



A Review education Trends in Corrosion of Zinc-Implants

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Abstract

Zinc is one of the most used metals for implants. The review analysis had been conducted to understand the active authors, organizations, journals, and countries involved in the research domain of “corrosion of Zinc-implants”. All published articles related to “corrosion of Zinc-implants” from “Scopus”, were analyzed using the Meta Analysis to develop analysis tables and visualization maps. This article had set the objective to consolidate the scientific literature regarding “corrosion of Zinc-implants” and also to find out the trends related to the same. The leading Journals were Material Science and Engineering and Acta Biomaterialia. The most active country was China. The leading organization engaged in the research regarding corrosion of Zinc-implants was the School of Materials Science and Engineering, Xiangtan University, China. The most active authors who had made valuable contributions related to Zinc-implants were Goldman J, Zhang X, and Lin J.

Keywords: Zinc-implants, Corrosion, Material engineering, Review analysis, Meta Analysis,

1. Introduction

An engineered medical device to replace a missing or damaged biological structure is known as an implant. Different types of metals and materials are used to create implants. The Bio-compatibility of Zinc and its biodegradability had been helpful for diversified medical applications (Chen *et al.*, 2011). Similarly, the high concentration of metals in body fluids, toxicity, and allergy of metals should also be considered in the cases of bio-implants. The anti-bio-film properties of Zinc, make it a biocompatible option for surface-coating of dental implants; zinc phosphate-calcium phosphate composite coatings on pure iron for biodegradable implant applications; zinc phosphate coating for biodegradable implant applications.

Corrosion is throwing a minor threat to Zinc implants. The threat of corrosion can be reduced by surface coating. Zinc and zinc alloys are good prospective bio-materials for implants. However, the Zinc coating of implants can resist corrosion.

Material engineering and surface engineering can play a significant role in improving the performance and life of Zinc-implants along with measures for reducing toxicity and



hypersensitivity of the metal implants. Future research can also be on surface coatings by using, metal implants using Zinc. This review analysis will be a useful platform for future researchers by realizing the top researchers, organizations, and countries involved in research regarding Tungsten-implants. This article is arranged into four sections. The first section is the introduction, followed by the discussion of the methodology by which the research was conducted. The third section deals with results and discussion. 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 literature regarding corrosion of Zinc-implants
- b) To find out the trends related to research in corrosion of Zinc-implants

1.2 Research Questions

- a) Who are the active researchers working on corrosion of Zinc-implants?
- b) Which are the main organizations and countries working on corrosion of Zinc-implants?
- c) Which are the main journals on corrosion of Zinc-implants?

2. Research Methodology

Scopus files had been used for this article. For the article selection, the Boolean used was TITLE-ABS (Corrosion of Zinc-implant). All the tables in this paper were created by using Microsoft Excel and Meta Analysis. Grammarly was used for spelling and grammar checks. Mendeley was used for article review and citation. 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

This first round of search produced an outcome of 215 documents, in six languages, out of which 206 documents were in English. The classification of document categories is shown in Table 1. For improving the quality of the analysis, we 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 158 English articles (both open access and others) and had been used to conduct review analysis and visualization using Meta Analysis. The English research articles in this domain since 1974 had been shown in Table1. Co-authorship analysis of top authors had been shown in Table1. For a better presentation of the analysis, the parameters used were the minimum number of documents of an author as four and the minimum number of citations of authors as one. This combination plotted the map of 29 authors, in five clusters. The overlay



visualization map of co-authorship analysis plotted in Table1, 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, along with co-authorship links. For the citation analysis, the parameters used were the minimum number of documents of an author as one and the minimum citations of an author as one.

Table 1: Highlights of most active authors

Description	Authors	Documents	Citations	Average citations per documents	Link strength
Authors with the highest publication	Goldman J	10	391	39.1	50
Authors with the highest citation	Zhang X	7	1175	168	43
Authors with the highest links	Lin J	9	90	10	62

In Co-occurrence analysis, we had used all keyword analyses, by keeping the minimum number of occurrences of a keyword as 25. This combination plotted the map of 21 thresholds, in two clusters. The overlay visualization of co-occurrence analysis of keywords has been shown in Table2. The leading organizations engaged in research on “Corrosion of Zinc-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. The leading organizations in the research regarding “Corrosion of Zinc-implants”, with the highest number of publications and citations, were the School of Materials Science and Engineering, Xiangtan University, China (Refer to table 2).

Table 2: Highlights of the most active organization

Organizations	Country	Documents	Citations	Average Citations per document
School of Materials Science and Engineering, Xiangtan University	China	7	81	28

Co-authorship analysis of the countries engaged in the research on “Corrosion of Zinc-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 a country as one and the minimum citations of the country as one.

Table 3: Highlights of Active Countries

Description	Country	Documents	Citations	Average citations
The country with the highest publication, citations, and co-authorship links	China	56	2044	36

The most active country in this research domain was China, with the highest number of publications, links, and citations.

Link analysis and citation analysis were used to identify the most active journal in this research domain. We have taken the parameters of the minimum number of documents of a journal as one and the minimum number of citations of a journal as one for the link analysis and citation analysis. Highlights of the most active and relevant journals related to “Corrosion of Zinc-implants” are shown in table 4. Table 4 shows the journal activity of this research domain through parameters of publication volume, citations, and co-authorship linkages.

Table 4: Analysis of journal activity

Description	Journal details	Documents	Citations	Average citations per documents	Links
Journal with the highest publications	Material Science and Engineering	12	1470	122.25	66
Journal with highest citations and links	Acta Biomaterialia	15	429	28.6	56

From the above discussion regarding the review patterns in the research regarding corrosion of Zinc-implants, this research had observed a gradual increase in research interest regarding corrosion of Zinc-implants from 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 domain were Goldman J, Zhang X, and Lin J with the highest publication, citations, and co-authorship links respectively (Refer to table 1). The overlay analysis of top countries researching corrosion of Zinc-implants indicates that China was the leading country relating to the highest number of publications, citations, and co-authorship links (Refer to Table 5). The top journals of this research domain were identified as Material Science and Engineering and Acta Biomaterialia. From these wide sources of



information, researchers can focus on top journals where they can identify the most relevant and highly cited articles regarding corrosion of Zinc-implants.

4. Conclusion

Corrosion of Zinc-implants was an interesting research domain and the most active journals related to this research domain were Material Science and Engineering and Acta Biomaterialia. The most active country was China. The leading organization engaged in the research regarding corrosion of Zinc-implants was the School of Materials Science and Engineering, Xiangtan University, China. The most active authors who had made valuable contributions related to Zinc-implants were Goldman J, Zhang X, and Lin J with the highest publication, citations, and co-authorship links respectively. This research domain offers a new avenue for researchers and future research can be on innovations in corrosion of Zinc-implants.

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