *Molecules* **2022**, *27*, 2733. [CrossRef]
10. Bezerra, C.V.; Rodrigues, A.M.d.C.; de Oliveira, P.D.; da Silva, D.A.; da Silva, L.H.M. Techno-logical properties of amazonian oils and fats and their applications in the food industry. *Food Chem.* **2017**, *221*, 1466–1473. [CrossRef]
11. Banov, D.; Banov, F.; Bassani, A.S. Case Series: The Effectiveness of Fatty Acids from Pracaxi Oil in a Topical Silicone Base for Scar and Wound Therapy. *Dermatol. Ther.* **2014**, *4*, 259–269. [CrossRef] [PubMed]
12. Oliveira, P.d.; Mansur, H.; Mansur, A.; Silva, G.d.; Clark Peres, A.E. Apatite flotation using pataua palm tree oil as collector. *J. Mater. Res. Technol.* **2019**, *8*, 4612–4619. [CrossRef]
13. Crespi, B.; Guerra, G.A.D. Ocorrência, coleta, processamento primário e usos do pracaxi (Pentaclethra macroloba (Willd.) Kuntze) na Ilha de Cotijuba, Belém-PA. *Rev. Bras. Agroecol.* **2013**, *8*, 176–189.
14. Colicchia, C.; Strozzi, F. Supply chain risk management: A new methodology for a systematic literature review. *Supply Chain Manag. Int. J.* **2012**, *17*, 403–418. [CrossRef]
15. Kim, S.; Colicchia, C.; Menachof, D. Ethical Sourcing: An Analysis of the Literature and Implications for Future Research. *J. Bus. Ethics* **2018**, *152*, 1033–1052. [CrossRef]
16. Colicchia, C.; Creazza, A.; Noè, C.; Strozzi, F. Information sharing in supply chains: A review of risks and opportunities using the systematic literature network analysis (SLNA). *Supply Chain Manag. Int. J.* **2019**, *24*, 5–21. [CrossRef]
17. Mongeon, P.; Paul-Hus, A. The journal coverage of Web of Science and Scopus: A comparative analysis. *Scientometrics* **2016**, *106*, 213–228. [CrossRef]
18. Canavesi, A.; Minelli, E. Servant Leadership: A Systematic Literature Review and Network Analysis. *Employ. Respons. Rights J.* **2022**, *34*, 267–289. [CrossRef]
19. Falagas, M.E.; Pitsouni, E.I.; Malietzis, G.A.; Pappas, G. Comparison of PubMed, Scopus, Web of Science, and Google Scholar: Strengths and weaknesses. *FASEB J.* **2008**, *22*, 338–342. [CrossRef] [PubMed]
20. Darnet, S.H.; Silva, L.H.M.d.; Rodrigues, A.M.d.C.; Lins, R.T. Nutritional composition, fatty acid and tocopherol contents of buriti (*Mauritia flexuosa*) and patawa (*Oenocarpus bataua*) fruit pulp from the amazon region. *Food Sci. Technol.* **2011**, *31*, 488–491. [CrossRef]
21. Van Eck, N.; Waltman, L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* **2010**, *84*, 523–538. [CrossRef]
22. Liberati, A.; Altman, D.G.; Tetzlaff, J.; Mulrow, C.; Gøtzsche, P.C.; Ioannidis, J.P.; Clarke, M.; Devereaux, P.J.; Kleijnen, J.; Moher, D. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *Ann. Intern. Med.* **2009**, *6*, e1000100.

23. Pati, D.; Lorusso, L.N. How to write a systematic review of the literature. HERD: Health. *Environ. Res. Des. J.* **2018**, *11*, 15–30.
