ReGeo
ISSN: 2177-3246

BIBLIOMETRIC ANALYSIS AND STATE-OF-THE-ART REVIEW OF CURAUÁ (ANANAS COMOSUS VAR. ERECTIFOLIUS): CHARACTERISTICS, APPLICATIONS, AND TRENDS

ANÁLISE BIBLIOMÉTRICA E ESTADO DA ARTE SOBRE O CURAUÁ (ANANAS COMOSUS VAR. ERECTIFOLIUS): CARACTERÍSTICAS, APLICAÇÕES E TENDÊNCIAS

ANÁLISIS BIBLIOMÉTRICO Y REVISIÓN DEL ESTADO DEL ARTE DEL CURAUÁ (ANANAS COMOSUS VAR. ERECTIFOLIUS): CARACTERÍSTICAS, APLICACIONES Y TENDENCIAS

10.56238/revgeov17n2-039

José Luiz Zanirato Maia[1], Francisco Xavier Nobre[2], Luiz Antonio de Oliveira[3]

ABSTRACT

The recurring need for the partial or total replacement of inputs derived from non renewable sources has strengthened efforts to promote bioeconomy and to advance sustainable technologies. This study sought to investigate, through scientific documents published in the scopus database, the number of scientific publications and citations related to factors such as countries, authors, main funding agencies, keywords, journals, and the temporal evolution of publications that included the word curauá. Based on the results obtained, it was possible to confirm that the term curauá appeared in 368 scientific documents available in the database, with 221 published between 2015 and 2025, representing approximately 60% of all publications. Brazilian leadership in the development of technologies with diverse applications derived from curauá fibers or bioactive compounds was evident, as the main funding agencies supporting this type of research are brazilian, including the National Council for Scientific and Technological Development (CNPq), the Coordination for the Improvement of Higher Education Personnel (CAPES), and the Carlos Chagas Foundation (FCC). Among the countries that published the most, Brazil stands out with 86% of all publications, followed by India (8%), Portugal (5%), France (3%), the United States (2%), Japan (2%), the Netherlands (2%), Italy (2%), and the United Kingdom (2%). Finally, the present study revealed information indicating significant advances and potential investments, especially in the Northern region of Brazil, which shows strong potential for leading the production of biofibers with diverse applications derived from Amazonian curauá.

Keywords: Natural Fibers. Scopus. Biofibers. Bioactive Compounds. Amazon.

[1] Doctoral student in Biotechnology. Universidade Federal do Amazonas (UFAM).
E-mail: jmaia_lic@uea.edu.br Lattes: 8574960760424620 Orcid https://orcid.br/0000-0001-6493-8901
[2] Dr. in Chemistry of Materials and Interfaces. Instituto Federal do Amazonas (IFAM-CMC).
E-mail: Francisco.nobre@ifam.edu.br Lattes http://lattes.cnpq.br/0241423062695352
Orcid https://orcid.org/0000-0002-0883-3651
[3] Dr. in Soil Sciences. Instituto Nacional de Pesquisas da Amazônia. E-mail: luizoli51@gmail.com
Lattes http://lattes.cnpq.br/9931395111001102 Orcid https://orcid.org/0000-0002-2008-7292

RESUMO
A recorrente necessidade em substituição parcial ou total dos insumos derivados de fontes não renováveis tem reforçado a busca pela valorização da bioeconomia e fortalecimento de tecnologias sustentáveis. Este estudo buscou investigar por meio de documentos científicos publicados na base de dados Scopus, o número de publicações científicas e citações relacionadas a fatores como países, autores, principais financiadores, palavras-chave, periódicos e evolução temporal do número de publicações onde constavam a palavra curauá. Com base nos resultados obtidos, foi possível confirmar que a palavra curauá esteve presente em 368 documentos científicos disponíveis na base de dados, sendo 221 publicadas entre 2015 e 2025, o que representa 60% das publicações. O protagonismo brasileiro no desenvolvimento de tecnológicas com diversas aplicações a partir das fibras ou bioativos do curauá ficou evidente, onde as principais financiadoras deste tipo de pesquisa são brasileiras, dentre as quais, o Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) e Fundação Carlos Chagas (FCC). Dentre os países que mais publicaram destaca-se o Brasil com 86% do total das publicações, seguido da Índia (8%), Portugal (5%), França (3%), Estados Unidos (2%), Japão (2%), Holanda (2%), Itália (2%) e Reino Unido (2%). Por fim, o presente estudo revelou informações que apontam para avanços significativos e potencial investimentos, sobretudo na região Norte do Brasil, com elevado potencial na liderança de produção de biofibras com aplicações diversas a partir do curauá amazônico.

Palavras-chave: Fibras Naturais. Curauá. Análise Bibliométrica. Scopus. Biofibras. Compostos Bioativos. Amazônia.

