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The Visualisation and Review Analysis of AI Research Trends

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Abstract

Hip implants are a common type of medical implant. This review paper is the consolidation of research trends related to copper-based hip implants, visualized through Review analysis.The active authors, organizations, journals, and countries involved in the research on"copper-based hip implants" were highlighted in this review.The leading journal was the Journal of Nuclear Materials. The most active country was the United States of America. The leading organization engaged in research regarding copper was the National Institute of Sciences, Japan. The most active authors who had made valuable contributions related to copper-based hipwere Sato S., and Rowcliffe A.F.

Keywords: Copper, Hip-implants, Reviews, Material engineering, Review analysis, Meta Analysis

1. Introduction

Hip implants and hip implantation surgeries are common in the modern medical field. Copper is a biocompatible metal, used for diversified medical applications(Baier and DePalma, 1985). Surface coating of copper implants improves the performance and longevity of implants, (Prantl *et al.*, 2010)(Rosenfeld, Williams, and Sharma, 1981). The major concerns regarding copper implants are due to metal discharge, corrosion, allergy or hypersensitivity of copper, and toxicity of copper. Both material engineering and surface engineering have great scope in improving the performance and life of copper-based.

All the above features and specialties make copper a good candidate for implants, especially hip implants. The implant material should be carefully selected that a minor lapse may lead to complete failure of the implant (Petrescu *et al.*, 2013). Similarly, Copper coated implants had good anti-bacterial properties (Schlosser *et al.*, 2011) (Chai *et al.*, 2011) (Habibovic *et al.*, 2008; Gosau *et al.*, 2010).

The metallic components of implants will lead to metal discharge, also common among copper-based hip implants after total hip arthroplasty. Here, these metal implants may be the primary cause of the metal discharge. All these can even lead to failure of the implant (Kręcisz, Kieć-

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Świerczyńska and Chomiczewska-Skóra, 2012). The metal discharge may lead to allergies and toxicity of the metal (Hallab *et al.*, 2008). Similarly, metal allergies due to arthroplasty had been reported. However, the possibility for probable copper contamination was highlighted.

This review paper containsfour sections. The introduction of copper implants with a special focus on copper-based hip implants is the first section, followed by the discussion of the research methodology of this paper. The results and discussions are included in the third section of this paper. The fourth section deals with the conclusion. The following research objectives and research questions were framed for conducting Review analysis systematically.

1.1 Research Objectives

a) To consolidate the scientificpapers on the research regarding thecopper-basedhip implants
b) To find out the trends related to research in copper-based hip implants

1.2 Research Questions

a) Who are the active researchers working on copper-based hip implants?
b) Which are the main research organizations and countries working on copper-based hip implants?
c) Which are the leading journalspublishing scientific papers oncopper-based hip implants?

2. Research Methodology

This paper had used the resources from Scopus and, the Boolean used was TITLE-ABS (Copperhip implant). The softwares used for this paper were Microsoft Excel, Mendeley, Grammarly, and Meta Analysis.This paper had been inspired by Review analysis in its presentation style, analysis, and methodology from the works.

3. Results and discussion

3.1 Results

The first search on Scopus had obtained 329 documents, in 12 languages, out of which 292 documents were in English. The document categories were classified and shown in Table 1. This review had selected only the peer-reviewed articles and all other documents had not been considered. Thus after using filters “Article”and “English” the second round search produced an outcome of 210 English articles (both open access and others) andhad been used to conduct Review analysis and visualization using Meta Analysis. The English research articles in this domain since 1959 had been shown in Figure 1.

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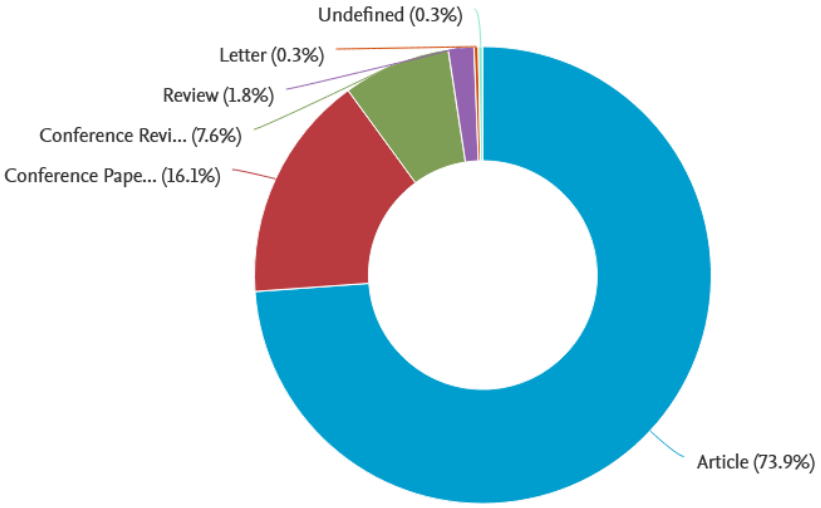