24. Page, M.J.; McKenzie, J.E.; Bossuyt, P.M.; Boutron, I.; Hoffmann, T.C.; Mulrow, C.D.; Shamseer, L.; Tetzlaff, J.M.; Akl, E.A.; Brennan, S.E.; et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *Syst. Rev.* **2021**, *10*, 89. [CrossRef] [PubMed]
25. Aria, M.; Cuccurullo, C. bibliometrix: An R-tool for comprehensive science mapping analysis. *J. Informetr.* **2017**, *11*, 959–975. [CrossRef]
26. Oyewola, D.O.; Dada, E.G. Exploring machine learning: A scientometrics approach using bibliometrix and VOSviewer. *SN Appl. Sci.* **2022**, *4*, 143. [CrossRef]
27. Arruda, H.; Silva, E.R.; Lessa, M.; Proença Jr, D.; Bartholo, R. VOSviewer and bibliometrix. *J. Med. Libr. Assoc.* **2022**, *110*, 392. [CrossRef] [PubMed]
28. Börner, K.; Chen, C.; Boyack, K.W. Visualizing knowledge domains. *Annu. Rev. Info Sci. Technol.* **2003**, *37*, 179–255. [CrossRef]
29. Waltman, L.; van Eck, N.J.; Noyons, E.C.M. A unified approach to mapping and clustering of bibliometric networks. *J. Informetr.* **2010**, *4*, 629–635. [CrossRef]
30. Klarin, A. How to conduct a bibliometric content analysis: Guidelines and contributions of content co-occurrence or co-word literature reviews. *Int. J. Consum. Stud.* **2024**, *48*, e13031. [CrossRef]
31. van Eck, N.J.; Waltman, L.; Dekker, R.; van den Berg, J. A comparison of two techniques for bibliometric mapping: Multidimensional scaling and VOS. *J. Am. Soc. Inf. Sci. Technol.* **2010**, *61*, 2405–2416. [CrossRef]
32. Eck, N.J.v.; Waltman, L. How to normalize cooccurrence data? An analysis of some well-known similarity measures. *J. Am. Soc. Inf. Sci. Technol.* **2009**, *60*, 1635–1651. [CrossRef]
33. Caneppele, N.R.; Shigaki, H.B.; Ramos, H.R.; Ribeiro, I. A utilização do software VOSviewer em Pesquisas Científicas. *Rev. Ibero-Am. Estratégia* **2023**, *22*, e24970. [CrossRef]
34. Hyk, V.; Vysochan, O.; Vysochan, O. Sustainability Reporting Trends: A Systematic Literature Network Analysis. *Comp. Econ. Res. Cent. East. Eur.* **2023**, *26*, 7–31. [CrossRef]
35. Hosoya, R.; Ding, Z.; Kamioka, T. A Bibliographic Network Analysis of Big Data Literature. PACIS. 2017. Available online: https://web.archive.org/web/20220802072312id_/https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1259&context=pacis2017 (accessed on 10 June 2024).
36. Veronezi, C.M.; da Silva, A.C.; Freitas, I.R.; Jorge, N. *Óleos Vegetais: Propriedades Físico-Químicas, Bioativas e Antioxidantes*; Agron Food Academy: São Carlos, Brazil, 2022.