RESUMEN
La necesidad recurrente de sustituir parcial o totalmente los insumos derivados de fuentes no renovables ha fortalecido los esfuerzos para promover la bioeconomía y avanzar en tecnologías sostenibles. Este estudio buscó investigar, a través de documentos científicos publicados en la base de datos Scopus, el número de publicaciones científicas y citas relacionadas con factores como países, autores, principales agencias de financiamiento, palabras clave, revistas y la evolución temporal de las publicaciones que incluían la palabra curauá. Con base en los resultados obtenidos, fue posible confirmar que el término curauá apareció en 368 documentos científicos disponibles en la base de datos, de los cuales 221 fueron publicados entre 2015 y 2025, lo que representa aproximadamente el 60% de todas las publicaciones. El liderazgo brasileño en el desarrollo de tecnologías con diversas aplicaciones derivadas de fibras o compuestos bioactivos de curauá fue evidente, ya que las principales agencias de financiamiento que apoyan este tipo de investigación son brasileñas, entre ellas el Consejo Nacional de Desarrollo Científico y Tecnológico (CNPq), la Coordinación de Perfeccionamiento del Personal de Nivel Superior (CAPES) y la Fundación Carlos Chagas (FCC). Entre los países que más publicaron, Brasil se destaca con el 86% del total de publicaciones, seguido de India (8%), Portugal (5%), Francia (3%), Estados Unidos (2%), Japón (2%), Países Bajos (2%), Italia (2%) y el Reino Unido (2%). Finalmente, el presente estudio reveló información que indica avances significativos y potenciales inversiones, especialmente en la región Norte de Brasil, que presenta un fuerte potencial para liderar la producción de biofibras con diversas aplicaciones derivadas del curauá amazónico.

Palabras clave: Fibras Naturales. Scopus. Biofibras. Compuestos Bioactivos. Amazônia.

1 INTRODUCTION

The curauá (Ananas erectifolius or Ananas comosus var. erectifolius) is a bromeliad native to the Amazon, popularly known as curauá, curauá-da-Amazônia, ornamental pineapple and wild pineapple (CAMPELO et al., 2021). It is widely used by the peoples of the Brazilian Amazon and other bordering countries (British Guiana, Venezuela, Suriname and Colombia) for different applications, due to the physical and chemical properties exhibited, which guarantee a remarkable versatility of its fibers (KRISHNASAMY et al., 2025). It is a monoecious, herbaceous and rustic plant, whose erect, leathery leaves in the shape of a sword, can have a green (white curauá) or purplish (purple curauá) color, which can reach 2 m in length (NEVES et al., 2023).

Adapted to different soils and tropical climates, curauá is cultivated mainly in the states of Pará and Amazonas (DE CASTRO et al., 2025). According to DUVAL et al., (2003), curauá evolved from Ananas comosus var. Microstachys through multiple processes of domestication adaptation. Its fibers stand out for being extremely light and soft, being considered one of the most resistant among the known vegetable fibers, reaching tensile strength of approximately 630 MPa and density of 1.12 gcm-3 depending on processing and combinations with other materials (SALIM et al., 2025). However, OLIVEIRA, E. C. P. DE et al., (2008) describe in their study that climatic factors, such as temperature, humidity, water availability and solar radiation, as well as soil characteristics (drainage, pH, single concentration and concentration of macro and micronutrients), can drastically interfere with fiber yield per hectare.

The genre Pineapple It has a chemical composition rich in three-dimensional carbon chains of cellulolse (~73.6%) and a lower composition of hemicellulose (~9.9%) and lignin (~7.5%), with moisture and ash contents, respectively, about 0.9 % and 7.9 % (AZEVEDO; GIACON; BORTOLETO, 2025). Fibers from plant matrices, such as curauá, represent the most abundant group of natural fibers with potential for scaling and recovering degraded areas. According to the study presented by ELEUTÉRIO et al. (2025), the cellulose content in curauá fiber contributes to improvements in its interaction with other organic or inorganic matrices in the manufacture of polymeric composites, while hemicellulose and lignin favor at the hydrophobic characteristics and thermostability of the desired product.

From an environmental point of view, curauá is an ecologically and economically viable alternative to replace synthetic materials of non-renewable origin, contributing to the reduction of impacts caused by microplastic derivatives or reinforcement in structures or processes that emit high rates of greenhouse gases (PORTELA et al., 2025). In this context, BARBOSA et al., (2025) report improvements in the mechanical properties of cementitious

mortar with the addition of curauá fibers compared to the standard mortar containing propylene fibers as reinforcement after 365 days, confirming promising characteristics for the field of civil construction. On the other hand, GRANDSON et al., (2023) carried out the study of the thermal and mechanical properties of curauá fibers combined with carbon nanotubes and epoxy resin, where it was found that the combination of these materials resulted in a composite with improvements in thermal stability, reducing the percentage of loss between 25 and 300 ºC, as well as confirming the increase in tensile strength by approximately 82%. The mechanical properties of curauá composites have also been studied by DELGADO-AGUILAR et al., (2019) with the purpose of developing automotive parts, where it was confirmed the compliance with the minimum standards required for the desired application, becoming a promising candidate in the manufacture of automotive parts based on composites with natural fibers.

