International Platform of Registered Systematic Review and Meta-analysis Protocols

INPLASY

INPLASY202590019

doi: 10.37766/inplasy2025.9.0019

Received: 6 September 2025

Published: 6 September 2025

Corresponding author:
Banon Rustiaty

banon.rustiaty@brin.go.id

Author Affiliation:
National Research and Innovation Agency (BRIN).

Hydroxypropyl cellulose in sustainable functional materials: A two-decade research landscape analysis with translational insights

Paramitasari, D; Amelia, O; Pudjianto, K; Musa; Rustiaty, B; Supriyanti, A; Meidiawati, DP; Putra, ON; Pramana, YS; Yassaroh; Yuliati, F; Witoyo, JE; Sari, UK..

ADMINISTRATIVE INFORMATION

Support - Research Organization for Nanotechnology and Materials – National Research and Innovation Agency (BRIN) research grant 2025.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202590019

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 6 September 2025 and was last updated on 6 September 2025.

INTRODUCTION

Review question / Objective This study aimed to systematically analyze the global research landscape of Hydroxypropyl Cellulose (HPC) over the past two decades (2005-2024), identifying publication trends, research impact, and thematic directions through bibliometric analysis.

Rationale Although hydroxypropyl cellulose (HPC) has well-established physicochemical advantages and diverse applications, the research landscape is fragmented. Most studies focus narrowly on specific uses—such as H-HPC in drug delivery and functional materials or L-HPC in tablet disintegration—without providing a cohesive, data-driven overview of the field. Moreover, reliance on commercially available grades has constrained innovation, leaving greener synthesis strategies, functionalization for next-generation devices, and industrial scale-up underexplored. Despite a rapid increase in publications over the past two decades, no comprehensive bibliometric synthesis exists to map global research trends, key contributors, and thematic clusters. This gap motivated the present study, which applies systematic bibliometric methods to reveal the intellectual structure, collaborative networks, and translational opportunities in HPC research.

Condition being studied The study examined hydroxypropyl cellulose (HPC) research, including highly substituted (H-HPC) and low-substituted (L-HPC) forms, as a research field with applications in pharmaceuticals, nanotechnology, and sustainable functional materials."

METHODS

Search strategy The bibliometric data were retrieved from the Scopus database, covering the

period 2005–2024. The search was conducted on 7 July 2025 using predefined keywords applied to titles, abstracts, and author keywords. Two distinct search strings were used to capture the different standardized forms of hydroxypropyl cellulose (HPC):
1. For H-HPC:
("hydroxypropyl cellulose" OR "hydroxypropylcellulose" OR "HPC") AND NOT ("low substituted" OR "low-substituted").
2. For L-HPC:
("low-substituted hydroxypropyl cellulose" OR "low substituted hydroxypropyl cellulose" OR "low-substituted hydroxypropylcellulose" OR "low substituted hydroxypropylcellulose" OR "L-HPC").

Duplicates were removed using Microsoft Excel. The final dataset consisted of 1,273 publications for H-HPC (1,197 research articles and 76 conference papers) and 92 publications for L-HPC.

Participant or population This review does not involve patients or clinical participants. Instead, the population of interest is the body of published research indexed in Scopus between 2005 and 2024 that investigates hydroxypropyl cellulose (HPC), including both its highly substituted form (H-HPC) and low-substituted form (L-HPC). The included publications encompass research articles and conference proceedings across disciplines such as pharmaceutical sciences, materials science, nanotechnology, biotechnology, and sustainable functional materials.

Intervention Application of bibliometric analysis methods (publication counts, citation analysis, co-authorship networks, keyword co-occurrence, and thematic mapping) to systematically evaluate the global HPC research landscape.

Comparator Comparative analysis between H-HPC and L-HPC research trends, including differences in publication output, citation impact, geographic distribution, collaboration networks, and thematic applications.

Study designs to be included This review includes original research articles and conference proceedings indexed in the Scopus database that address hydroxypropyl cellulose (HPC), including both highly substituted (H-HPC) and low-substituted (L-HPC). No restrictions were applied regarding study design (e.g., experimental, applied, or computational), provided the publication directly related to HPC. Non-research documents such as reviews, editorials, notes, short surveys, book chapters, and errata were excluded.

Eligibility criteria 1. Inclusion criteria:
a. Publications indexed in Scopus between 2005 and 2024.
b. Studies containing relevant keywords for hydroxypropyl cellulose (HPC), including both highly substituted (H-HPC) and low-substituted (L-HPC), in the title, abstract, or keywords.
c. Document types limited to peer-reviewed research articles and conference proceedings.
2. Exclusion criteria:
a. Duplicate records (removed during screening).
b. Non-research document types, including reviews, editorials, short surveys, book chapters, letters, errata, and notes.
c. Publications without substantive relevance to HPC (e.g., those mentioning "HPC" as an unrelated acronym).

Information sources The primary information source was the Scopus database, which was systematically searched on 7 July 2025 to retrieve publications from 2005 to 2024. The search was conducted using predefined keywords applied to article titles, abstracts, and author keywords. Only documents indexed in Scopus were considered, as the database provides extensive coverage of multidisciplinary literature and allows export of complete metadata required for bibliometric analysis. No additional databases, trial registers, or grey literature sources (e.g., theses, preprints, or institutional reports) were included, and no direct contact with authors was undertaken.

Main outcome(s) Identification of global publication and citation trends, leading contributors (countries, institutions, authors, journals), thematic clusters, and research gaps. The outcomes also highlight future translational opportunities, including greener synthesis, functionalization for next-generation devices, and industrial scalability.