37. Alves, A.Q.; da Silva, V.A.J.; Góes, A.J.S.; Silva, M.S.; de Oliveira, G.G.; Bastos, I.V.G.A.; de Castro Neto, A.G.; Alves, A.J. The Fatty Acid Composition of Vegetable Oils and Their Potential Use in Wound Care. *Adv. Skin Wound Care* **2019**, *32*, 1–8. [CrossRef] [PubMed]
38. Rodrigues, A.M.D.C.; Darnet, S.; Silva, L.H.M.D. Fatty acid profiles and tocopherol contents of buriti (*Mauritia flexuosa*), patawa (*Oenocarpus bataua*), tucuma (*Astrocaryum vulgare*), mari (*Poraqueiba paraensis*) and inaja (*Maximiliana maripa*) fruits. *J. Braz. Chem. Soc.* **2010**, *21*, 2000–2004. [CrossRef]
39. Eberhart, B.d.S.; Komiyama, C.M.; Burbarelli, M.F.d.C.; Castilho Heiss, V.A.R.; Garcia, R.G.; Borges, R.; Felix, G.A.; Cardoso, C.A.L.; Braz, P.H.; Teodoro, C.R.; et al. Characterization and subchronic oral toxicity of *Pentaclethra macroloba* (pracaxi) oil in Rattus norvegicus (lin. Wistar). *Toxicon* **2023**, *230*, 107151. [CrossRef] [PubMed]
40. Lima, T.d.P.d.L.; Canelas, C.A.d.A.; Dutra, J.d.C.F.; Rodrigues, A.P.D.; Brígida, R.T.S.S.; Concha, V.O.C.; da Costa, F.A.M.; Passos, M.F. Poly (ε-caprolactone)-Based Scaffolds with Multizonal Architecture: Synthesis, Characterization, and In Vitro Tests. *Polymers* **2023**, *15*, 4403. [CrossRef] [PubMed]
41. Angélica Evangelista de Carvalho, J.; Roberto Gomes Brandão, P.; Bicalho Henriques, A.; Silva de Oliveira, P.; Zanoni Lopes Cançado, R.; Rodrigues da Silva, G. Selective flotation of apatite from micaceous minerals using patauá palm tree oil collector. *Miner. Eng.* **2020**, *156*, 106474. [CrossRef]
42. Martins, R.L.; Fernandes De Magalhães, L.; Santos, L.H.; Rodrigues Da Silva, G. The use of pracaxi oil collector in the selective flotation of xenotime from silicates. *Heliyon* **2023**, *9*, e15874. [CrossRef]
43. Santos, L.H.; Santos, A.M.A.; de Magalhães, L.F.; de Souza, T.F.; da Silva, G.R.; Peres, A.E.C. Synergetic effects of fatty acids in amazon oil-based collectors for phosphate flotation. *Miner. Eng.* **2023**, *191*, 107932. [CrossRef]
44. Albuquerque da Silva, D.; Manoel da Cruz Rodrigues, A.; Oliveira dos Santos, A.; Salvador-Reyes, R.; Meller da Silva, L.H. Physicochemical and technological properties of pracaxi oil, cupuassu fat and palm stearin blends enzymatically interesterified for food applications. *LWT* **2023**, *184*, 114961. [CrossRef]
45. Candido, G.S.; Natarelli, C.V.L.; Carvalho, E.E.N.; Oliveira, J.E. Bionanocomposites of pectin and pracaxi oil nanoemulsion as active packaging for butter. *Food Packag. Shelf Life* **2022**, *32*, 100862. [CrossRef]

46. Pereira Lima, R.; Souza da Luz, P.T.; Braga, M.; dos Santos Batista, P.R.; Ferreira da Costa, C.E.; Zamian, J.R.; Santos do Nascimento, L.A.; da Rocha Filho, G.N. Murumuru (*Astrocaryum murumuru* Mart.) butter and oils of buriti (*Mauritia flexuosa* Mart.) and pracaxi (*Pentaclethra macroloba* (Willd.) Kuntze) can be used for biodiesel production: Physico-chemical properties and thermal and kinetic studies. *Ind. Crops Prod.* **2017**, *97*, 536–544. [CrossRef]