In this scenario, this work sought to present the scenario of scientific publications related to curauá in the Scopus database, using bibliometric analysis, which consists of a quantitative method used to evaluate scientific production through the statistical treatment of publications, citations, authors, journals, keywords and collaboration networks (DING et al., 2023; ZHENG et al., 2022). Therefore, the central objective of this type of analysis is to identify patterns, trends, impacts and relationships in the development of an area of knowledge, allowing to map the state of the art, the most recurrent themes, the most influential researchers and the temporal evolution of research. This approach helps in scientific decision-making, in the definition of research strategies, and in the understanding of the dynamics of knowledge in a given field (ANKRAH; MONTEIRO; MADUREIRA, 2022; SAAVEDRA-CORDOVA et al., 2025).

2 METHODOLOGY

2.1 SCOPUS DATABASE SEARCH AND EXPORT

The bibliographic and state-of-the-art survey was carried out in the Scopus database (Elsevier) from January 10 to 12, 2026, based on the study carried out by OLIVE TREE et al. (2024). Therefore, the search terms were inserted, that is, keywords, "curauá" and "Ananas erectifolius", as well as the combinations of these two words by means of the Boolean operators "AND" and "OR".

3 RESULTS AND DISCUSSION

The results obtained for the number of scientific publications related to the searches are available in Table 1. This refers to the total number of documents published for each

search term, as well as the manuscripts published in the last 10 years and the percentage of articles published in the last 10 years, in relation to the total, which indicates the state of the art of the research developed (SA ratio).

As presented, when the search term "curauá" is adopted, it is clearly noted that the return on the number of scientific publications is significantly higher than that compared to the keyword "Ananas erectifolius", as well as the combination of the two words, performed by means of the Boolean operators AND and OR. In this case, the total number of publications was 368 scientific papers, and the first study was reported in the form of a conference article by MUENKER; HOLTMANN; MICHAELI, (1998), at the International SAMPE Symposium and Exhibition (Proceedings) event entitled "Improvement of the fiber/matrix-adhesion of natural fiber reinforced polymers" in 1998. On the other hand, the last published manuscript, that is, the most recent manuscript involving the search term curauá, has the title "Evaluation of the weathering processes after natural exposure of polypropylene/curauá fiber composites" by DOS SANTOS et al., (2026), and which was published in the journal Polymer with an impact factor of 4.4, in the year 2026.

For all cases, the percentage of manuscripts published in the last 10 years was higher than 50%, which indicates a predominance of publications in recent years, as a result of the trend towards studies that enable technologies related to natural and renewable sources of fibers for the manufacture of composites (KUMAR et al., 2025), biomaterials (DE OLIVEIRA, J. M. et al., 2024), mortar reinforcement in civil construction (BARBOSA et al., 2025), development of 3D architectures, manufacture of coatings (DE QUEIROZ; CIARDIELLO; BANEA, 2025), rubberized (AZEVEDO; GIACON; BORTOLETO, 2025), ballistic purposes (MELIANDE et al., 2023) and reduction of dependence on synthetic polymers, especially fossil derivatives (GANESAN et al., 2025).

The reduction observed for the number of scientific publications related to the other keywords used as search terms is due to specificities of the search adopted, mainly with the addition of Boolean operators, which limit by combining or excluding search terms. Similar behavior was observed in the study conducted by ANKRAH; MONTEIRO; MADUREIRA, (2022), which reports a reduction from 2516 scientific documents to 1453 documents, i.e., a reduction of approximately 42.3% after the use of Boolean operators, as a result of the combination or exclusion of search terms in the search performed.

Table 1

Total documents, documents published in the last 10 years and state of art ratio (SA) from Scopus database corresponding to the keywords: curauá, Ananas erectifolius, curauá and Ananas erectifolius and curauá or Ananas erectifolius

Keyword	Total documents	Last 10 years	SA ratio (%)
Curauá	368	221	60.0
Ananas erectifolius	80	45	56.3
Curauá and *Ananas erectifolius*	55	33	60.0
Curauá or *Ananas erectifolius*	81	49	60.5

Legend: SA = State of art ratio.

From the data obtained from the 368 documents related to the keyword curauá, the analysis of the occurrence of the keywords was carried out, which resulted in a total of 144 documents containing the keyword "fibers", while the keywords "natural fiber", "curauá fibers", "reiforcement", "reinforced plastic", "tensile stretching" "mechanical Properties", "composites", "curauá fiber" and "composite materials", resulted in a total of 135, 116, 98, 82, 81, 81, 76, 51 and 51, documents, respectively. These results confirm the interest in research related to curauá fibers, mainly as structural reinforcement of composites, with interest in improving mechanical and thermal properties and increasing the biodegradable character. Figure 1 shows the word cloud created from the number of related keywords, where the words with the most prominence indicate those that had the highest recurrence, i.e., "natural fibers", "fibers", "curauá fibers" and "reinforcement".