Figure 1: Classification of the documents on "Copper hip implants

Co-authorship analysis of top authors had been shown in Table 3. For a better presentation of the analysis, the parameters used were the minimum number of documents of an author as fourand the minimum number of citations of authors as one. This combination plotted the map of17authors, in fourclusters. The overlay visualization map of co-authorship analysis plotted in Table3, points out the major researchers with their strong co-authorship linkages and clusters involved.The citation analysis of top authors had been shown in table 1.For the citation analysis, the parameters used were the minimum number of documents of an author as two and the minimum citations of an author as one. Sato S., and Rowcliffe A.F

Table 1: Highlights of most active authors

Description	Authors	Documents	Citations	Average citations per documents	Link strength
Authors with the highest publication and links	Sato S.	7	90	13	21
Authors with the highestcitations	RowcliffeA.F	5	115	23	15

In Co-occurrence analysis, we had used all keyword analyses, by keeping the minimum number of occurrences of a keyword as10. This combination plotted the map of 37thresholds, in threeclusters. The overlay visualization of co-occurrence analysis of keywords has been shown in Table2.The leading organizations engaged in research on "copperhip implants" had been found out by the volume of publications and citation analysis, the parameters used are the minimum number of documents of an organization as one and the minimum number of citations of organizations as one.

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The leading organization in the research regarding "copper hip implants", with the highest number of publications and citations,was the National Institute of Sciences, Japan(Refer to table 2).

Table 2: Highlights of the most active organization

Organizations	Country	Documents	Citations	Average Citations per document
National Institute of Sciences, Japan	Japan	7	33	4.7

Co-authorship analysis of the countries engaged in the research on "copperhip implants" had been shown in Table3. The overlay visualization map of co-authorship analysis plotted in Table3, points out the main countries with their strong co-authorship linkages and clusters involved.The citation analysis of top countries had been shown in table 3, along with co-authorship links. For the citation analysis, the parameters used were the minimum number of documents of acountry as one and the minimum citations of the country as one.

Table 3: Highlights of Active Countries

Description	Country	Documents	Citations	Link strength
The country with the leading publication, citations, and co-authorship links	United States of America	44	1028	12

The most active country in this research domain was the United States of America, with the highest number ofpublications, and citations.

The most active journals engaged in the research were identified through analyzing co-authorship links and citation analysis. Highlights of the most active and relevant journals related to "copper-based hip implants"are shown in table 4. Table 4 shows the journal activity of this research domain through parameters of publication volume and citations.

Table 4: Analysis of journal activity

Description	Journal details	Documents	Citations	Average citations per documents	Links
Journal with the highest publications and citations	Journal of Nuclear Materials	23	376	16	12

From the above discussion regarding the Review patterns in the research regarding copper-based hipimplants,this research had observed a gradual increase in research interest regarding copper-based hip implantsfrom the starting of the millennium, and the momentum is going on positively.This points out the relevance and potential of this research domain (Refer to Table 2).The most active authors in this research domainwereSato S., and Rowcliffe A.Fwith the leadingpublication, links,and citations (Refer to table 1).The overlay analysis of top countries researching copper-based hip implants indicates that the United States of America was the leading countryrelating tothe highest numberof publications and citations (Refer to Table 5). The top journal of this research domain was identified as theJournal of Nuclear Materials.Fromthese wide sources of information, researchers can focus on top journals where they can identify the most relevant and highly cited articles regarding Copper-based hip implants.

4. Conclusion

Copper-based hip implants have great scope for future research and the most active journal related to this research domain wasthe Journal of Nuclear Materials.The most active countrywas the United States of America.The leading organization engaged in research regarding copperwas theNational Institute of Sciences, Japan. The most active authors who had made valuable contributions related tocopper-based hipwere Sato S., and Rowcliffe A.F.This research domain offers a new avenue for researchers and future research can be on innovations in copper-basedhip implants.

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