47. Serra, J.L.; Rodrigues, A.M.d.C.; de Freitas, R.A.; Meirelles, A.J.d.A.; Darnet, S.H.; Silva, L.H.M.d. Alternative sources of oils and fats from Amazonian plants: Fatty acids, methyl tocols, total carotenoids and chemical composition. *Food Res. Int.* **2019**, *116*, 12–19. [CrossRef] [PubMed]
48. Speranza, P.; Ribeiro, A.P.B.; Macedo, G.A. Lipase catalyzed interesterification of Amazonian patauá oil and palm stearin for preparation of specific-structured oils. *J. Food Sci. Technol.* **2015**, *52*, 8268–8275. [CrossRef] [PubMed]
49. Araújo, P.H.F.; Barata, P.H.d.S.; Araújo, I.F.; Curti, J.M.; Amaral, R.R.; Bereau, D.; Carvalho, J.C.T.; Ferreira, I.M. Direct and Solvent-Free Aminolysis of Triglyceride from *Oenocarpus bataua* (Patawa) Oil Catalyzed by Al_2O_3. *Catal. Lett.* **2018**, *148*, 843–851. [CrossRef]
50. Oliveira, P.D.; Araujo, L.A.; Silva, L.H.M.; Rodrigues, A.M.C. Predicting Temperature-Dependent Viscosity of Amazonian Vegetable Oils and Their Mixtures from Fatty Acid Composition. *Int. J. Food Prop.* **2016**, *19*, 1972–1982. [CrossRef]
51. Oliveira, P.D.; Rodrigues, A.M.C.; Bezerra, C.V.; Silva, L.H.M. Chemical interesterification of blends with palm stearin and patawa oil. *Food Chem.* **2017**, *215*, 369–376. [CrossRef]
52. Teixeira, G.L.; Maciel, L.G.; Mazzutti, S.; Gonçalves, C.B.; Ferreira, S.R.S.; Block, J.M. Composition, thermal behavior and antioxidant activity of pracaxi (*Pentaclethra macroloba*) seed oil obtained by supercritical CO_2. *Biocatal. Agric. Biotechnol.* **2020**, *24*, 101521. [CrossRef]
53. Magri, R.; Gaglieri, C.; Alarcon, R.T.; dos Santos, G.I.; Bannach, G. From Patauá Oil to Sustain-633 able Polymers: Investigation of Epoxy/Anhydride Crosslink in Different Proportions. *J. Polym. Environ.* **2024**, *32*, 1453–1468. [CrossRef]
54. Pereira, E.; Ferreira, M.C.; Sampaio, K.A.; Grimaldi, R.; Meirelles, A.J.d.A.; Maximo, G.J. Physical properties of Amazonian fats and oils and their blends. *Food Chem.* **2019**, *278*, 208–215. [CrossRef]
55. Teixeira, R.d.S.; Rocha, P.R.; Polonini, H.C.; Brandão, M.A.F.; Chaves, M.d.G.A.M.; Raposo, N.R.B. Mushroom tyrosinase inhibitory activity and major fatty acid constituents of Amazonian native flora oils. *Braz. J. Pharm. Sci.* **2012**, *48*, 399–404. [CrossRef]
56. Cardona Jaramillo, J.E.C.; Carrillo Bautista, M.P.; Alvarez Solano, O.A.; Achenie, L.E.K.; González Barrios, A.F. Impact of the Mode of Extraction on the Lipidomic Profile of Oils Obtained from Selected Amazonian Fruits. *Biomolecules* **2019**, *9*, 329. [CrossRef] [PubMed]
57. Santos, O.V.d.; Gonçalves, B.S.; Macêdo, C.d.S.; Conceição, L.R.V.d.; Costa, C.E.F.; Mon-teiro Júnior, O.V.; Souza, A.L.G.d.; Lannes, S.C.d.S. Evaluation of quality parameters and chromatographic, spectroscopic, and thermogravimetric profile of Patauá oil (*Oenocarpus bataua*). *Food Sci. Technol.* **2019**, *40*, 76–82. [CrossRef]