Figure 1

Main keywords related to the search terms used in the Scopus database search

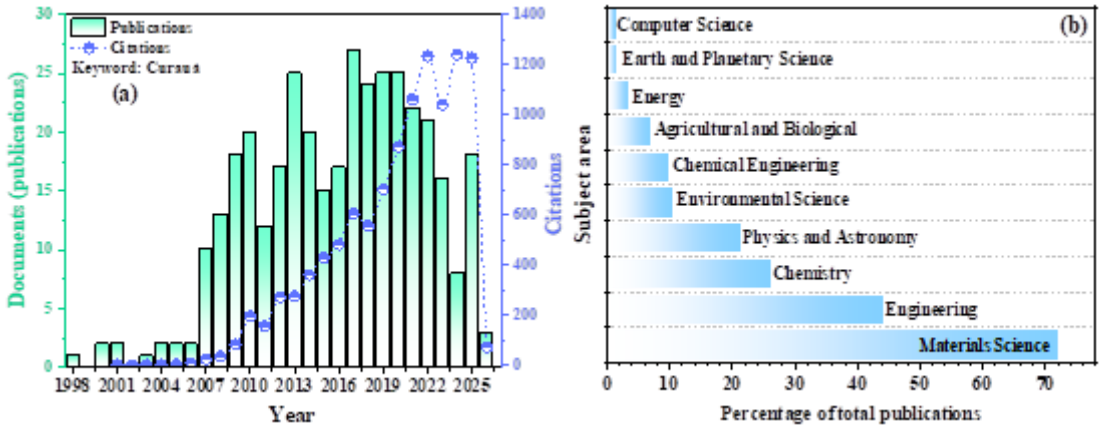
Figure 2(a-b) shows in parts the evolution of the number of scientific publications and citations as a function of the year of publication, as well as the percentage of publications as a function of the area of knowledge. Based on the graphically arranged data (Fig. 2a), it is possible to note that the interval between 1998 and 2006 did not result in a significant

evolution in the number of scientific publications, with only two scientific manuscripts per year, following an almost constant profile for the number of publications and citations. On the other hand, both the number of publications and the citations exhibit a growing profile; however, not linearly dependent, for the interval between the years 2007 and 2026, reaching the peak of publications in 2016, totaling 27 scientific publications. On the other hand, the number of citations for the same interval was expressively increasing, exhibiting an almost exponential profile, with the number of citations in the years 2021, 2023, and 2025, being 1.235, 1.243, and 1.225, respectively.

In the study conducted by ROJAS-FLORES et al., (2025) The authors present the state of the art and bibliometric survey on topics related to biopolymers associated with fuel cells and membranes, in the interval between 2012 and 2025. Among the information contained in the study, there is a growing trend in the number of scientific publications and citations, especially after 2016, which is due, according to the authors, to the interest in the development of ecologically and economically viable routes for new materials. In addition, it is possible to highlight the evolution of the field of biobased materials, which have the advantages of strengthening the local and regional bioeconomy, maintaining preserved areas, reducing regional inequalities, and reducing inputs of fossil origin (FAVARINI; MARANDUBA, 2025).

Figure 2

(a) Evolution of publications and citations against time (year) and (b) percentage of publications by subject area.



The percentage of publications by area of knowledge is shown in Figure 3(b), where it is possible to highlight the top10 areas of science in which publications containing the keyword "curauá" are concentrated. In this case: computer Science, Earth and Planetary Science, Energy, Agricultural and Biological, Chemical engineering, Environmental Science,

Physics and Astronomy, Chemistry, Engineering and Materials Science. Therefore, based on graphical analysis, the main area of research is Materials Science, concentrating approximately 72% of the publications. In second and third place are Engineering and Chemistry, with 44% and 26%, respectively. As expected, the plastics, coatings and fibers industry is directly related to the areas described, which reinforces the importance of biofibers for the development of technologies under less dependence on inputs derived from non-renewable sources (GANESAN et al., 2025).

In the State of Amazonas, projects related to the valorization of curauá have been the focus of investments in the primary sector, which has shown promise for various purposes. In 2010, the Amazonas State Development Agency S.A. (AFEAM) highlighted the region's leading role in the production of curauá, which has chemical, biological and physiological characteristics that are considered of great importance for the regional economy, becoming an opportunity to meet local industrial interests related to biofibers (https://www.afeam.am.gov.br/material-extraido-de-planta-amazonica-substitui-a-fibra-de-vidro-com-vantagens/). On the other hand, in 2017, the Amazonas State Research Support Foundation (FAPEAM), made public the investments in projects related to the enhancement of the use of curauá fiber, especially for the purpose of replacing fiberglass, a material widely used in different industrial purposes in the Manaus Industrial Pole (https://www.fapeam.am.gov.br/pesquisas-pretendem-potencializar-uso-da-fibra-de-curauá-no-amazonas/). In January 2024, the State Secretariat for Rural Production (Sepror), together with the State Secretariat for Economic Development, Science, Technology and Innovation (Sedecti), the Institute for Sustainable Agricultural and Forestry Development (Idam), the Amazon Biobusiness Center (CBA) and the Superintendence of the Manaus Free Trade Zone (Suframa) in partnership with the Unifruti companies, Compol and Tutiplast, carried out the implementation of the pilot project for the production of curauá fibers in the community of Novo Remanso, in the municipality of Itacoatiara in Amazonas. Where, the objective was to produce natural fibers for use as reinforcement of plastic materials, reducing the load of fossil derivatives, adding improvements in the mechanical and biodegradable properties of hybrid materials (https://www.sepror.am.gov.br/governo-do-amazonas-lanca-projeto-piloto-da-producao-de-fibra-do-curauá-em-itacoatiara/).

