ABSTRACT

Background: Bioceramic-polymer composites are biodegradable and often used as bone implant for osteomyelitis. Aspects of biocompatibility, biodegradability and mechanical strength is very important in order to meet the clinical suitability of the use of bone implant biomaterials. This literature review research aims to compare the profiles of the compressive strength and degradation properties of implants with various bioceramic-polymer composites. Methods: Literature searching were carried out on databases, such as Google Scholar, Unair Repository, and Researchgate. The inclusion criteria included original articles published from 1999 until 2020 with English or Indonesian languages that provided data on the value of compressive strength and/or degradation rate of bioceramic-polymer composites. Results: Twenty eight articles that meet inclusion criteria were reviewed. It was found that the use of bioceramic-polymer composites which is able to produce the best compressive strength that comparable with cortical bones (100-200 MPa) and also produce long time degradation are HAp-PLLA with compressive value is 110.5 MPa and degradation time almost one year (52 weeks). Conclusion: The differences in the results of the composite compressive strength values are caused by several factors, i.e type and composition of the bioceramic-polymer used, preparation method during drying, and use of cross-linking agents. Meanwhile, factors that can affect differences in the degradation time of the composites i.e type and composition of the bioceramic-polymer used and use of cross-linking agents.

Keywords: bioceramic-polymer composite, osteomyelitis, compressive strength, degradation rate.

1. BACKGROUND

The alternative to providing the long-term intravenous antibiotic therapy for osteomyelitis, it is necessary to consider using a more effective local drug delivery systems, which is can provide greater efficacy, avoid fluctuations in plasma drug levels, and minimize drug for toxicity in patients (Sealy, 2013). One of the dosage forms with a controlled delivery system is an implant preparation. Furthermore, in the formulation of implants for bone, a carrier that is biodegradable and biocompatible is used. The biodegradable carrier used can be a composite consisting of a combination of bioceramics and polymers. Bioceramic-polymer composites were chosen because they were able to improve the mechanical properties of the implant, produce controlled degradation, and have good osteoconductive properties (Ghassemi et al., 2018). Mechanical properties such as compressive strength and degradation are important in an applied implant for bone tissue repair. The compressive strength and degradation of the implants were studied to assess the clinical suitability of the use of biomaterials in bone. This study aimed to compare the compressive strength and degradation profiles of implants with various bioceramic-polymer composites for osteomyelitis.

2. METHODS

Databases: Google Scholar online database, Unair Repository, and Researchgate.

Keywords: “bioceramic-polymer composite for osteomyelitis”, “compressive strength bioceramic-polymer composite for osteomyelitis”, “and degradation bioceramic-polymer composite for osteomyelitis”.

Inclusion Criteria: The limitations of this research are used by original articles and dissertations with published from 1999 to 2020, the articles studied that be used by the writer are articles that provide data on the value of compressive strength and degradation of bioceramic-polymer composites, either with the addition of a cross-linking agent component or not used as an antibiotic carrier or as a substitute for reconstruction of bone tissue damaged by infection, the journal articles are published in English or Indonesian.

3. RESULTS AND DISCUSSION

Based on the results of the compressive strength test that has been carried out, it showed that the value of HAp-PLLA is quite strong because PLLA has a hemisyracthine shape and a regular chain structure (Chen et al., 2019). Meanwhile, degradation rate profile of up to 52 weeks which may be due to the relatively high crystallinity of the composites that inhibits the hydrolysis reaction.

4. CONCLUSION

The differences in the results of the composite compressive strength values are caused by several factors, i.e type and composition of the bioceramic-polymer used, preparation method during drying, and use of cross-linking agents. Meanwhile, factors that can affect differences in the degradation time of the composites i.e type and composition of the bioceramic-polymer used and use of cross-linking agents.

References