58. Pereira, E.; Pereira, D.T.V.; Ferreira, M.C.; Martínez, J.; Meirelles, A.J.A.; Maximo, G.J. Deacidifi-cation of Amazonian Pracaxi (*Pentaclethra macroloba*) and Patawa (*Oenocarpus bataua*) oils: Experimental and modeling of liquid–liquid extraction using alcoholic solvents. *Braz. J. Chem. Eng.* **2020**, *37*, 783–794. [CrossRef]
59. Pires, C.L.; Zanetti, T.A.; Mantovani, M.S.; Gaivão, I.O.d.M.; Perazzo, F.F.; Rosa, P.C.P.; Maistro, E.L. Pracaxi oil affects xenobiotic metabolisms, cellular proliferation, and oxidative stress without cytotogenotoxic effects in HepG2/C3A cells. *Toxicol. Vitr.* **2022**, *83*, 105392. [CrossRef] [PubMed]
60. Cunha de Melo, K.; Silva de Oliveira, I.; Helena de Oliveira Pires, L.; Santos do Nascimento, L.A.; Roberto Zamian, J.; Narciso da Rocha Filho, G.; Fonseca Passos, M.; Santos Lopes, A.; Converti, A.; Costa, C.E.F.d. Study of the Antioxidant Power of the Waste Oil from Palm Oil Bleaching Clay. *Energies* **2020**, *13*, 804. [CrossRef]
61. Lüdtke, F.L.; Grimaldi, L.M.; Silva, T.J.; Ramponi, K.; de Godoi, R.; Silva, M.G.; Grimaldi, R.; Ribeiro, A.P.B. Physicochemical properties of Andiroba (*Carapa guianensis*) and Pracaxi (*Pentaclethra macroloba*) oils. *Green Mach.* **2021**, *32*, 30. [CrossRef]
62. Suffredini, I.B.; Frana, S.A.; Santos, Á.M.M.; Díaz, I.E.C. Pracaxi impairs general activity andlocomotion in male mice. *PhOL-PharmacologyOnLine* **2017**, *3*, 91–104.
63. Ximango, P.B.; da Rocha, E.B.D.; de Sousa, A.M.F.; Scofield, C.F.; Paredes, M.L.L.; Lima, E.R.d.A. Preparation and characterization of patauá and pracaxi Brazilian vegetable oil emulsions. *J. Dispers. Sci. Technol.* **2023**, *44*, 2452–2462. [CrossRef]
64. Khasseh, A.A.; Soheili, F.; Moghaddam, H.S.; Chelak, A.M. Intellectual structure of knowledge in iMetrics: A co-word analysis. *Inf. Process. Manag.* **2017**, *53*, 705–720. [CrossRef]
65. Dos Santos, O.V.; Langley, A.C.d.C.P.; de Lima, A.J.M.; Moraes, V.S.V.; Soares, S.D.; Teixeira-Costa, B.E. Nutraceutical potential of Amazonian oilseeds in modulating the immune system against COVID-19–A narrative review. *J. Funct. Foods* **2022**, *94*, 105123. [CrossRef]
66. Shvindina, H. Coopetition as an Emerging Trend in Research: Perspectives for Safety & Security. *Safety* **2019**, *5*, 61. [CrossRef]
67. Khalili Tilami, S.; Kouřimská, L. Assessment of the nutritional quality of plant lipids using atherogenicity and thrombogenicity indices. *Nutrients* **2022**, *14*, 3795. [CrossRef] [PubMed]

68. Montúfar, R.; Laffargue, A.; Pintaud, J.C.; Hamon, S.; Avallone, S.; Dussert, S. *Oenocarpus bataua* Mart. (Arecaceae): Rediscovering a Source of High Oleic Vegetable Oil from Amazonia. *J. Am. Oil Chem. Soc.* **2010**, *87*, 167–172. [CrossRef]
69. Şimşek, E.K.; Kara, M.; Kalıpçı, M.B.; Eren, R. Sustainability and the Food Industry: A Biblio-metric Analysis. *Sustainability* **2024**, *16*, 3070. [CrossRef]
70. Vogt, M.; Frankenreiter, I. Bioeconomy: The Innovative Twin of Sustainability. *Sustainability* **2022**, *14*, 14924. [CrossRef]

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