In order to highlight the top10 articles with the highest number of citations related to the search term curauá in the Scopus database, we chose to present the data available in Table 2, where the title of the manuscripts, the year of publication, the journal, impact factor and total number of citations are summarized. Based on the results presented, the manuscript with the highest number of citations was published by ALVES FIDELIS et al.,

(2013) with the title "The effect of fiber morphology on the tensile strength of natural fibers" no Journal of Materials Research and Technology (IF. 6.6), totaling 398 citations to date. The manuscript reports the mechanical properties of natural fibers, emphasizing the jute species (Corchorus capsularis), sisal (Agave sisalana), curauá (Ananas erectifolius) coir (Pithecellobium dulce) and piassava (Attalea funifera Martius), where curauá fiber resulted in the best mechanical properties, with tensile stress and Young's modulus of 543 MPa and 63.7 GPa, respectively. The other manuscripts occupying the top 10 citations include applications involving the automotive industry, development of ecological composites, cellulose extraction and different fiber treatment processes and characterization techniques. Among the journals reported, the following stand out: Journal of Cleaner Production (IF. 10), Polymer Degradation and Stability (IF. 7.4), Metallurgical and Materials Transactions A: Physical metallurgy and materials science (2.5), Composites Part A: Applied Science and Manufacturing (IF. 8.9), Carbohydrate Polymers (IF. 12.5), Cellulose (IF. 4.8), Polymer Degradation and Stability (IF. 7.4) and Composites Part B: Engineering (IF. 14.2).

The graphical summary of the types of documents and the main countries (Top10), i.e., the countries that published the most scientific documents related to the keyword curauá, are presented in parts of Figure 4(a-b). Therefore, concentrating about 86% of scientific publications, Brazil stands out among the countries of the American continent, followed by India with 8% of publications and Portugal with approximately 5%. On the other hand, Japan, Canada, the United States (US), the Netherlands, Italy, the United Kingdom (UK) and France, had percentages close to 2%, with the exception of France, which exhibited about 3% of the total publications.

Although the predominance of curauá is in the Brazilian Amazon, the occurrence of this bromeliad in Venezuela and French Guiana expands the possibilities of studies, cultivations, genetic improvements and technological innovations related to the plant (MARQUES; GUTIÉRREZ; DEL RÍO, 2007). However, unsuccessful attempts at cultivation in Japan, South Africa and Malaysia have been confirmed, which indicates the interest in investments and studies by other countries. In the study conducted by OLIVEIRA, E. C. P. DE et al., (2008) The morphological aspects of curauá seedlings implanted and cultivated under different conditions in a tropical Amazonian climate were described in detail, where the authors describe the dependence on the physicochemical characteristics of the soil and factors such as exposure to light, temperature, humidity and rainfall indices as being fundamental for the development of the plant.

Table 2

Title of manuscripts, year of publication, journals title, impact factor (IF), and citations.

Title	Year	Journal	IF	Citation
The effect of fiber morphology on the tensile strength of natural fibers	2013	Journal of Materials Research and Technology	6.6	398
Curauá Fibers in the automobile industry - a sustainability assessment	2007	Journal of Cleaner Production	10	356
Thermal properties of high-density polyethylene composites with natural fibres: Coupling agent effect	2008	Polymer Degradation and Stability	7.4	329
Natural lignocellulosic fibers as engineering materials-An overview	2011	Metallurgical and Materials Transactions A: Physical metallurgy and materials science	2.5	299
Development and effect of alkali treatment on tensile properties of curauá fiber green composites	2007	Composites Part A: Applied Science and Manufacturing	8.9	297
Characterization of lignocellulosic curauá fibres	2009	Carbohydrate Polymers	12.5	281
Cellulose nanofibers from curauá fibers	2010	Cellulose	4.8	253
Sugar cane bagasse and curauá lignins oxidized by chlorine dioxide and reacted with furfuryl alcohol: Characterization and stability	2004	Polymer Degradation and Stability	7.4	223
Preparation, morphology, and structure of cellulose nanocrystals from bamboo fibers	2012	Cellulose	4.8	217
Mechanical characterization of intralaminar natural fiber-reinforced hybrid composites	2019	Composites Part B: Engineering	14.2	207

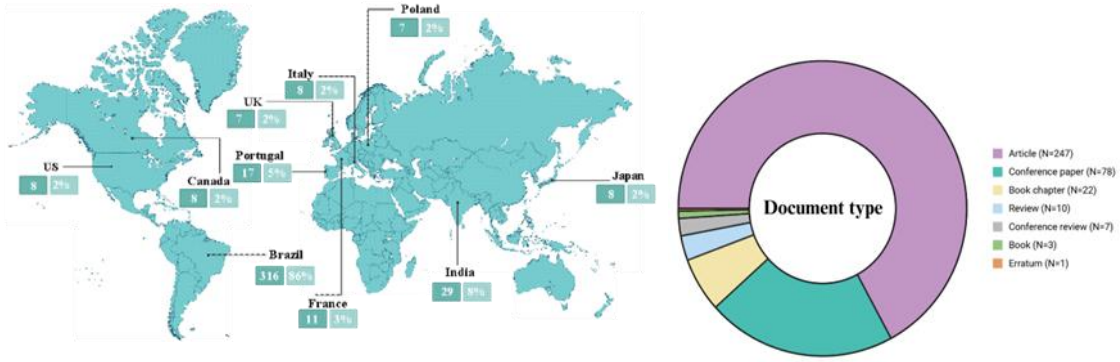
Legend: IF = Impact Factor.