Additional outcome(s) In addition to publication and citation trends, the review also assessed:
1. Geographic distribution of research output, highlighting leading countries and regional patterns.
2. Authorship dominance factors to evaluate intellectual leadership and first-author contributions.
3. Global co-authorship and collaboration networks at both country and institutional levels.
4. Keyword co-occurrence mapping to identify thematic clusters, niche applications, and emerging research domains.
5. Comparative analysis between H-HPC and L-HPC in terms of scope, applications, and scientific influence.

Quality assessment / Risk of bias analysis This study did not perform a traditional risk of bias assessment of primary studies, as is common in systematic reviews of clinical trials, because the present work is a bibliometric review. Instead, quality assurance was ensured by:
a. Using Scopus, a comprehensive and validated bibliographic database, as the sole information source.
b. Applying structured keyword strategies to minimize retrieval bias.
c. Screening and removing duplicates to ensure dataset accuracy.
d. Using objective bibliometric indicators (publication counts, citation data, co-authorship networks, and keyword co-occurrence) that reduce subjective interpretation.

No further risk of bias assessment was required, since the study evaluates the published research landscape rather than outcomes from experimental or clinical studies.

Strategy of data synthesis Data synthesis will be performed using a quantitative bibliometric approach. First, descriptive analyses (annual publication and citation trends, document types, and geographic distributions) will be conducted in Microsoft Excel. Next, VOSviewer software (v1.6.20) will be applied to construct and visualize bibliometric networks, including co-authorship, co-citation, bibliographic coupling, and keyword co-occurrence. Cluster analysis will be used to identify thematic structures and research frontiers. Comparative synthesis will be undertaken to contrast highly substituted HPC (H-HPC) and low-substituted HPC (L-HPC) in terms of research volume, citation impact, and application domains. The integrated results will provide a comprehensive map of the intellectual structure, collaboration networks, and emerging trends in HPC research.

Subgroup analysis Subgroup analyses will be conducted to enable comparative insights across different dimensions of HPC research. Specifically:
1. H-HPC vs. L-HPC: Comparative analysis of publication volume, citation impact, and thematic applications.
2. Research domains: Stratification by subject categories (e.g., pharmaceuticals, chemistry, materials science, engineering).
3. Geographic distribution: Analysis of leading countries and regions contributing to HPC research.
4. Authorship dynamics: Examination of dominance factors and co-authorship patterns by author and institution.
5. Temporal trends: Comparison of early (2005–2014) vs. recent (2015–2024) publications to capture thematic evolution.

Sensitivity analysis Formal sensitivity analysis of primary studies was not applicable, as this is a bibliometric review. Instead, robustness of the findings was ensured by:
1. Duplicate removal and validation of search results to avoid data distortion.
2. Cross-checking keyword strategies (e.g., "hydroxypropyl cellulose" vs. "hydroxypropylcellulose," "H-HPC" vs. "L-HPC") to confirm consistency in dataset retrieval.
3. Testing alternative thresholds in VOSviewer (e.g., minimum keyword co-occurrence set at 5 vs. 10) to verify stability of thematic clusters.
4. Comparing results across timeframes (early vs. late periods) to ensure observed trends were not driven by a single peak year.

Country(ies) involved Indonesia.

Other relevant information PRISMA checklist is available as a supplementary material of the submitted manuscript.

Keywords hydroxypropyl cellulose; bibliometric analysis; drug delivery; thermochromic; hydrogels; polysaccharides derivative.

Contributions of each author
Author 1 - Derina Paramitasari - Author 1 contributed to conceptualize the review substance, software selection and analysis for H-HPC as well as writing the original draft of the review.
Email: deri003@brin.go.id
Author 2 - Okta Amelia - Author 2 involved in designing the methodology, writing the original draft of the review, and supervise the result data evaluation.
Email: okta.amelia@tip.itera.ac.id
Author 3 - Karjawan Pudjianto - Author 3 also conceptualized the systematic review together with Author 1 and retrieved and screen the Scopus database.
Email: karj001@brin.go.id
Author 4 - Musa Musa - Author 4 contributed in designing methodology and formal analysis for publication output (2005-2024) from Scopus database for the review.
Email: musa002@brin.go.id
Author 5 - Banon Rustiaty - Author 5 contributed to analyze the dominance factor of authorship and administration of the systematic review.
Email: banon.rustiaty@brin.go.id

Author 6 - Arni Supriyanti - Author 6 involved in software data curation of VOSviewer and Scopus database for L-HPC research.
Email: arni001@brin.go.id
Author 7 - Dyah Primarini Meidiawati - Author 7 contributed on formal analysis and resources for most cited publications of L-HPC.
Email: dyah001@brin.go.id
Author 8 - Okta Nama Putra - Author 8 involved in VOSViewer methodology and investigate the top ten most cited publication of H-HPC.
Email: okta005@brin.go.id
Author 9 - Yanuar Sigit Pramana - Author 9 contributed in data validation for VOSviewer and data curation for all data analysis (H-HPC and L-HPC) from Microsoft Excel.
Email: yanu008@brin.go.id
Author 10 - Yassaroh Yassaroh - Author 10 worked in data validation together with Author 9 and review-editing the manuscript review.
Email: yass001@brin.go.id
Author 11 - Frita Yuliati - Author 11 contributed in data validation from Microsoft Excel and visualize the co-occurence mapping of H-HPC and L-HPC including define the big thematic cluster from the map.
Email: frit001@brin.go.id
Author 12 - Jatmiko Eko Witoyo - Author 12 assisted in review and editing and graph visualization of the manuscript.
Email: jatmiko.witoyo@tip.itera.ac.id
Author 13 - Untia Kartika Sari - Author 13 involved in investigating duplicate data from Scopus database and supervise the content of L-HPC application and future recommendation in the manuscript.
Email: untia.sari@fa.itera.ac.id