When analyzing the composition of publications by type of document, as shown in Figure 3(b), it is clear that scientific manuscripts predominate, resulting in 247 documents, followed by conference articles with 78 manuscripts, then 22 book chapters, and review articles with 10 units. Finally, the minority composition of which includes books, errata and conference reviews totaling 11 documents. This behavior is commonly reported in publications that use bibliometric analysis or literature review, because scientific manuscripts in the original article structure is the format commonly adopted by scientific journals by area of knowledge, as well as the more traditional format of peer review and speed in scientific communication.

ROSA LATAPIE, ABOU-CHAKRA and SABATHIER (2023) report in their bibliometric study the trends in the development of biobased and mineral-derived materials, and observe that when the type of scientific document for the research interval between the years 1990 and 2022 using the Web of Science database was used as a criterion, 68% of the scientific documents were of the "original article" type, while review articles made up 15% of the total, followed by proceeding materials and book chapters with 13% and 2%, respectively.

Figure 3

(a) number and percentage of documents per country (left) and (b) document type (right) for curauá

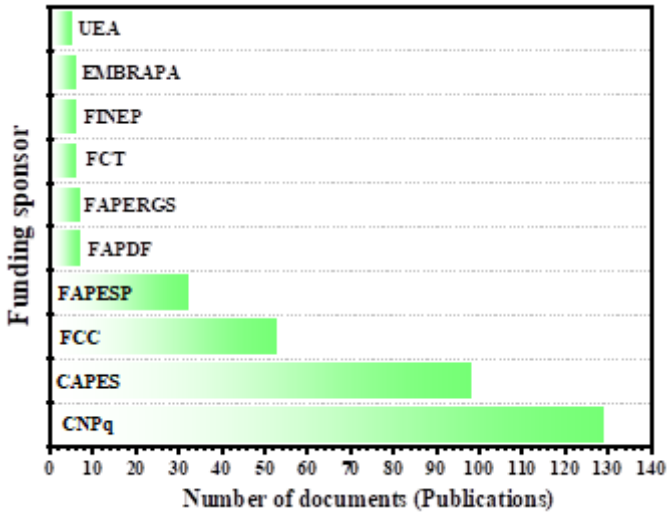


Corroborating the information presented so far, the Top10 of the main funders of projects involving curauá according to the search for scientific manuscripts on the Scopus platform, is presented in Figure 4. As can be seen, the main funder of projects was the National Council for Scientific and Technological Development (CNPq) with 128 scientific manuscripts, in second place is the Coordination for the Improvement of Higher Education Personnel (CAPES) with 98 publications, the Carlos Chagas Foundation (FCC) with 53 publications, the São Paulo Research Foundation (FAPESP) with 32 publications, while the Research Support Foundation of the Federal District (FAPDF) and the Research Support Foundation of the State of Rio Grande do Sul (FAPERGS) have so far 7 related publications. Finally, the Foundation for Science and Technology (FCT), the Financier of Studies and Projects (FINEP) and the Brazilian Agricultural Research Corporation have 6 related scientific manuscripts, while the University of the State of Amazonas (UEA) is present in 5 scientific documents.

The data presented confirm the involvement of the Brazilian government's research foundations in the development of research related to biological matrices and natural resources, showing itself to be active in the financing and monitoring of projects with dispersion in different regions of Brazil. Becoming attractive to connections with different research groups and attempts to mature prototypes, economic viability, development of technologies and process and regional structuring to reduce asymmetries in different regions of the country. Among the funders, the University of the State of Amazonas also stands out, which reflects the regional role in valuing local research and encouraging technological and scientific development, a fundamental role in strengthening the bioeconomy in the North region.

Figure 4

Key funders of resources for the development of projects and research related to the searches conducted



Legend: CNPq = National Council for Scientific and Technological Development; CAPES = Coordination for the Improvement of Higher Education Personnel; FCC = Carlos Chagas Foundation; FAPESP = São Paulo Research Foundation; FAPDF = Research Support Foundation of the Federal District; FAPERGS = Research Support Foundation of the State of Rio Grande do Sul (FAPERGS); FCT = Foundation for Science and Technology (FCT); FINEP = Financier of Studies and Projects (FINEP); EMBRAPA = Brazilian Agricultural Research Corporation; and UEA = University of the State of Amazonas.

The list of first authors, number of publications, H factor, total number of citations in the Scopus database, and affiliation are summarized in Table 4. Based on these data, Prof. Dr. Sérgio Monteiro, graduated in metallurgical engineering from the Federal University of Rio de Janeiro with a master's and doctorate in Materials Science from the University of Florida (USA) is the main author related to the publications involving the keyword curauá. Prof. Dr. Sérgio Monteiro is a CNPq 1A productivity fellow and Full Professor at the Military Institute of Engineering (IME), where he concentrates 60 publications involving the study search term of this work, H factor = 64 and 16,485 citations in the Scopus database.

The predominance of Brazilian researchers, or researchers affiliated with Brazilian institutions, reveals the protagonism of researchers in a theme that is fundamental for national technological development, revealing, above all, the quality of the works developed, which are accompanied by a significant volume of citations, and which place Brazil among the main countries related to the development of composites based on natural fibers. As can be seen, among the institutions related to the Top10 of researchers are the Military Institute of Engineering, Rio de Janeiro, State University of Campinas, São Paulo, Federal University of Rio Grande do Sul, Porto Alegre, Institute of Materials of Aveiro, Portugal, State University of Norte Fluminense, Campos dos Goitacazes, Pontifical Catholic University of Rio de

Janeiro, Rio de Janeiro, Federal Center for Technological Education Celso Suckow Da Fonseca, Rio de Janeiro and University of Caxias do Sul, Caxias do Sul, Brazil.

Table 3

Author, publications, H-index, citation, and filiation

Author	Publications	H-index	Citation*	Filiation
Monteiro, S.N.	60	64	16,485	Military Institute of Engineering, Rio de Janeiro, Brazil.
De Paoli, M.A.	22	58	11,122	State University of Campinas, Campinas, Brazil.
Amico, S.C.	19	49	9,556	Federal University of Rio Grande do Sul, Porto Alegre, Brazil.
Banea, M.D.	17	48	8,708	CICECO – Aveiro Institute of Materials, Aveiro, Portugal.
Zattera, A.J.	16	42	8,141	University of Caxias do Sul, Caxias do Sul, Brazil.
Lopes, F.P.D.	15	17	1,596	State University of Norte Fluminense, Campos dos Goitacazes, Brazil.
Frollini, E.	15	45	6,119	University of São Paulo, São Paulo, Brazil.
Margin, F.M.	13	20	1,417	State University of Norte Fluminense, Campos dos Goitacazes, Brazil.
de Andrade Silva, F.	12	46	7,723	Pontifical Catholic University of Rio de Janeiro, Rio de Janeiro, Brazil.
Neto, J.S.S.	11	21	1,779	Federal Center for Technological Education Celso Suckow Da Fonseca, Rio de Janeiro, Brazil.

Legend: * = Scopus Database; IF = Impact Factor.

5 CONCLUSIONS

The bibliometric analysis carried out in the Scopus database using the keyword curauá, enabled a broad view of the possibilities of application and trends that may be useful in the prospection of new technologies, financing and inter-institutional partnerships, especially with regard to economic and technological purposes.

The analysis of the manuscripts identified in the adopted searches revealed a total of 368 scientific articles, with Brazil, India and Portugal being the Top3 countries that published the most on the main theme. In addition, the original article format leads among the publication formats, followed by conference papers and book chapters.

In the context of affiliated institutions with the highest recurrence among the published manuscripts, Brazilian public institutions stand out, mainly the Military Institute of Engineering (IME - Rio de Janeiro), the State University of Campinas (UNICAMP, São Paulo), the Federal University of Rio Grande do Sul (UFRGS), the State University of Norte Fluminense (UENF), the Pontifical Catholic University of Rio de Janeiro (PUC-Rio) and Federal Center for Technological Education Celso Suckow Da Fonseca (CFETCSF).

Therefore, the study revealed details of the richness from Amazonian biodiversity and the potential of curauá in the development of renewable-based technologies to meet the demands of the global market with an emphasis on the reduction of oil-based inputs.

ACKNOWLEDGMENTS

The authors would like to thank the Fundação de Amparo à Pesquisa do Estado do Amazonas (FAPEAM) for financial support through the approved projects Notices No. 012/2023 -STARTUP STRATEGIC AREAS, FAP/CNPq Call no. 003/2022, Resolution No. 023/2022 - INICIATIVA Amazônia + 10, NOTICE No. 010/2022 − PDCA/AM, and Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP, Grant 2022/10416-9) for scholarships and financial support.

REFERENCES

Alves Fidelis, M. E., et al. (2013). The effect of fiber morphology on the tensile strength of natural fibers. Journal of Materials Research and Technology, 2(2), 149–157. https://doi.org/10.1016/j.jmrt.2013.02.003

Ankrah, J., Monteiro, A., & Madureira, H. (2022). Bibliometric analysis of data sources and tools for shoreline change analysis and detection. Sustainability, 14(9), 4895. https://www.mdpi.com/2071-1050/14/9/4895

Azevedo, J. D. L. de, Giacon, V. M., & Bortoletto, J. R. R. (2025). Composites of natural rubber with curaua fibers. Polímeros, 35(2), 1–9. https://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-14282025000200602

Barbosa, C. E. da S. M., et al. (2025). Feasibility of Amazonian natural fibers as sustainable alternatives for mortar reinforcement. Waste and Biomass Valorization, 16(11), 6075–6097. https://doi.org/10.1007/s12649-025-02992-z

Campelo, M. F., et al. (2021). Fenologia reprodutiva de Carapichea ipecacuanha e sua correlação com variáveis climáticas. Research, Society and Development, 10(5), e7610514625. https://rsdjournal.org/index.php/rsd/article/view/14625

Castro, D. O. de, et al. (2025). Properties of composites from curauá fibers and high-density bio-based polyethylene. Fibers, 13(4), 45. https://www.mdpi.com/2079-6439/13/4/45

Delgado-Aguilar, M., et al. (2019). Explorative study on the use of curauá reinforced polypropylene composites for the automotive industry. Materials, 12(24), 4185. https://www.mdpi.com/1996-1944/12/24/4185

Ding, H., et al. (2023). Facial cosmetic injection: A bibliometric analysis of research status and hotspots. Journal of Cosmetic Dermatology, 746–757.

Dos Santos, T. A., et al. (2026). Evaluation of the weathering processes after natural exposure of polypropylene/curauá fiber composites. Polymer, 342, 129300. https://doi.org/10.1016/j.polymer.2025.129300

Duval, M. F., et al. (2003). Relationships in Ananas and related genera using chloroplast DNA restriction site variation. Genome, 46(6), 990–1004. https://doi.org/10.1139/g03-074

Eleutério, T., et al. (2025). A review of natural fibers: Classification, composition, extraction, treatments, and applications. Fibers, 13(9), 119. https://www.mdpi.com/2079-6439/13/9/119

Favarini, C., & Maranduba, H. L. (2025). Unlocking the sustainable potential of Amazonian curauá fiber in industrial polymer composites: A life cycle approach. Science of the Total Environment, 1004, 180699.

Ganesan, V., et al. (2025). Mechanical and structural characterization of curauá fiber, sugarcane biochar, and PLA hybrid green composites. Sugar Tech, 27(6), 1925–1946. https://doi.org/10.1007/s12355-025-01628-9

Krishnasamy, S., et al. (2025). Examining the mechanical properties of hybrid curauá–basalt reinforced polyester composites. Polymer Composites, 46(12), 11416–11431. https://doi.org/10.1002/pc.29694

Kumar, V. P. S., et al. (2025). Investigation on the mechanical and thermal properties of coconut shell powder and HDPE composites. AIP Conference Proceedings, 070009. https://doi.org/10.1063/5.0276194

Marques, G., Gutiérrez, A., & del Río, J. C. (2007). Chemical characterization of lignin and lipophilic fractions from leaf fibers of curauá (Ananas erectifolius). Journal of Agricultural and Food Chemistry, 55(4), 1327–1336. https://doi.org/10.1021/jf062677x

Meliande, N. M., et al. (2023). Thermal behavior of curauá–aramid hybrid laminated composites for ballistic helmet. Polymers, 15(15), 3214. https://doi.org/10.3390/polym15153214

Muenker, M., Holtmann, R., & Michaeli, W. (1998). Improvement of the fiber/matrix adhesion of natural fiber reinforced polymers. Polymer Composites, 2123–2133.

Neto, J. S. S., et al. (2023). Effect of multi-walled carbon nanotubes on the mechanical and thermal properties of curauá natural fiber-reinforced composites. C, 9(4), 102. https://www.mdpi.com/2311-5629/9/4/102

Neves, P., et al. (2023). Leaf anatomy and fiber types of curauá (Ananas comosus var. erectifolius). Cellulose, 30(6), 3429–3439. https://doi.org/10.1007/s10570-023-05107-w

Oliveira, E. C. P. de, et al. (2008). Estrutura foliar de curauá sob diferentes intensidades de radiação fotossinteticamente ativa. Pesquisa Agropecuária Brasileira, 43(2), 163–169.

Oliveira, J. P. de, et al. (2024). Bibliometric study and potential applications in the development of starch films with nanocellulose. International Journal of Biological Macromolecules, 277, 133828. https://doi.org/10.1016/j.ijbiomac.2024.133828

Portela, A. C., et al. (2025). Unlocking the sustainable potential of Amazonian curauá (Ananas erectifolius) fiber in industrial polymer composites. Science of the Total Environment, 1004, 180699. https://www.sciencedirect.com/science/article/pii/S0048969725023393

Rojas-Flores, S. J., et al. (2025). Biopolymers as sustainable materials for membranes in microbial fuel cells: A bibliometric analysis. Proceedings, 27(1), 3. https://www.mdpi.com/2673-4605/27/1/3

Rosa Latapie, S., Abou-Chakra, A., & Sabathier, V. (2023). Bibliometric analysis of bio- and earth-based building materials. Construction Materials, 3(4), 474–508. https://www.mdpi.com/2673-7108/3/4/31

Saavedra-Cordova, M. A., et al. (2025). Advances in resistant starch research from agro-industrial waste. Foods, 14(16), 1–19.

Salim, M. Y., et al. (2025). Natural fibre-reinforced thermoplastic composites. Journal of Materials Research and Technology, 39, 6755–6774. https://doi.org/10.1016/j.jmrt.2025.102770

Zheng, Q., et al. (2022). Past, present and future of living systematic review. BMJ Global Health, 7(10), e009378. https://doi.org/10.1136/bmjgh-2022-009378